Networks, cluster development programs, and performance: the electronics cluster in Córdoba, Argentina

Elisa Giuliani, Andres Matta, Carlo Pietrobelli

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Chapter 6

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Introduction

This chapter is based on the results of a study on evaluating cluster development programs (CDPs) in the electronics cluster in Córdoba, Argentina, and combines that case study with a social network analysis (SNA). The study evaluates the relationship between CDP development in this cluster and the evolution of local interorganizational networks, which were key targets in light of their expected influence on performance of cluster firms. The cluster was part of a wider set of CDPs, called Productive Integration Programs, co-funded between 2003 and 2007 by the Inter-American Development Bank (IDB) and the Multilateral Investment Fund (MIF) in line with the IDB approach to CDPs. The main objectives of the CDPs were (i) to strengthen local linkages and cooperation among private actors, and between private actors and local institutions; (ii) to improve local firms' access to new production technologies and organizational innovations; (iii) to promote access to new markets; and (iv) to demonstrate the effects of CDPs to other industry clusters in Córdoba and the rest of the country. The program included activities such as setting up real service centers, promoting industry fairs, and organizing thematic workshops and coordination activities.

We had two primary objectives for our study. First, we analyzed the evolution of interorganizational networks in the electronics cluster in Córdoba,[1]

[1] Although the CDP in Córdoba targeted, among other industries, information and communication technology as a whole, our study focused only on the electronics manufacturing industry.

including the relationships between local firms, and between local firms and external institutions such as universities, other agencies and government institutions. We also wanted to explore whether and how these relationships could be related to the CDP. Second, we investigated whether the changes in the interorganizational networks generated beneficial effects for firm performance. Based on our evaluation, we made recommendations for policy design and best practices for future policymaking.

Our study used primary data collected through interviews undertaken at the firm level in the cluster. We designed a structured questionnaire that allowed us to compare the data with a baseline survey carried out in 2005. The questionnaire was administered to both beneficiary and nonbeneficiary firms within the cluster, including a special section to collect network data, which we analyzed using both descriptive and stochastic SNA methodologies. We also conducted a focus group after a first report to check the results of our analysis.

We found that the CDP led to new and stronger technology-transfer ties between electronic firms in Córdoba and other local, provincial, and national institutions, including local universities. However, we did not find a significant impact on new ties to promote export-oriented activities. Our analysis showed that firms that participated intensively in the activities promoted by the CDP were more likely to form new information ties over the 2005–12 period. This suggested that, although over the period of analysis a significant portion of relationships were discontinued, some activities within the CDP relatively successfully promoted new ties among local firms. Our findings also suggested that some of the CDP activities stimulated new ties more than others. In particular, all activities that were designed to promote networking per se failed to do so. Instead, concrete activities designed to solve specific practical problems successfully promoted new ties.

Origins of the Electronics Industry in Córdoba

The electronics industry in Argentina is characterized by the presence of many small- and medium-sized enterprises (SMEs) and a few large firms—recent estimates suggest that about 80 percent of the firms in the industry have less than 50 employees (Trends Consulting, 2007). About 75 percent of the electronics activities are concentrated in the City and Province of Buenos Aires, while the rest is distributed across three regional poles: Rosario, Córdoba, and the free zone of Tierra del Fuego. The electronics industry as a whole targets the domestic market, with only 20 percent of the firms exporting (Trends Consulting, 2007).

In Córdoba, the first electronics companies started up in the 1970s. Three factors seem to have influenced this process: a military plant for aircraft

production (the Fábrica Argentina de Aviones, formerly Fábrica Militar de Aviones), several local universities that provided a pool of specialized human resources (the first wave of engineers graduated in 1968), and import substitution policies that protected the production of consumer products between the 1950s and mid-1970s.[2] According to Berti (2006), before 1975, there were already 22 firms in Córdoba that specialized in producing consumer electronics (e.g., TVs, radios, and components).

During the military dictatorship (1976–83), changes in macroeconomic policies toward a higher international openness of markets contributed to the out-competition of many electronics SMEs and to processes of industrial concentration. According to Azpiazu, Basualdo, and Nochteff (1992, cited in Berti, 2006), over that period, the production volumes of the electronics component industry declined by 91 percent, which meant that most of the firms in that subsector either closed or converted into importers of electronics components. The Alfonsin Government (1983–89) attempted to promote an industrial policy in favor of the electronics and informatics industries.[3] Although largely unsuccessful (Berti, 2006), these policies eventually contributed to a certain degree of diversification of industrial activities, and strengthened specific market niches (e.g., telecommunication, electromedicine, computer electronics for industry, and video games). According to Blanco, Branda, and Frediani (1986), in 1986, Córdoba counted 25 firms operating in these niches, but only two had more than 150 employees.

The trade and monetary policies of the 1990s contributed to the weakening of SMEs and their local value chains, and attracted foreign investors that offered better working conditions and therefore attracted the most talented human resources available at the local level. To face such difficulties, the existing local electronics producers in Córdoba gathered into a new business association (Cámara de Industrias Informáticas, Electrónicas y de Comunicaciones del Centro de Argentina, or CIIECCA), which Berti (2006) considered to be the result of preexisting strong social ties between local entrepreneurs. In fact, most of those entrepreneurs had either studied together at the university or had been colleagues at IA Electronica or Microsistemas, two of the largest companies of the area, which

[2] During the period of import substitutions, producers of consumer goods in the electronics industry benefited from trade barriers in importing electronics products and from government procurement policies. In contrast, import substitution policies did not favor producers of semimanufactured goods or other inputs in the electronics industry (Berti, 2006).

[3] The policy consisted of three parallel initiatives: (i) upgrading technology and infrastructure in the communication industry (Plan Megatel); (ii) promoting the informatics industry (Plan Nacional de Informatica); and (iii) promoting the electronics industry (Plan Nacional de Electronica) (Berti, 2006).

failed during the mid-1990s giving rise to 10 spinoff firms. Since the turn of the century, the new macroeconomic policy, the development of new industrial policies, and the currency devaluation that followed the 2001 economic crisis have increased competitiveness in the electronics industry. This competitiveness has resulted in new SME startups in Córdoba and the arrival of foreign multinational companies in the software industry (e.g., Motorola, Intel, and EDS)[4] attracted by fiscal incentives and the local availability of skilled workers. Compared to the software industry, which has been characterized by a considerable number of startups since 2000, the electronics industry has seen lower startup rates but has been characterized by stronger existing firms in terms of number of employees, revenue, and to a lesser extent, exports (Matta 2012; Trends Consulting, 2007).

In spite of these achievements, in the early 2000s, the electronics industry still suffered from limited competitiveness, especially in international markets. Policymakers acknowledged that CDPs might help strengthen the electronics industry in Córdoba (Mazzonis et al., 2002).

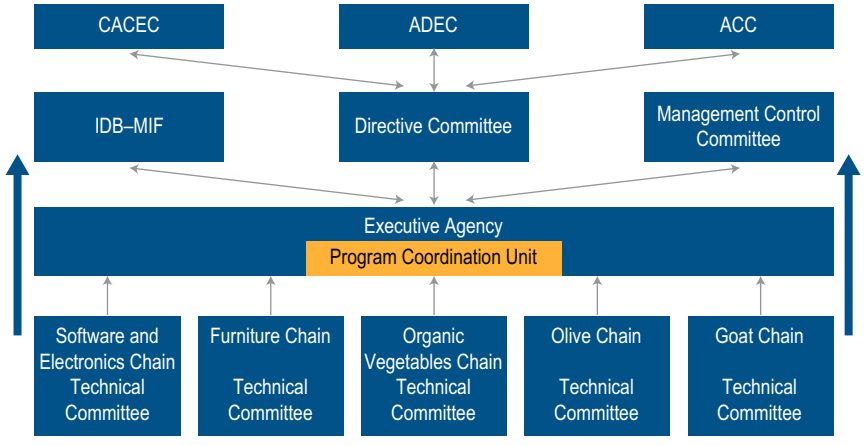
The CDP in Córdoba

The CDP was implemented in Córdoba for the 2003–07 period. The total investment from the IDB and IMF and local sources reached 3,979,798 Argentinian pesos (ARS) (approximately US$1.3 million). These funds were distributed across different industry clusters, with the electronics and software industries receiving approximately 50 percent of the total. These funds were complemented by subsequent government resources of US$300,000, for an average investment per firm of 29,504 ARS (US$9,700) (Saffe et al., 2011).

From an operational viewpoint, the program was implemented through the joint effort of local public and private actors (Figure 6.1). The agencies responsible for executing the CDP were the Agencia para el Desarrollo Económico de la Ciudad de Córdoba (ADEC), Agencia Córdoba Ciencia (ACC), and Cámara de Comercio Exterior de Córdoba (CACEC). Representatives of each of these public institutions formed part of a Directive Committee, which was responsible for defining the strategic goals of the project and evaluating achievements annually. The Management Control Committee, which comprised ADEC representatives, was in charge of administering the program and financial supervision, while the Executing Agency implemented the CDP's main tasks in coordination with the technical committees.

[4] Multinational corporations have been more interested in the software industry than the electronics industry and thus have not dramatically affected the structure of the electronics industry, which is the focus of this analysis.

Figure 6.1 ■ The CDP Governance Structure



Source: Mitnik and Magnano (2011).

The technical committees comprised industry representatives whose role was to give local entrepreneurs a voice and to provide control over what was being funded and whether the activities were being executed efficiently and were likely to achieve the proposed objectives. Members of local business associations were part of technical committees. For instance, the software and electronics industries' technical committee included members of industry associations Cluster Córdoba Technology and CIIECCA.

The CDP consisted of a set of parallel activities in which firms voluntarily decided to participate. Participation in one activity did not imply (or require) participation in all of the activities and initiatives promoted by the program. The activities encompassed:

1. Developing real service centers such as the Centro de Servicios Tecnológicos y de Manufactura con Tecnología de Montaje Superficial (CSMT) and the Centro de Abastecimientos Comunitarios y Desarrollo de Proveedores (CACyDP). The CSMT was created to produce electronics components with higher productivity and better quality standards compared to the standards achieved by individual local firms. In this way, local firms were given the opportunity to improve quality and efficiency by assembling components at the center at a very competitive cost.[5] One of the interviewees

[5] The CSMT recently shifted to producing 1.2 million components per month (from 750,000) and obtained a new line of FONTAR credit.

noted: "thanks to the quality and higher productivity achieved by the CSMT, we were able to satisfy clients that requested short delivery times and small production volumes, which otherwise we would have never been able to serve."

2. Jointly acquiring electronics components and other inputs, which favored economies of scale and reduced procurement costs for the firms that joined the initiative, was made possible through the CACyDP's activities.
3. Promoting industry fairs. The CDP favored active participation in different fairs (Feria Expotrónica, FICO, and SINPRODE) to improve the visibility of Córdoba electronics firms in national and international markets. The project funded travel, promotion, and marketing expenses.
4. Organizing thematic workshops and coordinating activities such as:
   - Strategic planning workshops (*talleres de planificación estratégica*) to help firms define future strategies and long-term activities to develop the industry.
   - Affinity group workshops (*talleres de afinidad*) to find opportunities for intersectorial collaboration among entrepreneurs from the electronics industry and complementary industries.
   - Institutional activities to promote CIIECCA (Mitnik and Magnano, 2011), including hiring a consultant to support matchmaking between firms with similar interests, to promote the affiliation with CIIECCA, and to increase the visibility of the sector through wider media coverage and marketing and promotion programs.

Table 6.1 provides information about participants and the funding received for each activity.

Table 6.1 ■ Participants and Funding of CDP Activities

	Participants in the electronics industry[a]	Total amount of direct investments (in USD)[b]
CSMT[c]	22	22,667
CACyDP	16	36,000
Trade fairs	24	56,000
Strategic planning workshops	21	8,667
Affinity groups workshops	12	2,667
Institutional activities	48	8,333

Source: Authors' calculations based on data from CDPs.
[a] Participant numbers include only firms in the electronics industry.
[b] Direct investment amounts do not include indirect costs. Exchange rate used ARS/USD = 3.
[c] The Argentinean government invested an additional 800,000 ARS in this activity.

Methodology

Overview

For this study, we collected primary data by interviewing firms in the electronics cluster of Córdoba. We designed a structured questionnaire to collect information that was comparable to the baseline survey carried out in 2005, which was administered to both treated and untreated firms in the cluster. We collected the data through face-to-face interviews with professionals in key management positions (in many cases with the owners), and we included a special section on network data. We then codified the answers into variables and created different datasets. We also held a focus group.

Selection of the Sample

First, we identified the universe of firms that were active electronics manufacturers in Córdoba. Since we were not able to access census data, we used CIIECCA as the main source of information. We also conducted ad hoc interviews with key industry informants. In 2012, CIIECCA listed 70 affiliated firms, but not all were relevant to our study (e.g., some traded imported goods, while others were excluded because they had changed their business activity at the time of the study). Based on suggestions from key informants, we also considered a list of firms that were not affiliated with CIIECCA at the time of the survey.

In 2012, the universe of electronics firms in Córdoba was 49.[6] All firms in the universe were contacted to be interviewed, assuming this would allow us to collect full network data.[7] A total of 38 firms (78 percent response rate) were interviewed; the rest were unavailable.

The final sample included 22 treated and 16 untreated firms (Table 6.2). Table 6.2 also reports information about the 2005 baseline sample. The total number of electronics firms existing in 2012 that were interviewed in 2005 was 27, four of which were not interviewed in 2012. Hence, 23 firms were interviewed in both years and 15 firms included in the 2012 study either did not exist (6) or did not answer the questionnaire in 2005 (9). Furthermore, 14 firms

[6] Note that our universe included only firms that were active manufactures whose main activity was classified as electronics when the survey took place. Accordingly, it excluded service providers, traders, and other producers that supplied the electronics industry but were not electronics producers themselves (e.g., cable producers).

[7] To allow a richer analysis of social networks and actors' positions in the network compared to other methods of data collection.

Table 6.2 ■ Sample

	2005	2012
Total number of firms in the electronics industry (treated and untreated)	50	49
Total number of treated firms in the electronics industry	35	26
Total number of untreated firms in the electronics industry	15	23
Total number of interviewed firms	41	38
Total number of treated firms interviewed	31	22
Total number of untreated firms interviewed	10	16
Total number of firms existing in both 2005 and 2012	27	
Total number of firms interviewed in both 2005 and 2012	23	
Total number of firms interviewed only in 2012	15	
Total number of firms interviewed only in 2005	14	

Source: Authors' calculations.

included in the 2005 study no longer existed or had migrated to other industries by 2012.

Data Collection

Prior to the main fieldwork, we tested the questionnaire in three different interviews and then introduced changes according to the respondents' suggestions. Each interview was carried out by the assistant of the person in charge of the 2005 evaluation study and lasted about one hour (see Box 6.1 for an outline of the questionnaire).

Network data was collected using a roster recall method (Wasserman and Faust, 1994), which means firms were given a full list (roster) of the rest of the electronics firms in Córdoba and asked about transfers of information and collaborations. Firms that did not answer the questionnaire were also included in the roster. We tracked nonrespondent firms to see if they established links with respondent firms and vice versa. In our research, we considered a relationship a link if at least one of the respondents indicated that the link was established. We expected the quality of the relational data to be high since we analyzed a well-bounded system (e.g., the population of firms was known, the numbers were workable, and the firms all belonged to the same industry). Especially in the case of collaboration networks, links were institutionalized, increasing the reliability of responses (Calloway, Morrissey, and Paulson, 1993). The stability of the observed patterns of interaction over time (discussed in the following sections), the qualitative information gathered during this round of interviews, and the focus group led us to believe that the data were reliable. In particular, nonrespondent firms did not appear to have characteristics that would have significantly influenced network structure, and most respondents did not mention them as partners

Box 6.1 ■ Outline of the Questionnaire Used to Evaluate the CDP in Córdoba

SECTION A: General firm-level data
- Name, address, contact numbers, email, etc.
- Size, main activity/ies, type of firm, etc.

SECTION B: Degree of participation in the CDP and relationship with CIIECCA
- Main activities undertaken during (and through) the CDP
- Perception of CDP impact on the Córdoba cluster and on firm's activities
- Activities that benefited from the CDP

SECTION C: Networks
- Interfirm networks with other electronics firms in Córdoba
- Networks with institutional actors
- *Section C has one roster for firms and another for organizations.*

SECTION D: Innovation, entrepreneurship, and performance
- Entrepreneurial capabilities, business practices
- Sales, profits/losses, exports, innovative output
- Expected performance in the absence of CDP

SECTION E
- Open questions on the effectiveness of the CDP and network management models

Source: Authors' elaboration.

in relationships.[8] This is consistent with the 2005 data, which suggested that nonrespondent firms occupied a peripheral role in the network (Matta, 2011).

We codified the answers from the questionnaire into a dataset and the SNA data into relational data files. Besides interviews of entrepreneurs and managing directors, the study was based on six further interviews conducted with key stakeholders in the cluster; three were involved in promoting and coordinating different activities under the CDP, and three were current or former presidents of CIIECCA.

Sample Characteristics

We provide information about various characteristics of our sample in Table 6.3. The sample comprised micro-small-medium enterprises that on average in 2011 employed 32 employees. About 35 percent of the firms in the sample were

[8] The Quadratic Assignment Procedure correlation between information networks including all relational data about the nonrespondents and the information networks including only incident relations to nonrespondents had a Pearson coefficient of 0.9607.

Table 6.3 ■ Descriptive Statistics of Sample Firms in the Córdoba Cluster, 2011

			Treated	Untreated
Size	**N**	**%**	**N (%)**	**N (%)**
Micro (0–5 employees)	6	16	1 (4.8%)	5 (29.4%)
Small (6–20 employees)	16	42	7 (33.3%)	8 (41.6%)
Medium (21–150 employees)	15	39	12 (57.1%)	3 (17.6%)
Large (>150 employees)	1	3	1 (4.8%)	1 (5.9%)
Years since foundation	**N**	**%**	**N (%)**	**N (%)**
Prior to 1990	13	34.2	10 (47.6%)	3 (17.6%)
1991–2000	16	42.1	8 (38.1%)	8 (47.1%)
2001–09	9	23.7	3 (14.3%)	6 (35.3%)
Segments	**N**	**%**	**N**	**N**
Electronics components	5	13.2	3	2
Measurement devices (e.g., electric weights)	6	15.8	4	2
Energy devices (e.g., transformers)	3	7.9	2	1
Industrial electronics	6	15.8	5	1
Electro-medical devices	4	10.5	3	1
TLC	3	7.9	1	2
TV and radio production (e.g., broadcasting devices, antennas)	3	7.9	1	2
Security and alarms	1	2.6	0	1
Audio-visual and entertainment devices (e.g., home theatre, video games)	3	7.9	2	1
Distribution services (e.g., ATM)	4	10.5	1	3
Industrial control and automation (e.g., computerized numerical control, mecatronics)	6	15.8	2	4
Others	11	28.9	5	6
Activities performed internally	**N**	**%**	**N (%)**	**N (%)**
R&D	35	92.1	20 (95.2%)	15 (88.2%)
Design	36	94.7	21 (100%)	15 (88.2%)
Manufacturing	38	100	21 (100%)	17 (100%)
Marketing	34	89.5	18 (85.7%)	16 (94.1%)
Distribution and Logistics	18	47.4	11 (52.4%)	7 (41.2%)
Other (professional or technical services)	4	0.1	1 (4.8%)	3 (17.6%)
Exports [a]	**N**	**%**	**N (%)**	**N (%)**
Only domestic market	15	53.6%	9 (50%)	6 (60%)
Exporting 1 to 20% of sales	9	32.1%	6 (33%)	3 (30%)
Exporting 20 to 40% of sales	0	—	—	—
Exporting more than 40% of sales	4	14.4%	3 (17%)	1 (10%)

Source: Authors' calculations.
[a] Ten firms did not answer the question on exports; percentages refer to percent of valid responses to the question on exports.

founded prior to 1990, while the remaining started operations during the 1990s (42 percent) or in the previous decade (24 percent).

The firms in the cluster specialized in different segments of the electronics industry, ranging from producing basic electronics components and circuits to more sophisticated final products, such as telecommunications equipment and electromedical devices. There was an average of three to four firms per market segment. Firms tended to be vertically integrated, performing R&D and design activities (over 90 percent), manufacturing (100 percent), and marketing (around 90 percent) internally. This evidence pointed to specific characteristics of this cluster, where the local division of labor seemed to be rather limited, which contrasts the high division of labor archetype of the Marshallian industrial district. Finally, only four firms in Córdoba were strongly export oriented (i.e., they exported between 40 and 60 percent of their production, mainly to Latin America and other emerging economies). In contrast, about half of the firms sold only within the domestic market.

Table 6.3 also reports separate statistics for treated and untreated firms. The two sample groups were not randomly selected, which means that they may have differed qualitatively. A clear distinctive factor was the size of the firm, since most of the treated firms were medium-sized (52.3 percent), while close to a third of the untreated firms were classified as micro-sized (29.4 percent). While about half of the treated firms were relatively old, having been founded prior to 1990, more than a third of the untreated firms were founded after 2000.

For the firms interviewed, we also tracked different management issues, such as strategy formulation, human resources training, innovation, market orientation, funding, and social and environmental management. Firms were rather heterogeneous on several dimensions, although we identified some common patterns. First, most respondents declared that they had developed a clear long-term and ambitious strategy, and considered their firm to be innovative and able to compete with leading international firms and products.[9] However, the majority of the firms still failed to have ISO certifications to operate in international markets, and only 10 firms had at least 1 patent registered at the Argentinean Patent Office between 1999 and 2012.

Second, firms showed little interest in addressing social issues using corporate social responsibility practices. Although more than 90 percent of the firms considered reducing pollution critical, in practice, only about half had invested considerable resources in this task. In some cases, environmental issues were

[9] We note that the international orientation of these producers was mainly toward Latin American countries. Hence, when respondents declared they had products that complied with international standards, they may have been referring mainly to Latin American standards.

not considered a problem since the manufacturing activities performed were not perceived as contaminating the environment.[10] Finally, all respondents said that women enjoyed the same working conditions and opportunities as men; however, in about 40 percent of the sample women did not occupy leading management positions.

Social Network Analysis

This section provides an overview of the SNA measures and methods used in this study. Analyzing social networks requires data regarding those networks. For this purpose, we used two sets of relational questions, which allowed us to map information and collaboration networks (Box 6.2).[11]

We organized relational data resulting from answers to these questions in a matrix composed of *n* rows and *n* columns, where *n* was the number of firms in the study (49 in the case of the 2012 relational matrixes).[12] Given the nature of the questions, the information network was a directed network, which means that its ties were not symmetric (i.e., the information transfer was not necessarily reciprocated), whereas the collaboration network was symmetrical because collaborations are by definition mutual relationships.

We performed both descriptive and dynamic SNA. The objective of the former was to describe certain characteristics of networks, while the latter investigated the factors that influenced changes in the network over time based on stochastic actor-oriented models (SAOM) for network change.

The first part of Table 6.4 shows the measures used to analyze characteristics of local networks in 2012: density, fragmentation, dyad-based reciprocity, number of isolates, size of largest component, and degree of centrality. We calculated all of these measures using the software UCINET. As explained in the table, density, fragmentation, and components refer to the network as a whole, while dyad-based reciprocity refers to pairs of firms and actor-level degree of centrality refers to individual firms. Degree of centrality measured the number of ties established by each firm with other firms in the network.[13] The second part of Table 6.4

[10] Qualitative insights from the interviews suggested that respondents were not particularly concerned about contamination connected to disposing electronics components (e-waste).
[11] To allow comparability over time, in formulating the relational questions, we took into account and made only minor modifications to the questions in the 2005 questionnaire.
[12] The networks also include nonrespondent firms.
[13] We only considered the degree of centrality as a measure of actor centrality because, given the structural properties of the network, most of the centrality indicators were highly correlated. For instance, correlations between degree of centrality and betweenness centrality were above 0.80. Also, there were no real justifications for adopting other centrality indicators.

Box 6.2 ■ Questions to Identify Information and Collaboration Networks

Information networks:

A. To which of the firms included in List 1 did you transfer business information (e.g., technological advice, marketing advice, or any other kind of information that is relevant to the business) in the 2008–11 period?

B. From which of the firms included in List 1 did your firm receive business information (e.g., technological advice, marketing advice, or any other kind of information that is relevant to the business) in the 2008–11 period?

- Please indicate the importance you attach to the information obtained in each case by marking the identified firms on the following scale: 0 = none; 1 = low-value information, with minor impact on your business; 2 = information of moderate value; 3 = information of strategic value, which generated technological change and/or better economic performance.

Collaboration networks:

With which of the firms included in List 1 did your firm collaborate (e.g., develop new products, promote new marketing initiatives, solve common technological problems) in the 2008–11 period?

Note: Collaborative ties do not include market operations (e.g., sale of goods).

- Please indicate the importance you attach to the collaboration in each case by marking the identified firms on the following scale: 0 = none; 1 = only occasional collaborations that no longer exist; 2 = medium-term collaborations (2–3 years) that are likely to come to an end soon; 3 = medium-term collaborations (2–3 years) that are likely last in the long term.

Note: List 1 included all of the 49 electronics firms that we identified as the universe of electronics firms in Córdoba.

Source: Authors' elaboration.

presents the measures used to identify the dominant players in the network based on k-core analysis and on Gould and Fernandez (1989) brokerage roles.

Table 6.5 reports the variables included in our SAOM analysis (Snijders, 2001; 2005).[14] It also provides a guideline for how to interpret the results of the

[14] SAOMs are based on Markov Chain Monte Carlo simulations and model the change of one tie variable by one actor at a time (a so-called network micro-step) by specifying a multinomial logit distribution that maximizes a random utility function (the so-called evaluation function) that describes actors' satisfaction with their local network neighborhood configurations.

Table 6.4 ■ Descriptive SNA: Key Concepts and Measures

Concepts	Description	Measures
Network characteristics		
Density of the network	The overall connectedness of firms in a network.	*ND* is the proportion of possible linkages that are present in a graph. It is calculated as the ratio of the number of linkages present, *L*, to its theoretical maximum, *n(n-1)/2*, with *n* being the number of nodes in the network (Wasserman and Faust, 1994): $ND = \frac{L}{n(n-1)/2}$ It ranges from 0 (total disconnection) to 1 (maximum connection).
Fragmentation of the network	The degree to which some firms are disconnected from the network.	The number of components (see below) divided by the number of nodes.
Dyad-based reciprocity	An indicator of the degree to which firms establish reciprocal ties.	The number of reciprocated dyads (i.e., two nodes with bi-directional ties) divided by the number of adjacent dyads (i.e., two nodes with at least one uni-directional tie).
Isolates	The number of disconnected nodes in a network.	Firms with no connections to other firms in the network.
Component	A group of firms that are connected in a network.	Components are separate subsets within a network.
Actor-level degree of centrality	Number of ties a firm maintains with other actors in the network.	Degree of centrality is the number of links incident upon a node (i.e., the number of ties that a node has). The indicator can be standardized by *n*, with *n* being the number of nodes in the network: $DC_i = \frac{\sum_i xij}{n-1}$
Dominant Players		
k-core analysis	A k-core is a maximal group of actors, all of whom are connected to some number (*k*) of other members of the group. We selected the firms with the highest *k*-cores in the network as dominant players.	
Gould and Fernandez (1989) gatekeeper indicator	Actors connecting different communities or subgroups (in this case treated and untreated firms) have access to resources that are different, and they can also exert control on the actors that they are connecting. The *gatekeeper* is defined here as a dominant player that connects treated and untreated firms through information and/or collaboration ties.	

Source: Authors' elaboration.

Table 6.5 ■ Stochastic Actor-Oriented Model for Network Change

Variables	Measure/description *A positive and significant coefficient means*[a]
CDP effects	
CDP participation intensity	Firms with higher involvement in different CDP activities, proxied by the number of initiatives in which they participated during the CDP, had a higher propensity to form new ties.
CSMT	Firms that participated in the CSMT had a higher propensity to form new ties.
CACyDP	Firms that participated in the CACyDP had a higher propensity to form new ties.
Fairs	Firms that participated in trade fairs had a higher propensity to form new ties.
Strategic planning workshops	Firms that participated in the strategic planning workshops had a higher propensity to form new ties.
Affinity group workshops	Firms that participated in the affinity group workshops had a higher propensity to form new ties.
Institutional activities	Firms that participated in the institutional activities had a higher propensity to form new ties.
Controls	
Structural effects	
Reciprocity	Forming new ties was based on the search for reciprocation.
Transitive triplets	A new tie was more likely to occur between A and B, if A and B were tied to a common actor (C) in 2005.
Preferential attachment	Firms with high out-degrees (i.e., outgoing ties) in 2005 had a tendency to generate extra outgoing ties.
Firm-level effects	
Size	Larger firms, measured by the number of employees in 2012, were more likely to form new ties.
Age	Older firms were more likely to form new ties.
Patents	Firms with more patents were more likely to form new ties (based on Argentinean Patent Office data).
Exports	Firms that exported were more likely to form new ties. We used a binary variable that took the value 1 if the firm exported, and 0 otherwise.
Proximity effects	
Friendship and kinship	Firms whose entrepreneurs were tied in 2005 by friendship or kinship relationships were more likely to form ties with each other.
Geographical distance	The higher the geographical distance between two firms, the higher the probability that they would form new ties.
Sector	Firms belonging to the same electronics subsector were more likely to form new ties with their peers.
CIIECCA Directive Comm. Membership	Members of the Directive Committee of CIIECCA were more likely to form new ties with their peers.

Source: Authors' elaboration.
[a] A negative and significant coefficient should be interpreted with the reverse sign.

estimations (i.e., how to interpret a positive and significant coefficient). Through this statistical approach, the SAOM estimates the probability with which a firm will create a new tie. In this estimation, we analyzed the impact of CDP participation on the formation of new information ties with other electronics firms in the cluster over the 2008–12 period, controlling for other possible effects that could also have influenced the formation of ties. We based this exercise on the 2005 and 2012 dichotomous information networks.

Focus Group

Our objective for the focus group was to discuss the validity of our results and gain interpretative insights. We invited six entrepreneurs affiliated with CIIECCA; one did not participate.

Limitations of the Study

This study had some methodological limitations. First, it did not use a proper baseline study because information about the characteristics of the firms and the cluster prior to implementation of the CDP in 2003 was not available. For our baseline, we used 2005 data, which we obtained from a previous evaluation study. Second, earlier evaluations studies were not designed to collect data about a control group of firms. We collected information about untreated firms. However, the treated and untreated firms that we interviewed were not randomly selected, since the study sought to interview the universe of treated and untreated firms in both 2005 and 2012, and thus our sample included only firms whose representatives agreed to be interviewed. Third, a 78 percent response rate in 2012 may have biased our network data because we could not collect relational data from nonrespondent firms. Accordingly, we asked each respondent to tell us about relationships with all of the cluster actors, including nonrespondents. Fourth, we had a low response rate for the questions about performance indicators (i.e., sales, profits/losses, exports, and innovative output) because half of the respondents considered these questions confidential. These firms would not allow us to consult their financial data or documents.

These caveats had implications for the type of study that could be undertaken in this particular case. The low response rate regarding performance indicators, the lack of a proper baseline, and the lack of a control group impeded the adoption of policy impact assessments based on econometric analysis and quasi-experimental approaches, as was done in some other chapters of this book. In contrast, our evaluation took a mixed-method approach by combining case-study methodology with statistical analysis of firm-level and network variables. Our approach was therefore not meant to prove causality between the

policy treatment and firm-level performance, but to analyze the effectiveness of the CDP on local coordination and firm-level behavior.

Empirical Results

Analysis of Local Networks

Network Characteristics

The study carried out prior to starting the CDP (IDB–MIF, 2008; Mazzonis et al., 2002) suggested that the level of connectivity among the firms was poor, with minimal collaboration. In contrast to this initial evidence of weak connectivity, a study undertaken in 2005, two years after the CDP was initiated, showed significant interorganizational networks that exchanged knowledge locally or had collaborative interfirm projects (Matta, 2012). Our study corroborated this earlier finding about local networks but showed that the network had evolved toward higher levels of concentration and slightly lower density. Table 6.6 compares a set of indicators about the structural properties of information and collaboration networks in 2005 and 2012. We observed a decrease in the density of linkages over time in the networks, declining from 0.17 for both networks in 2005 to 0.08 for the information network and 0.06 for the collaboration network in 2012.[15] In 2005, the number of isolated firms was lower in both networks. Moreover, the network structure seemed to have moved toward higher polarization and centralization, with the GINI coefficients for degree of centrality increasing for both networks.[16]

Table 6.6 ■ Network Characteristics, 2005 and 2012

	Information network		Collaboration network	
	2005	2012	2005	2012
Number of firms	41	49	41	49
Density	0.17	0.08	0.17	0.06
Number of isolates	1	3	5	11
GINI coefficient for degree of centrality	0.4028	0.5417	0.5384	0.6264

Source: Authors' calculations and data from Matta (2012).

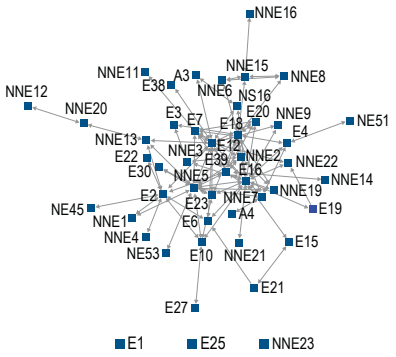
[15] We carried out a bootstrap t-test to check that the two networks' densities were statistically different and found a t-statistic of 2.7, which rejects the null hypothesis of no difference (Snijders and Borgatti, 1999).

[16] The GINI coefficient is a measure of statistical dispersion and is often used to measure the inequality among values of a frequency distribution. A GINI coefficient of 0 expresses perfect equality where all values are the same (e.g., where all firms have exactly the same number of ties). A GINI coefficient of 1 expresses maximal inequality among values.

Figure 6.2 shows the 2012 information and collaboration networks. The information network had a density value of 0.08, which means that, on average, firms in the cluster asked or transferred information to/from about 8 percent of the other cluster firms. The collaboration network had a density value of 0.06, which, likewise, means that firms collaborated on average with 6 percent of the other cluster firms. Thus the information network (0.08) was denser than

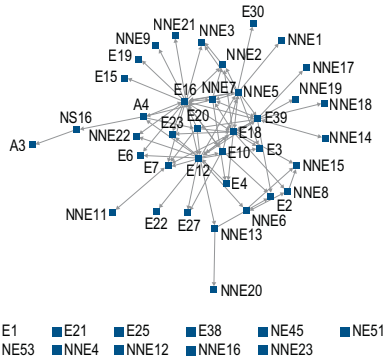
Figure 6.2 ■ Information and Collaboration Networks, 2012

Figure 6.2.a. Information Network



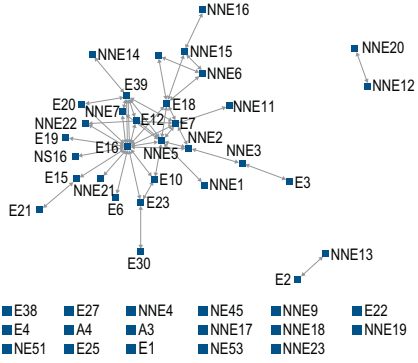
Density: 0.0838
Fragmentation: 0.120
Number of isolates: 3
Size of largest component: 46

Figure 6.2.b. Collaboration Network



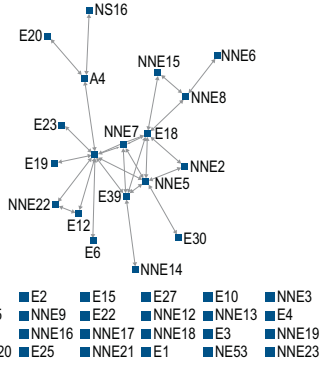
Density: 0.0646
Fragmentation: 0.402
Number of isolates: 11
Size of largest component: 38

Figure 6.2.c. Information Network – Strong Ties



Density: 0.0391
Size of largest component: 28

Figure 6.2.d. Communication Network – Strong Ties



Density: 0.0238
Size of largest component: 19

Note: We include only ties that were given a value higher than 1 by both respondents (i.e., information of moderate and strategic value).

Note: We include only medium-term collaborations (2–3 years) that were likely to last in the long term.

Source: Authors' calculations.

the collaboration network (0.06). However, the density of linkages per se tells us very little about the beneficial effects of a network. As forming and maintaining ties requires considerable time and resources, firms often "economize" on the number of ties they form by selecting only partners from which they believe they can obtain some kind of benefit. In fact, most of the linkages formed in the information network were reciprocated—with a dyad-based reciprocity of 0.74—indicating that firms tended to establish mutually enriching relationships.

More important than density is the way the network is structured, which tells researchers more about the way resources are transferred and/or shared at the local level. A comparative analysis of the two 2012 networks showed that the collaboration network was slightly more fragmented than the information network, counting 11 isolated firms (i.e., firms holding no collaborative tie with other cluster firms), whereas only 3 firms in the information network were isolated. This is consistent with the fact that collaboration networks require a higher commitment from the interactive parties (i.e., collaboration on given projects), which makes connections more selective and harder to maintain.

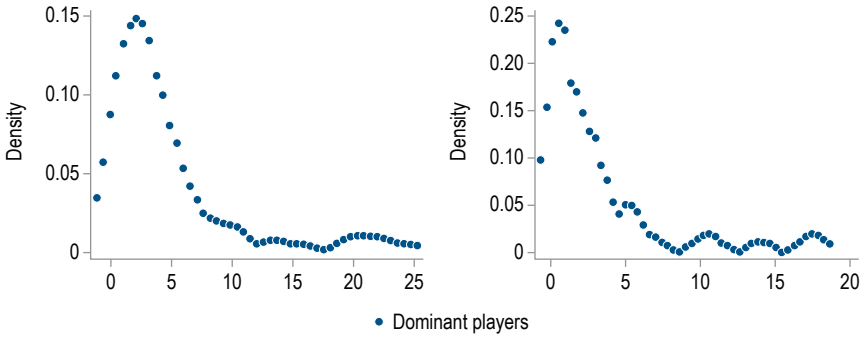
Figures 6.2.c and 6.2.d display only the strong ties of the information and collaboration networks. For the information network, strong ties correspond to linkages that were considered by the respondents to have from moderate to high strategic value in terms of the impact on the firm's own business activities and performance. For the collaboration network, strong ties were relationships that had lasted for a period of two to three years and that the respondents considered would last over the long term. In both cases, strong ties were sparse, but a group of firms maintained strong and valuable ties, which entrepreneurs considered would last.

The results of the descriptive SNA suggest that both the information and collaboration networks displayed rather centralized structures, which were held together by a group of central firms: the *dominant players*. This is consistent with the GINI coefficient of the degree of centrality indicator, which revealed that ties were rather unevenly distributed across firms.

Figure 6.3 illustrates the Kernel density distributions of the degree of centrality values for the information and collaboration network. It shows that both networks were characterized by few firms with many ties, while the majority of the other firms displayed much lower connectivity.[17]

[17] The high correlation values between the degrees of centrality of information and collaboration networks (Pearson coefficient was above 0.9) revealed that actors central in one network were also central in the other.

Figure 6.3 ■ Kernel Density Distribution of Degree of Centrality for the Information and Collaboration Networks, 2012

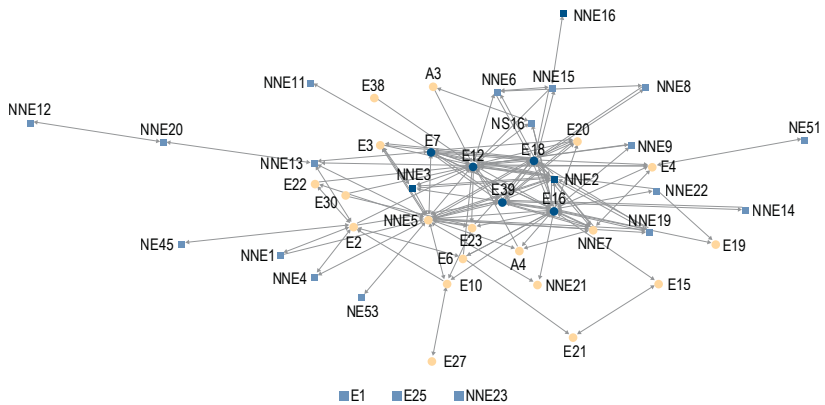


Source: Authors' calculations.

Dominant Players

We identified seven firms with the characteristics of dominant players, defined as those firms that had strong connectivity in both the information and collaboration networks (Figure 6.4).[18] Five of them were medium-sized firms founded in the 1980s, which were also central firms in 2005, one was a new entrant, and another existed in 2005 but came out prominently as a central firm only in 2012.

Figure 6.4 ■ Dominant Players in the Information Network



Source: Authors' calculations.
Notes: Dominant players are marked as blue nodes. Circle nodes indicate treated firms; square nodes indicate untreated firms; blue square nodes indicate first tier indirect beneficiaries (i.e., untreated that have at least one collaborative tie with a treated firms); light blue nodes indicate all other firms.

[18] See Table 6.4 on page 130 for reference on the measurement of dominant players.

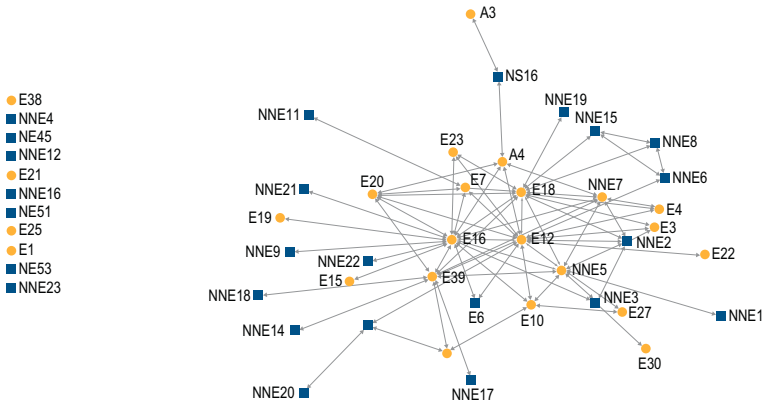
The latter two were smaller and more recently founded firms whose entrepreneurs showed a very dynamic and collaborative attitude toward local initiatives, including participation in CDP and CIIECCA activities. Dominant players were considered the technological leaders of different market niches, spanning production of TV electronic devices, telecommunications devices, industrial electronics, electromedicine products, control systems for public transport, and automation systems for the industrial sector. Qualitative insights from fieldwork suggested that these firms were tied together by the strong social linkages their owners had established even prior to the creation of CIIECCA and implementation of the CDP. At the time of our study, they were all active members—many with directive responsibilities—of CIIECCA and, with one exception, their owners were enthusiastic participants in the many CDP initiatives. At the local level, other firms in the same subsector often recognized these firms as leading actors in their respective subsectoral niches and often imitated them.

Among the entrepreneurial and performance indicators, the only significant differences from the rest of the electronics firms in Córdoba were that they had international clients in Latin America, which they considered important for technological upgrading, and that they invested considerable resources in ISO standards certifications. For instance, a dominant player set up an export consortium with other firms to sell electronics equipment to Latin America, the Emirates, and Iran. Such relationships were considered important learning sources about the business. Likewise, another dominant player, specialized in TV electronics, had among its clients all of the major broadcasting companies in Bolivia, Chile, Paraguay, Peru, and Uruguay, which stimulated technological learning and more investments in frontier broadcasting technologies like satellite technologies.

Dominant players were among the firms that mobilized more knowledge resources in the cluster, by forming information and collaborative ties with other cluster members. Moreover, the dominant players generated spillovers in the cluster by engaging in interactions not only with treated firms, but also with untreated firms, which we call indirect beneficiaries of the CDP (see earlier chapters). Figure 6.5 shows the first tier indirect beneficiaries.[19] As argued elsewhere in this book, this indirect effect of the CDP should be considered a potentially important outcome of the policy—a positive side effect of belonging to the same cluster.

[19] Indirect beneficiaries are not necessarily free riders. They connect to dominant players because there is an interest in collaborating with them, not because there is an intention to behave as a free rider.

Figure 6.5 ■ Indirect Beneficiaries in the Collaboration Network



Source: Authors' calculations.
Note: Circle nodes indicate treated firms; square nodes indicate untreated firms; blue square nodes indicate first tier indirect beneficiaries (i.e., untreated that have at least one collaborative tie with a treated firms); orange nodes indicate all other firms.

The spillovers generated by dominant players were significantly higher than those generated by other firms in the cluster since dominant players established more direct ties with other firms. With reference to the collaboration network, Table 6.7 shows that dominant players on average had eight direct collaborative ties with treated firms (versus an average of 1.6 for the other firms in the cluster) and they maintained three direct collaborative ties with indirect beneficiaries, a value that is threefold the value of the other firms in the cluster (1.3). Finally, we found that these actors played the role of gatekeepers, connecting treated and indirect beneficiaries on average 37 times compared with an average of 0.96 times for other firms in the cluster (Gould and Fernandez, 1989). Hence, these results were consistent with the fact that dominant players were key actors in diffusing the benefits of the policy treatment to untreated actors in the cluster.

Table 6.7 ■ Dominant Players' Spillovers through Collaboration Ties

	Type of firm	N	Average	Sig. (2-tail)
Number of direct ties (degree of centrality) with treated firms	**Dominant players**	**7**	**8.3**	**0.002**
	Other firms	31	1.6	
Number of direct ties (degree of centrality) with untreated firms	**Dominant players**	7	**3.1**	**0.005**
	Other firms	31	1.3	
Number of times the firm played the role of gatekeeper	**Dominant players**	**7**	**36.7**	**0.023**
	Other firms	31	0.97	

Source: Authors' calculations.

The Effects of CDPs on Networks

Drivers of Network Change: The Role of CDP Initiatives

This section discusses the SAOM analysis of the information network. We used this analysis to assess whether participation in the CDP over the 2003–07 period influenced the formation of new ties in the 2008–12 period. The analysis was also intended to help us understand what CDP initiatives contributed more to the effect. Table 6.8 shows the CDP effects, controlling for a set of other factors that could have influenced the formation of new ties.

Model 1 in Table 6.8 shows that the more a firm was involved in different CDP activities, the more it was likely to generate new ties to transfer information to other electronics firms (coefficient 0.29; standard error [s.e.] 0.13). More specifically, for Model 2, the firms that participated in the CACyDP (coefficient 1.34; s.e. 0.57) and the strategic planning workshops (coefficient 1.91; s.e. 0.77) were the most likely to form new ties. In contrast, firms that participated in hiring the consultant to promote institutional activities were less likely to generate extra outgoing ties over 2008–12 (coefficient −1.51; s.e. 0.66). Other activities that were important in increasing production efficiency, like the CSMT, or for promoting the industry through fairs, did not have a clear effect on networks.

Among the control variables, it was interesting to notice that reciprocity was significant, which means that new ties tended to reciprocate existing ties and that local firms had a tendency to form stable and mutually enriching relationships. Also, in line with our observation about the emergence and consolidation of a group of dominant players, we found that preferential attachment was significant, indicating the tendency of the most connected actors to increase connectedness over time. In other words, firms with high connectivity in 2005 (i.e., high number of outgoing ties) had a tendency to extra outgoing ties in the following period.

None of the firm-level effects turned out to be significant, while two proximity effects appeared to be particularly important. First, firms whose owners were tied by friendship or kinship relationships in 2005 were more likely to form new ties with each other over 2008–12, which means that a preexisting social structure was important in determining the evolution of the network. Second, members of CIIECCA's Directive Committee were likely to form new ties among themselves, highlighting the importance of being active members of the business association. Finally, belonging to the same subsector or being geographically proximate did not make interactions more probable.

In summary, the descriptive SNA and the SAOM analysis showed that the information network of the electronics firms in Córdoba evolved in a path-dependent fashion toward consolidating a structure where dominant firms

Table 6.8 ■ Results of SAOM Analysis

		Model 1	Model 2
		Estimate (s.e.)	Estimate (s.e.)
CDP effects			
	CDP participation intensity	0.29 (0.13)**	
	CSMT		–0.02 (0.53)
	CACyDP		1.34 (0.57)**
	Fairs		–0.72 (0.68)
	Strategic planning workshops		1.91 (0.77)**
	Affinity group workshops		0.89 (0.69)
	Institutional activities		–1.51 (0.66)**
Controls			
Structural effects	Reciprocity	3.61 (0.72)**	4.25 (0.91)**
	Transitive triplets	0.09 (0.06)	0.07 (0.08)
	Preferential attachment	0.06 (0.03)**	0.05 (0.03)*
Firm-level effects	Size	0.17 (0.33)	0.26 (0.45)
	Age	–0.01 (0.03)	–0.03 (0.04)
	Patents	0.06 (0.21)	0.36 (0.36)
	Exports	0.21 (0.42)	0.94 (0.67)
Proximity effects	Friendship and kinship	1.19 (0.50)**	1.07 (0.50)**
	Geographical distance	0.02 (0.02)	0.00 (0.02)
	Subsector	0.47 (0.35)	0.55 (0.37)
	Member of CIIECCA Dir. Com.	0.93 (0.27)**	1.20 (0.33)**
	Rate parameter	13.23 (2.71)**	12.83 (2.34)**
	Out-degree (density)	–4.66 (0.74)**	–5.09 (0.80)**

Source: Authors' calculations.
Notes: Estimations are based on the relationships between the electronics firms existing in 2012 that were also interviewed in 2005 (i.e., 27 firms). **0.05; *< 0.10. All convergence diagnostics (t-ratios for deviations from targets) were close to 0.

continued to occupy a central position. The preexistence of a social structure based on friendship and kinship ties and the institutional framework tied to participation in CIIECCA and its Directive Committee contributed to the consolidation of this structure.. Also, the network's structural forces, like the search for reciprocity and the preferential attachment effect, contributed to reinforce existing ties and strengthen the centrality of dominant players. Within this context, firms that participated in the CDP displayed a higher propensity to generate new ties. However, participation in the CDP did not generate a disruptive effect in the preexisting structural characteristics of the local network.

A key question at this point is whether this should be considered a positive result of the CDP or not. To answer this question, we needed to abandon the idea that there was an optimal network structure that all cluster policies should promote. Rather, we needed to be aware of the fact that a given structure was associated with benefits as well as drawbacks. In this case, the benefits of the presence of a group of dominant players was that they acted as leaders that invested time and resources to promote initiatives that could be beneficial to the whole local community of firms and that generated spillovers to other local firms, including untreated firms. Dominant players were at the core of the network, were strongly connected to each other, and had consolidated a collaborative model that made their disconnection unlikely and that may have acted as a permanent platform for any collective activity that was promoted within the industry.

Moreover, the fact that not all firms were equally connected to the local network was not a sign of its weakness. We agree with one of our interviewees in the focus group who declared that: "we should give up thinking that these kinds of projects should involve most or all of the local entrepreneurs. They should involve those that are persuaded this is the right way to go." Hence, network members could economize on their ties, and a network structure could work perfectly well without giving prominence to all of its members. The risk of such a centralized structure is further marginalization of peripheral actors. However, in this case, the group of dominant firms proved generally to be very open to collaborations and had an interest in promoting the Córdoba electronics industry as a whole. This was one of the CDP's achievements: promoting a culture of partnership and collaboration. The bottom line is that consolidating a group of leading firms is a positive outcome of a CDP provided that a mentality oriented toward creating collective goods (like the CSMT and the CACyDP) and sharing knowledge and resources is maintained and nurtured over time.

Another objective of the CDP was to foster connections with different types of government organizations (at the local, provincial, and national level),

universities, and business associations. Key organizations included the provincial office for the Ministry of Industry, Commerce, and Employment (Ministerio de Industria, Comercio y Trabajo); the Science, Technology, and Innovation Ministry (Ministerio de Ciencia, Tecnología e Innovación Productiva); the provincial office of the Ministry of Science and Technology; and the Ministry of Industry (Ministerio de Industria). Other organizations included the National University of Córdoba (Universidad Nacional de Córdoba), National Technological University (Universidad Tecnológica Nacional), National Institute of Industrial Technology (Instituto Nacional de Tecnología Industrial), and other actors, such as the Instituto Argentino de Normalización y Certificación (IRAM), ADEC, and Córdoba Industrial Association (Unión Industrial de Córdoba). Key institutions that supported export-oriented activities included the provincial office of Agencia ProCórdoba, a public–private organization that promotes the internationalization and foreign trade of firms located in Córdoba and that supports participation in trade fairs and international business trips; and the Córdoba Chamber of Foreign Trade (CACEC), a business association created by exporting firms in Córdoba that promotes exporting initiatives.

Figure 6.6.a illustrates all of the linkages formed between the electronics firms and different institutional actors to transfer technology and technical knowledge. Figure 6.6.b shows only the technology-transfer linkages that were formed between 2008 and 2011 as a consequence of the CDP. Figures 6.7.a and 6.7.b show linkages formed to foster export-oriented activities. In comparing Figures 6.6.b and 6.7.b, we see that participation in the CDP contributed to the formation of new technology-transfer linkages; however, almost no new linkages were formed for exporting.

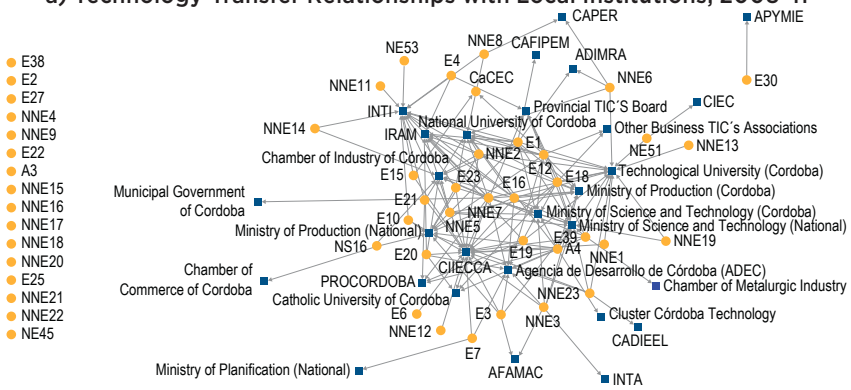
CDPs, Networks, and Performance: Perceptions about the Relevance of the CDP

Insights from Treated Firms

We asked the interviewees about their participation in the CDP and about the perceived benefits that CDP activities had on their businesses. We found that about 90 percent of the treated firms used the real service center CSMT and more than 70 percent participated in trade fairs promoted by the CDP. Other activities were less popular, as shown in Table 6.9. These choices are also reflected in the degree of satisfaction the respondents expressed about those initiatives, with the CSMT receiving a very high score (4.25 on 1–5 scale). The CSMT was considered to be the most successful initiative. It became an asset for the territory, also providing advantages to firms that did not participate in the CDP.

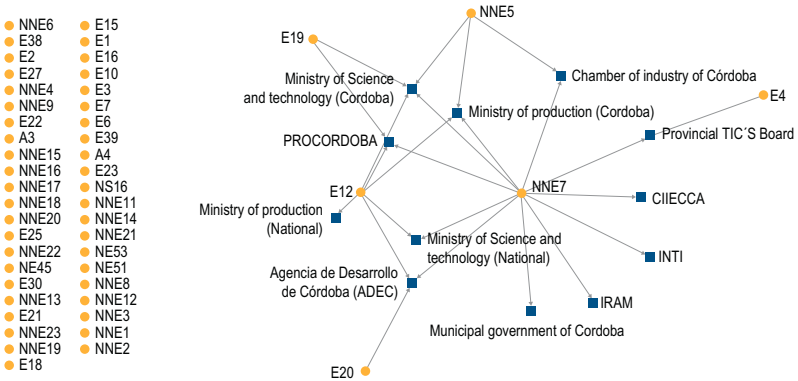
Figure 6.6 ■ Technology Transfer

a) Technology-Transfer Relationships with Local Institutions, 2008–11



Circle nodes indicate firms.
Square nodes indicate local institutions.

b) Technology-Transfer Relationships with Local Institutions Originated via the CDP, 2008–11



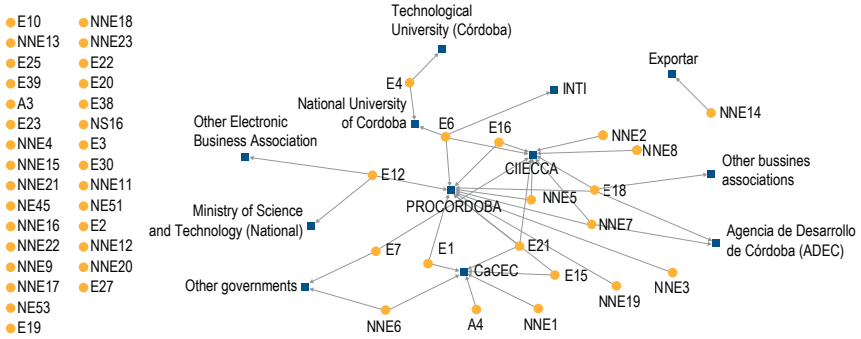
Circle nodes indicate firms.
Square nodes indicate local institutions.

Source: Authors' calculations.

Qualitative insights from the interviews suggested that the CSMT contributed to increasing the overall productivity of the Córdoba electronics industry and that it allowed many firms to survive in the market and face exporting difficulties. Other institutional activities, such as the workshops for joint strategic planning and the consultant to identify affinity groups, were perceived to be relatively less successful in generating tangible improvements for business activity (average lower than 3). Instead, contracting consultants to promote coordination activities (i.e., the institutional activities) was valued positively by the firms

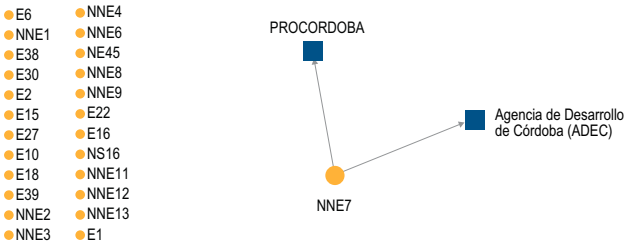
Figure 6.7 ■ Export-Oriented Relationships

a) Export-Oriented Relationships with Local Institutions, 2008–11



Circle nodes indicate firms.
Square nodes indicate local institutions.

b) Export-Oriented Relationships with Local Institutions via the CDP, 2008–11



Circle nodes indicate firms.
Square nodes indicate local institutions.

Source: Authors' calculations.

Table 6.9 ■ Participation in CDP Activities

	Number of participants (% of treated firms)	Satisfaction 1–5 (Min.–Max.)		
		Min	Max	Average
CSMT	19 (90.5)	3	5	**4.25**
CACyDP	7 (33.3)	2	5	3.00
Trade fairs	15 (**71.4**)	3	5	**3.82**
Strategic planning workshops	8 (38.1)	2	4	2.87
Affinity groups workshops	9 (42.9)	1	4	2.38
Institutional activities	9 (42.9)	2	5	**3.20**

Source: Authors' calculations.

that participated in this initiative (about 40 percent of treated firms); however, as noted above, participation in institutional activities did not help generate new ties. Indeed some activities may have been beneficial for some aspects of the business (e.g., improving production efficiency), but not necessarily for generating networks.

When asked about the general benefits of participating in the CDP, 62 percent of the respondents at treated firms declared that their overall judgment was positive and that they believed the policy produced some beneficial effects for their activities. In contrast, around 30 percent of the respondents felt that their firm had not benefited from the CDP at all. Respondents at treated firms believed, importantly, that the CDP contributed to improving local relationships (average of 3.54 on 1–5 scale). Two quotes illustrate the perceived importance of the CDP to foster local relationships:

> The program contributed mainly on relational grounds. Everybody talked about clusters, but no one had prior experience in the practice of taking part in a cluster and its consequent networking activities. Now we know how to do it and we moreover have developed a common identity through a set of institutional activities (based on interview with firm E12).
>
> The CDP contributed to create a positive attitude toward interfirm cooperation. Before, we had very closed attitudes and all the projects we are developing now with local and national institutions are mainly due to our participation in the program (based on interview with firm E23).

Qualitative insights also suggested that local entrepreneurs participating in the CDP would have welcomed a more structured and organized governance of the network right from the beginning of the policy. Codes of ethics, for instance, were introduced only at the very end of the program, while some respondents believed that an earlier introduction would have avoided conflicts among local entrepreneurs. Regarding other achievements, respondents at treated firms believed that the program contributed only moderately to improve product and process innovation (average of 2.62 on 1–5 scale), that it did not improve their financial performance (1.69), their commercial and marketing potential (0.54), their management skills (1.92), or management of social and environmental issues (1.46). Finally, respondents at treated firms who were not satisfied with the CDP declared that it was due mainly to problems internal to the firm (2.2) or to the way CIIECCA managed the program (3.0), while the CDP per se was not considered to have limitations or problems (1.0).

Table 6.10 ■ CDP and Perceived Relationship with Performance, 2008–11

	Number of respondents (% of treated firms)	Importance 1–5 (Min.–Max.)		
		Min	Max	Average
Revenue	19 (90%)	1	3	1.37
Profit	17 (81%)	1	3	1.41
Exports	19 (90%)	1	3	1.26
No. of employees	18 (86%)	1	3	1.22
R&D investment	18 (86%)	1	3	1.22
Commercialization of innovative products	6 (29%)	1	2	1.17

Source: Authors' calculations.

Insights from Untreated Firms

Our survey also targeted a group of untreated firms. Most respondents at untreated firms did not answer our questions about their view on the CDP nor had an opinion, and most of them did not participate in the CDP as they were not aware of its existence (respondents agreed with the statement that they were not aware of the program with an average of 3.8). The lack of awareness about the CDP was considered to be because local entrepreneurs did not receive sufficient information from CIIECCA because they were not affiliated with it when the policy was launched.[20] However, by observing the beneficial effects of the policy on treated firms, respondents at untreated firms believed that the policy was successful and would be keen to participate in such a policy in the future (respondents agreed that they would be keen to participate with a 3.25 average value on a 1–5 scale). Next, some believed that they had missed out on an opportunity by not participating to the CDP (respondents agreed that they had missed out on an opportunity with an average of 3.00).

Performance Indicators

The performance of cluster firms, however measured (i.e., revenue, profit, exports on total production, size, R&D investments, or share of innovative products on total production), improved remarkably during the years under analysis (Giuliani and Matta, 2013). However, treated firms perceived that very little of this was due to the CDP (Table 6.10).

The focus group agreed that the CDP had important beneficial effects on the process of doing business, in particular on improving local interfirm

[20] It is worth noting, however, that interviews of key informants, such as former directors of the CDP, suggested that, although recommendable, affiliation with CIIECCA was not a requirement for being included in the CDP.

coordination and more intense use of some of the joint activities promoted by the CDP. The following are a couple of comments made in the focus group:

> "Nowadays the firms that do not get together or associate with each other are likely to exit the market (...) I have no doubt that if our firm had not participated in the CSMT initiative, it would have gone bankrupt by now. In the past four years, all the Buenos Aires firms that were similar to ours disappeared due to the competition of importing firms. There is one firm that has downsized from 200 to 10 employees because of its isolation. Our reduced production scale leaves no option but to cooperate with other firms to reach economies of scale" (E16).
>
> "Here (in Córdoba) there are several firms—not just mine—that have survived thanks to the CSMT initiative. This has increased quality and productivity. Now I can satisfy clients' requests much more easily than before" (E18).
>
> "The CSMT was an absolute success, very prominent, very strong. Other activities that made us stronger were the Expotrónica fairs. During the first years, this fair made us more visible and contributed to create a group identity. Also, the workshops based on the development of a strategic plan were very good" (NNE5).

Summary

- In spite of the enormous increase in CDPs worldwide, and their emphasis on network strengthening, prior evaluations have often failed to measure network-related concepts appropriately. In contrast, this chapter suggests and tests the application of SNA as an alternative treatment of such concepts. An additional advantage is that SNA can be applied in combination with qualitative evaluation studies and quantitative exercises of CDP impact evaluations.
- This study on the electronics cluster in Córdoba, Argentina focuses on two types of local networks: the *information* network, which measures the transfer of business information, including any information relevant for the business (e.g., technological and marketing-related information), and the *collaboration* network, which measures the existence of collaborative projects between firms. An earlier study shows that, prior to the start of the CDP, connectivity was poor and collaboration minimal (Mazzonis et al., 2002; IDB–MIF, 2008). Two years after the start of the CDP, we have detected significant interorganizational networks, aimed at the local exchange of knowledge or based on collaborative interfirm projects (Matta, 2012).

- This new study corraborates this earlier finding about local networks but also detects a decrease in the density of linkages between 2005 and 2012 in both networks. Firms economize on the number of relationships they form by selecting only partners from which they believed they can obtain tangible benefits. The network becomes more centralized, with fewer selected firms becoming more central over time, while others become progressively more peripheral or isolated. We refer to these central firms as *dominant players*, and show that they are vital to guaranteeing network connectivity and creating the link between treated and untreated firms.
- There is a relatively stable pattern of interaction, characterized by the consolidation of a critical mass of firms—mainly the dominant players and their direct contacts—that are decisive in maintaining the level of activity of the local interorganizational network. These firms are also receptive to future policy initiatives and may have acted as a permanent platform for any collective activity that was promoted within the industry.
- The CDP leads to strengthening and creating new technology-transfer ties between the electronics firms in Córdoba and other local, provincial, and national institutions (sometimes also local universities), but has no impact on promoting new ties aimed at export-oriented activities. The firms that more intensively participated in the activities promoted by the CDP are also more likely to form new information ties over the 2005–12 period. However, all of the activities that are meant to form new ties (i.e., affinity group workshops and institutional activities) fail to do so: networking-oriented activities do not stimulate networking. Instead, firms that participate in the CACyDP and the strategic planning workshops successfully generate new ties with other local firms after the program is completed. One plausible interpretation of this result is that networks are formed when there is a real need, not when actors are invited to do so in a set of workshops. Entrepreneurs get connected when they have a problem to solve or an idea to promote.
- On these grounds, it is possible to draw several lessons and implications for policy. First, the evidence suggests that CDPs should promote activities that address real problems and concrete challenges rather than activities that strictly promote networking. Networking must be a tool, or an indirect objective, rather than the target. Consistently, policies should include developing selective and gradual networks. The success of a network is often based on a group of dominant players, visionary and motivated entrepreneurs who invest their time and resources in network-enhancing initiatives, and in avoiding disrupting the network over time. The design of new CDPs should take these results into account.

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