

# Input-Output Based Cluster Method to Identify Traded Industry Clusters in the Cali-Baja Binational Mega-Region

Sanchita Mukherjee, Ph.D.  
San Diego Association of Governments (SANDAG)

Daniel E. Flyte  
San Diego Association of Governments (SANDAG)

Alejandro Brugués, Ph.D.  
El Colegio de la Frontera Norte (COLEF), Mexico

## Acknowledgements

The authors would like to personally express their appreciation and gratitude for the contributions and support from the UC San Diego Center for US-Mexican Studies; the University of San Diego; the San Diego Regional EDC; the Cali-Baja Bi-National Mega-Region; the Office of the Mexican Consul General in San Diego; the Office of the U.S. Consul General in Tijuana; the Cali-Baja Advisory Committee; and the entire COLEF and SANDAG Technical Committee.

## Abstract

In this paper, we describe the methodology and results of a traded industry cluster study of the Cali-Baja Binational Mega-Region, using a multi-regional economic input-output (I-O) model. Using I-O interactions among 189 industry sectors in the Mega-Region that encompasses San Diego County, Imperial County and Baja California (Mexico), we examine cross-border buyer-supplier linkages. We use industry-specific location quotients to identify those industries with the strongest comparative advantage over other regions. These industries locally account for more employment than the U.S.-Mexico national average, and are selected as cluster seeds. Using a hierarchical distance-based crisp clustering technique, we identify “member industries” with strong buyer and/or supplier linkages (via intermediate transactions) with a seed industry. Collectively, these industries form a traded industry cluster. Identifying the most competitive and productive cross-border industry clusters serves many important purposes for both policymakers and planners. This study will help improve planning and decision-making efforts in workforce development, economic development, and border-related infrastructure investments as they pertain to traded industry clusters. We also discuss efforts underway to extend this study by developing cross-border value added trade matrices, so as to establish a deeper understanding of the drivers of wealth in the Mega-Region.

## 1. Introduction

In the two-plus decades following the establishment of the North American Free Trade Agreement (NAFTA), the US, Canada, and Mexico have benefited from tremendous economic expansion and a proliferation of trade between member countries. NAFTA's impact on border regions and their regional economies has been particularly striking—transforming entire regions and industries, contributing to the massive growth and evolution of the Mexican maquiladora and U.S.-Canadian automobile industries, and highlighting the strategic role of cross-border innovation and value chains. NAFTA's impact on trade has also underscored the significance of North American trade gateways and corridors, and the need for safe, efficient, and modern border crossing infrastructure.

As a testament to this growth, between 1995 and 2010 US-Mexican trade through land ports of entry grew from \$71 billion to \$255 billion (Wilson Center, 2013, p.30). Moreover, duty-free passage of goods through North American borders has facilitated sophisticated supply and value chains, allowing semi-finished (intermediate) goods to cross back and forth across borders often many times before final consumption. According to Koopman, et al (2010), 40% of the content of U.S. imports from Mexico is actually produced in the U.S. Barajas, et al (2014) and Wilson Center (2011) provide more complete analyses, and quantify the magnitude of NAFTA's economic impact on border regions at a state and sub-state scale. In addition, they identify those industries which contribute most to cross-border trade and economic interaction at major trade gateways.

In this study we identify traded industry clusters of the Cali-Baja Binational Mega-Region — home to over 6.5 million people and 2.5 million jobs in 2008. Encompassing San Diego County (California), Imperial County (California), and the State of Baja California (Mexico), the Cali-Baja Mega-Region is served by three international airports, two commercial seaports, and three commercial land ports of entry. It is also home to the San Ysidro port of entry—the busiest land border crossing in the Western Hemisphere<sup>1</sup>.

The Cali-Baja Mega-Region initiative was developed as part of a broad economic development coalition between the San Diego Regional Economic Development Corporation (EDC), the Imperial Valley EDC, and a consortium of Baja California partners, including the Tijuana EDC. Cali-Baja aims to promote the region as a globally competitive center for research and

---

<sup>1</sup> See GSA, <http://www.gsa.gov/portal/category/105703>

development, advanced manufacturing, and a rich diversity of services, with strong accessibility to global markets.

The cluster analysis was performed along with a binational research team that includes SANDAG—the San Diego region’s Metropolitan Planning Organization; Mexico’s El Colegio de la Frontera Norte (COLEF); the UC San Diego Center for U.S. Mexican Studies; the San Diego Regional EDC; the University of San Diego; and Cali-Baja Mega-Region.

For this study, we define traded industry clusters as groups of interrelated, export-oriented industries that bring wealth to a region. Building on previous cluster studies performed by SANDAG (2012 and 2008), and following a similar approach to Porter’s Diamond of National Advantage (1990 and 2000), we focus on identifying basic sectors that serve as regional drivers of economic activity. These industries have strong location quotients (LQs), and their exports generally represent a substantial share of their total production. Using an economic input-output (I-O) model, we then analyze the intermediate transactions matrix for these industries, which serve as seeds for the cluster process. We perform a hierarchical distance based crisp cluster analysis on these industries, with intermediate purchases and sales coefficient magnitudes serving as the basis for cluster membership.

The Cali-Baja clusters technical team advocates intermediate transactions analysis as a strong method for cluster development in the Mega-Region context due to its focus on value chains and its insight into the strategic drivers of cross-border interaction under NAFTA. Furthermore, it provides a better understanding of the industries most affected by the friction and costs associated with border crossing delays. Understanding cross-border economic interactions and the cooperative relationships between industries on either side of the border is important for carrying out a multitude of planning activities and policy making. The intent is to help identify common needs for improved border crossing infrastructure and investments in workforce development and other fixed capital.

The remainder of this paper describes the data sources and types of data used in this study, as well as challenges in developing a consistent and reliable binational data set at sub-national geographic scale. It presents the methodology and work completed as the first of two phases in studying Cali-Baja Mega-Region clusters. A discussion of future work underway is provided, describing the disaggregation of commodity trade flows through ports of entry, which aims to improve the study’s findings.

Based on 2008 data, our findings suggest that there are 15 traded industry clusters in San Diego County and 12 in Baja California. Imperial County has one industry cluster, Agriculture and animal production. We see a mix of manufacturing and non-manufacturing industry clusters in San Diego. These 15 clusters in San Diego County accounted for 1.5 million jobs and \$238bn of output in 2008. It is also interesting that ten out of the 12 industry clusters identified in Baja California are manufacturing related and the non-manufacturing clusters are the least productive. These 12 industry clusters together accounted for close to a million jobs and \$53bn of output in Baja California.

Results from this first phase of the analysis provide indisputable evidence of the Cali-Baja Mega-Region's importance as a global hub for manufacturing, with particular strengths in sectors like audio and video equipment manufacturing and medical device and supplies manufacturing. This study helps to illustrate the strengths and diversity of the binational region's three sub economies: the combination of high-tech research and development capability in the San Diego region, agricultural production in Imperial Valley, and diverse manufacturing in Baja California.

The paper is organized as follows. Section 2 describes data sources; Section 3 explains the methodology used for Phase I; Section 4 explains the results; and Section 5 describes the conclusions drawn in Phase I and the future research agenda for Phase II.

## **2. Data Sources**

To perform the analysis, we required a spatially and temporally consistent, disaggregate multi-regional (binational), economic I-O model. In the U.S., a commercially available I-O model at the county and sub-county level is produced on an annual basis from IMPLAN, Inc. However, for Mexico, no commercial data source for economic I-O models exists. Therefore, one had to be estimated using the most recently available (2009 vintage reflecting 2008 data) Censos Económicos (Economic Census) from the Instituto Nacional de Estadística y Geografía (INEGI).

The Mexican Economic Census—like the U.S. Economic Census—is produced every five years, and serves as the official measure of business and the economy. A 2008 Baja California I-O model was developed by the research team at COLEF from the Mexican national I-O model, and from previous surveys and estimates of state-level Regional Purchase Coefficient (RPC)

shares. It was standardized to reflect 2008 PPP<sup>2</sup> U.S. dollars in intermediate transactions activity.

In addition to the I-O models, employment at a common North American Industrial Classification System (NAICS) industry detail level was required, both locally and at a national level for each country. Employment data is also only available from INEGI, and from the Economic Census. It is reported at a state level at four-digit NAICS industry detail at the finest resolution. Therefore, for this analysis, a common 2008 economic data set was developed.

For San Diego and Imperial Counties, the 2008 California Employment Development Department's (EDD) Quarterly Census of Employment and Wages (QCEW) was used as the basis for employment at a four-digit NAICS level. For U.S. national employment, the Bureau of Labor Statistics 2008 QCEW was used.

To reconcile the sector composition differences between San Diego and Imperial County's IMPLAN models and COLEF's Baja California I-O model, a 189 sector scheme was devised that maps each of the 2008 IMPLAN 509 sectors and each of the four-digit Baja California sectors to a Cali-Baja industry sector. A similar approach was done to map employment in each four-digit employment sector to a Cali-Baja sector.

In performing the data synthesis, we discovered small, yet nonetheless significant, differences in reporting for certain employment sectors. Most importantly, we discovered INEGI's detailed reporting classification of employment in wholesale trade activities (NAICS 42XX) compared to the QCEW's aggregate reporting detail for wholesale. In addition, we discovered inconsistency in reporting of agriculture employment (NAICS 11XX) at a four-digit detail level. To resolve these differences, we resorted to choosing an aggregated wholesale trade activity and opting for three-digit NAICS specificity for the agriculture sector—thereby aggregating the four-digit based economic sectors each for agriculture and wholesale trade.

The resulting data set contains a 2008 representation of employment and LQ at each of 189 Cali-Baja sectors for San Diego County, Imperial County, and Baja California. Furthermore, a structurally consistent 189 sector I-O model was produced for each economy, and served as the driver for the cluster analysis.

---

<sup>2</sup> PPP: Purchasing power parity

### 3. Methodology for Phase I

In Phase I, we identify industry clusters for each of the three geographies – San Diego County, Imperial County and Baja California. Clusters are different from traditional sector employment because they focus on specialized industries as well as buyer and supplier linkages that are unique to a region’s economy.

#### 3.1. Location Quotient (LQ) tool to select “Seed” industry

We use employment concentrations to approximate an industry’s export strength and consequently to identify the industry clusters. High employment concentration in an industry would imply high production volume, suggesting these industries will be exporting most of its products after satiating regional demand. Employment concentrations are determined by calculating location quotients (LQ) for each 4-digit industry. A location quotient identifies the industries in each region with a comparative advantage over other industries and serves as a proxy calculation for identifying which industries export their goods and services out of the region, bringing wealth back into it. By employing more workers than the national average the industry is likely producing more goods and services than the region alone can consume; thus, the industries export the surplus product out of the region. The LQs are calculated as follows:

a) LQ for San Diego (SD) County:

$$LQ_{SD} = \frac{\text{San Diego Sector Employment} / \text{Total San Diego Employment}}{\text{U.S. Sector Employment} / \text{Total U.S. Employment}}$$

b) LQ for Imperial (Imp) County:

$$LQ_{Imp} = \frac{\text{Imperial County Sector Employment} / \text{Total Imperial County Employment}}{\text{U.S. Sector Employment} / \text{Total U.S. Employment}}$$

c) LQ for Baja California (BC):

$$LQ_{Imp} = \frac{\text{Baja California Sector Employment} / \text{Total Baja California Employment}}{\text{Mexico Sector Employment} / \text{Total Mexico Employment}}$$

Industries exhibiting an LQ at least half standard deviation above the average log (LQ) across all sectors are considered to be the “seed” industries. It should be noted that this threshold was developed empirically, and appeared to present a good balance between high LQ and

reasonable set size of seed industries. The log of LQ is used because of the strongly skewed distribution of LQs in the region.

Using location quotients, we identify the seeds for each region (San Diego County, Imperial County and Baja California) separately. These seed industries are considered to be the engines of growth of the local economy. The idea is that as the seed industries develop, they demand for new types of products and services. Existing firms can supply some of this new demand and some of it can be imported. However, this often results in creation of new local firms. These sectors create both competition and collaboration, spurring innovation, which eventually leads to new companies producing new products and services. The end result is a higher influx of capital, a rising economic profit, higher employment and growing wages.

Next, the seed industries are grouped by similar 3-digit NAICS where possible and reasonable in order to consolidate and group related seeds. For example, in the case of San Diego seed industries, 3341: Computer and peripheral equipment manufacturing, 3342: Communications equipment manufacturing, 3343: Audio and video equipment manufacturing and 3345: Electronic instrument manufacturing, are grouped by first three digits of their NAICS code (334) into one seed industry, 334 Aggregate: "Electronic equipment manufacturing". The Seed industries for San Diego County, Imperial County, and Baja California are shown in Tables 1, 2, and 3, respectively.

Column 1 in Table 1, 2 and 3 report the Cali-Baja code, which is essentially 4-digit NAICS code. Column 2 reports the name of the seed. Column 3 reports employment in the country. For San Diego County and Imperial County column 3 reports employment in the U.S. and for Baja California, column 3 reports employment in Mexico. Column 4 reports employment in San Diego County, Imperial County and Baja California. And column 5 reports industry specific location quotient in San Diego County, Imperial County and Baja California.

Both in San Diego and Baja California, 3343: Audio and video equipment manufacturing has the highest location quotient indicating it has the highest employment concentration among the seed industries. In Imperial County, 115: Services related to agricultural and forestry activities have the largest location quotient. In San Diego, 3366: Ship and Boat Building is the second largest industry in terms of LQ whereas in Baja California, 3391: Medical equipment and supplies mfg. is the second largest.

**Table 1: San Diego County Seed Industries by Cali-Baja Code**

Cali-Baja Code	Seed description	Employment in US	Employment in San Diego County	Location Quotient (LQ)
<b>334 Aggregate:</b>	<b>Electronic equipment mfg.</b>	779,304	19,311	2.71
<b>3343</b>	Audio and video equipment mfg.	26637	2694	11.06
<b>3342</b>	Communications equipment mfg.	127056	4751	4.09
<b>3345</b>	Electronic instrument mfg.	442711	8711	2.15
<b>3341</b>	Computer and peripheral equipment mfg.	182900	3155	1.89
<b>3366</b>	Ship and boat building	155,942	7,790	5.46
<b>5417</b>	Scientific research and development services	619,111	24,972	4.41
<b>7121</b>	Museums, historical sites, zoos, and parks	130,703	3,509	2.94
<b>7115</b>	Independent artists, writers, and performers	49,223	1,108	2.46
<b>517A</b>	Wired Telecommunications Carriers; Wireless Telecommunications Carriers (except Satellite); Satellite Telecommunications; All Other Telecommunications	1,019,148	18,982	2.04
<b>3391</b>	Medical equipment and supplies mfg.	308,372	5,554	1.97
<b>3399</b>	Other* miscellaneous mfg.	319,064	5,688	1.95
<b>721A</b>	Hotels (except Casino Hotels) and Motels; Bed-and-Breakfast Inns; Recreational and Vacation Camps (except Campgrounds); Rooming and Boarding Houses	1,858,911	31,326	1.84
<b>541A</b>	Architectural, Engineering, and Related Services; Management, Scientific, and Technical Consulting Services; Employment Services	2,449,306	40,368	1.80
<b>3254</b>	Pharmaceutical and medicine mfg.	289,586	4,656	1.76
<b>5611</b>	Office administrative services	404,079	6,464	1.75
<b>531A</b>	Lessors of Real Estate; Offices of Real Estate Agents and Brokers; Activities Related to Real Estate	1,470,846	22,961	1.71
<b>5112</b>	Software publishers	261,652	4,055	1.69
<b>3169</b>	Other** leather product mfg.	11,784	181	1.68

\*(Jewelry, silverware, hollowware, lapidary work, costume, sporting and athletic goods, game, toy, children's vehicle, office supplies (except paper), gasket, packing, sealing device, musical instrument, button, pin, mop, broom, brush, burial casket manufacturing).

\*\*Other refers to Luggage, women's handbag, purse and personal leather good manufacturing.



**Table 2: Imperial County Seed Industries by Cali-Baja Code**

Cali-Baja Code	Seed description	Employment in US	Employment in Imperial County	Location Quotient (LQ)
<b>11</b>	<b>Agriculture and animal production</b>	<b>1,098,772</b>	<b>11,141</b>	<b>32.91</b>
<b>Aggregate: 115</b>	Services related to agricultural and forestry activities	335,273	7,428	71.91
<b>111</b>	Agriculture	536,507	3,138	18.99
<b>112</b>	Animal breeding and production	226,992	575	8.22

**Table 3: Baja California Seed Industries by Cali-Baja Code**

Cali-Baja Code	Seed description	Employment in Mexico	Employment in Baja California	Location Quotient (LQ)
<b>334</b>	<b>Aggregate: Electronic equipment mfg.</b>	259,548	71,237	7.88
<b>3343</b>	Audio and video equipment mfg.	52,773	28,915	15.72
<b>3345</b>	Electronic instrument mfg.	12,975	4,075	9.01
<b>3344</b>	Semiconductor and electronic component mfg.	129,492	29,092	6.45
<b>3346</b>	Magnetic media mfg. and reproducing	4,857	1,053	6.22
<b>3342</b>	Communications equipment mfg.	59,451	8,102	3.91
<b>3391</b>	Medical equipment and supplies mfg.	99,524	37,461	10.80
<b>3364</b>	Aerospace product and parts mfg.	11,061	3,872	10.05
<b>7112</b>	Spectator sports	3,768	1,138	8.67
<b>332</b>	<b>Aggregate: Hardware and metals mfg.</b>	84,567	18,907	6.42
<b>3325</b>	Hardware mfg.	12,393	3,370	7.80
<b>3329</b>	Other fabricated metal product mfg.	56,236	13,264	6.77
<b>3328</b>	Coating, engraving, and heat treating metals	15,938	2,273	4.09
<b>3399</b>	Other <sup>†</sup> miscellaneous mfg.	101,250	12,472	3.54
<b>335</b>	<b>Aggregate: Electrical equipment and lighting mfg.</b>	143,273	16,365	3.28
<b>3353</b>	Electrical equipment mfg.	67,128	8,784	3.76
<b>3359</b>	Other electrical equipment and component mfg.	58,441	5,828	2.86
<b>3351</b>	Electric lighting equipment mfg.	17,704	1,753	2.84
<b>337</b>	<b>Aggregate: Furniture mfg.</b>	34,169	3,910	3.28
<b>3379</b>	Other furniture related product mfg.	13,510	2,072	4.40
<b>3372</b>	Office furniture and fixtures mfg.	20,659	1,838	2.55

**Table 3: Baja California Seed Industries by Cali-Baja Code (continued...)**

Cali-Baja Code	Seed description	Employment in Mexico	Employment in Baja California	Location Quotient (LQ)
<b>333</b>	<b>Aggregate: Machinery and equipment mfg.</b>	15,697	1,651	3.02
<b>3333</b>	Commercial and service industry machinery	5,490	765	4.00
<b>3336</b>	Turbine and power transmission equipment mfg.	10,207	886	2.49
<b>3261</b>	Plastics product mfg.	195,697	19,180	2.81
<b>3362</b>	Motor vehicle body and trailer mfg.	20,853	1,751	2.41
<b>5619</b>	Other <sup>††</sup> support services	32,215	2,575	2.29

<sup>†</sup>Jewelry, silverware, hollowware, lapidary work, costume, sporting and athletic goods, game, toy, children's vehicle, office supplies (except paper), gasket, packing, sealing device, musical instrument, button, pin, mop, broom, brush, burial casket manufacturing.

<sup>††</sup> Packaging and Labeling Services, Convention and Trade Show Organizers.

### 3.2 Identify strong buyer and supplier relationships – Industry Cluster

Once seed industries have been identified using LQ tool, next step is to identify the supporting industries with strong buyer supplier relationship with the seed – together they (seed and the supporting industries with strong buyer supplier relationship with the seed) are known as an “industry cluster”. In order to quantify the relationships between businesses within a cluster, we have used Input-Output (I-O) models for each region. These I-O models have transaction tables showing the U.S. dollar value and direction of the buyer-supplier relationships. The monetary values in the transactions table are used to determine the relative strengths of the relationships between businesses in a cluster; strong relationships (high transaction values) representing a possible cluster group.

To detect buyer supplier relationship, we use purchase magnitude and sales magnitude. Purchase magnitude is the ratio of each of the buyer's purchase transactions to that buyer's average purchases across all of its sectors. It is calculated for each cluster seed as follows:

$$\text{Purchase Magnitude} = \frac{\text{Each of the buyer's purchase transactions}}{\text{Buyer's average}}$$

Similarly, a sales magnitude is the ratio of each of the seller's sales transactions to seller's average sales across all of its sectors. It is calculated for each cluster seed as follows:

$$\text{Sales Magnitude} = \frac{\text{Each of the seller's sales transactions}}{\text{seller's average}}$$

Strong buyer supplier relationship is established when the supporting industry's purchase magnitude and sales magnitude is at least one standard deviation above the average purchase magnitude and sales magnitude across all sectors. This step is intended to find the biggest partners of a seed industry. It is to be noted that the same supporting industry may appear under different seed industries – the clusters we get following this technique can be referred to as fuzzy clusters (where same supporting industry can be found under different clusters).

Next we refine the fuzzy clusters using distance based crisp clustering technique so that there is no duplication. This means duplication of those supporting industries that are found in more than one Seed is removed and the supporting industries are exclusively assigned to a single Seed using distance clustering technique known as crisp clustering (where a supporting industry can only be found under a particular cluster).

Distance clustering involves calculating the distance of location of a supporting industry in terms of its purchase magnitude and sales share from the point of maximum purchase magnitude and maximum sales share of a cluster. Sales share denotes percent of sales that a supporting industry makes to the seed. In the sample, Sector 3161, Leather and hide tanning and finishing, sells 20.4% of all of its sales to Seed 3169, Other<sup>3</sup> leather product manufacturing. Purchase magnitude and sales share are being considered as key variables here to take into account both buyer's and seller's perspective. The supporting industry with the shortest distance is assigned to the seed cluster. The seed industry along with its supporting members found through crisp clustering appears at the core of the cluster. The rest of the supporting industries (of the same cluster) that meet the purchase magnitude cut-off, but appear under other clusters are mentioned in the outer circle. An example of Electronic equipment manufacturing cluster in San Diego region is shown in Figure 1. The inner circle shows the sectors that comprise the cluster core while the outer circle includes other sectors that support the core. For example, we have 12 industries at the core of Electronic equipment manufacturing clusters. These industries belong exclusively to Electronic equipment manufacturing and don't appear under any other cluster. The other 11 industries appearing in the outer circle support Electronic equipment manufacturing, however, they appear under other clusters as well. Apart from these 23

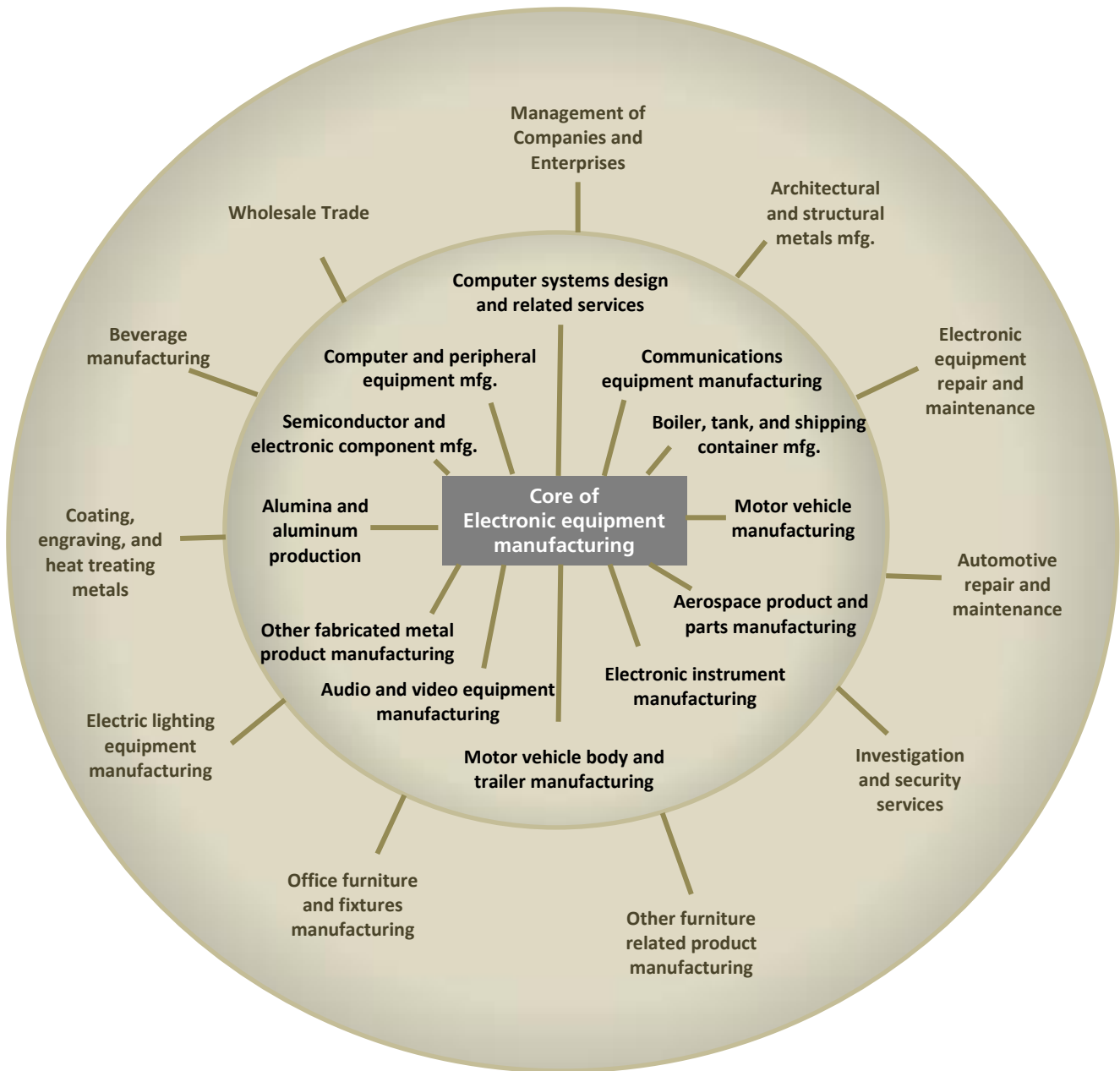
---

<sup>3</sup> Other refers to Luggage, women's handbag, purse and personal leather good manufacturing.

industries, there are hundreds of other industries that provide support to Electronic equipment manufacturing, but on a smaller scale and thus have not been reported.

The industry clusters with cluster seed and the supporting industries are reported in Table 7 (San Diego County), Table 8 (Imperial County) and Table 9 (Baja California). Column 1 of Table 7, 8 and 9 reports seed industry's Cali-Baja code, Column 2 reports seed name, Column 3 seed LQ; Column 4 reports supporting industry's Cali-Baja code, Column 5 supporting industry's name. We have separated industries between purchase side and sales side. Supporting industries from whom seed industries purchase products are listed under Purchase side and supporting industries to whom seed industries sell their (seed industries') products are listed under Sales side. If a supporting industry appears under purchase side, then Columns 6, 7 and 8 reports Purchase Magnitude, Sales Share and Transaction Amount between the seed industry and the supporting industry. If a supporting industry appears under sales side, then Columns 6, 7 and 8 reports Sales Magnitude, Purchase Share and Transaction Amount between the seed industry and the supporting industry. The seed industry and its supporting industries together create an industry cluster.

**Figure 1: Electronic equipment manufacturing cluster in San Diego County**



## 4. Results

Applying the methodology discussed in Section 2, we find 15 core industry clusters in San Diego County, one industry cluster in Imperial County and 12 in Baja California.

### 4.1 San Diego County Core Industry Clusters

The 15 industry clusters in San Diego County are listed in Table 4 along with cluster (comprising of seed and the supporting industries) employment, cluster output (total production in USD terms) and cluster productivity. Here, productivity is defined as output per worker. The industry clusters are portrayed in Figure 2 as well. On the x-axis of Figure 2, we measure employment in terms of numbers of people employed in thousands and on the y-axis we measure output produced in billions of U.S. dollars. And the size of the bubbles depicts productivity. In San Diego, 3391: Medical equipment and supplies manufacturing (mfg.) cluster employs the highest number of people, 246,179 workers, but is not the most productive cluster. 'Cluster 517A: Wired Telecommunications Carriers; Wireless Telecommunications Carriers (except Satellite); Satellite Telecommunications; All Other Telecommunications' – named 'Wired Telecommunications' in Figure 2 is the most productive cluster, indicating each person employed in the Wired Telecommunications cluster is producing more than any other cluster in San Diego County. 517A is closely followed by 5112: Software publishers and 334Agg: Electronic equipment manufacturing.

531A: Lessors of Real Estate; Activities Related to Real Estate produces the maximum output in value terms (\$35,424,100,541), with a moderate productivity level. Here, it is to be noted that some of these sectors, for example, 7115: Independent artists, writers, and performers and 5611: Office administrative services, are more labor intensive by nature and since we are not accounting for total factor productivity that is productivity of both labor and capital (machinery etc), the labor intensive sectors will reflect lower productivity level. However, given the data limitations, labor productivity is still the finest way to depict productivity level across clusters and would help us identify the clusters with high and low productivity.

### 4.2 Imperial County Core Industry Clusters

Imperial County has one industry cluster, Agriculture and animal production with an employment of 25,038 and output \$3,910,127,242 with productivity \$156,170 per worker (Table 5).

### 4.3 Baja California Core Industry Clusters

Baja California has 12 industry clusters and they are reported in Table 6 along with their respective cluster employment, cluster output and cluster productivity. These clusters are portrayed in Figure 3 as well. Similar to Figure 2, on the x-axis of Figure 3, we measure employment in thousands and on the y-axis we measure output produced in billions of U.S. dollars. And the size of the bubbles depicts productivity – output per worker.

334 Agg: Audio and video equipment manufacturing is the most productive sector in Baja California, followed by 335 Agg: Electrical equipment lighting manufacturing and 333 Agg: Machinery and equipment manufacturing. However, the largest employer is 5619: Other support services. Here ‘Others’ denote ‘Packaging and Labeling Services, Convention and Trade Show Organizers’. 334 Agg: Audio and video equipment manufacturing produces maximum amount of output in value terms (USD bn).

### 4.4 Comparing Industry Clusters in San Diego County and Baja California

It is very interesting that all of the industry clusters in Baja California are manufacturing sectors other than the least productive ones, ‘Other support services’ and ‘Spectator sports’. Whereas in San Diego County we see a mix of manufacturing and non-manufacturing industries – Wired Telecommunications, Software publishers, Electronic equipment manufacturing, Ship and boat building, Leather product manufacturing, Real estate activities, Scientific research and development services, Museums, historical sites, zoos, and parks, Hotels (except Casino Hotels) and Motels, Medical equipment and supplies manufacturing, Independent artists, writers, and performers etc.

The productivity level is relatively low in Baja California compared to San Diego County. For example, the most productive sector in San Diego County produces output \$659,203 per person, whereas the most productive cluster in Baja California produces only \$164,543 per person. If we compare the same industry cluster, ‘334 Agg: Electronic equipment manufacturing’ across San Diego County and Baja California, we find that it’s productivity level in San Diego is \$340,882 per worker, which is a little more than double of its productivity in Baja California (\$164,543 per worker). One reason behind that could be low labor cost in Baja California. Due to relatively low wage rate in Baja California compared to San Diego County, employers in Baja California employ more laborers than machinery. This could result in low productivity in Baja California compared to San Diego. However, if we compare these two

regions in terms of total production, San Diego produces \$20bn worth of goods in '334 Agg' while Baja California produces \$16bn worth of goods. The difference in production is significantly lower compared to productivity level. And by creating a cross-border industry cluster, San Diego County would be able to leverage Baja California's low labor cost reducing the cost of production and Baja California would gain in terms of infrastructure, skill and better production technique. This would also improve access to market as San Diego will then have access to Baja California's market demand and will not have to wait for import demand from China and other countries that involve large transportation costs.

## **5. Conclusions and Future Research**

This study is important as the effort to identify industry clusters in our Cali-Baja binational region has not been accomplished before. Given the uniqueness and magnitude of the project, this effort has evolved into different phases. This paper describes the initial phase (Phase 1) built upon the methodology that SANDAG has used for several decades to identify industry clusters in the San Diego region. This methodology begins with location quotient analysis to identify economic drivers in the economy and then uses an input-output model to identify buyer and supplier relationships to define the industry clusters.

In this paper, using three separate I-O models based on 4-digit NAICS code (year 2008), we have established 15 industry clusters for San Diego County, one industry cluster for Imperial County and 12 industry clusters for Baja California. Industry clusters are groups of interrelated, export-oriented industries that bring new money into the region. Clusters are different from traditional sector employment because they focus on specialized industries as well as buyer and supplier linkages that are unique to a region's economy. Viewing the regional economy through the perspective of clusters is important when describing the fast-paced, international economy of today.

We see a mix of manufacturing and non-manufacturing industry clusters in San Diego, whereas in Baja California, ten out of 12 industry clusters are manufacturing units, and they are the most productive clusters in terms of output per worker.

In San Diego, industry cluster '531A: Lessors of Real Estate; Activities Related to Real Estate' produces the maximum amount of output (\$35,424,100,541), industry cluster '3391: Medical equipment and supplies mfg.' generates the largest employment (246,179 persons). However, the most productive sector in terms of output per person is '517A: Wired Telecommunications



Carriers; Wireless Telecommunications Carriers (except Satellite); Satellite Telecommunications; All Other Telecommunications' generating \$659,203 per person.

Imperial County has only one industry cluster: '11 Aggregate: Agriculture and animal production' with an employment of 25,038, total production of \$3,910,127,242, producing \$156,170 per worker.

In Baja California, industry cluster '334 Agg: Audio and video equipment manufacturing' produces the maximum amount of output (\$35,424,100,541), industry cluster '5619: Other<sup>4</sup> support services.' generates the largest employment (246,179 persons) in the state. However, the most productive sector in terms of output per person is '334 Agg: Audio and video equipment manufacturing' producing \$164,543 per person.

Although this study captures the regional industry clusters well, we still lack the understanding of key industry clusters in our Cali-Baja bi-national region. It is a difficult task as we have only three regional I-O models available, capturing regional buyer supplier linkages. To identify binational industry clusters, we need to understand cross-border buyer supplier linkages and for that we would have to incorporate cross-border trade data to our model. Unfortunately, the trade data between San Diego County, Imperial County and Baja California are not easily available. However, we have started an effort to create a cross-border trade matrix that will help us identify the industry clusters in our Cali-Baja binational region using international trade data. This technique has not been accomplished before – this will be the Phase II of our study.

In Phase II of our study, to identify the industry clusters in Cali-Baja Mega-Region, we are using cross-border value added trade data. Why value added trade flow? In the production process, each producer purchases inputs and then adds values to create the final product. However, all official trade statistics are measured in gross terms, gross exports and gross imports, which include values of both intermediate goods and final products. Official trade flows are therefore, overstated because they “double-count” value of intermediate goods that cross international borders more than once. To avoid this “double counting” and pin down each industry’s actual contribution to cross-border trade, we want to focus on value added trade flow between San Diego County, Imperial County and Baja California. We are closely following the paper by Koopman, Powers, Wang and Wei (NBER 2010) to accomplish this goal.

---

<sup>4</sup> Packaging and Labeling Services, Convention and Trade Show Organizers

To identify the cross-border industry clusters we are creating value added trade matrices as described in Figure 4. We combine San Diego and Imperial County in one single region (SD&I) and calculate value added trade between SD&I and Baja California (BC). These four value added trade matrices will give us BC's value added exports to SD&I (which is equivalent of SD&I's imports from BC) and SD&I's value added exports to BC (BC's imports from SD&I). We could not add the regional I-O models together to reflect Cali-Baja Mega-Region trade as it was regional data. However, we can add the value added trade data as the exports from one region are the imports of the other region. Once we establish this I-O model for cross-border value added trade, we will repeat Phase I's methodology (Section 3) to identify cross-border cluster seeds and supporting industries to create traded industry clusters in Cali-Baja Mega-Region.

The identification of these industry clusters will detect the most competitive sectors in Cali-Baja Mega-Region, improve cross-border economic linkages, and help policymakers assess the type of infrastructure and other investments that could help the key industries.

**Table 4: San Diego County Industry Clusters: Employment, Output and Productivity**

<b>Cali-Baja Code</b>	<b>Cluster Name</b>	<b>Cluster Employment</b>	<b>Cluster Output (in 2008 USD)</b>	<b>Cluster Productivity (Output/Employment)</b>
<b>517A</b>	Wired Telecommunications Carriers; Wireless Telecommunications Carriers (except Satellite); Satellite Telecommunications; All Other telecommunications	31,883	21,017,232,468	659,203
<b>5112</b>	Software publishers	5,437	2,463,060,443	453,032
<b>334 Agg</b>	Electronic equipment manufacturing	61,378	20,922,667,512	340,882
<b>3366</b>	Ship and boat building	35,344	11,873,463,994	335,939
<b>3169</b>	Other** leather product manufacturing	2,680	892,685,049	333,135
<b>531A</b>	Lessors of Real Estate; Offices of Real Estate Agents and Brokers; Activities Related to Real Estate	210,015	35,424,100,541	168,674
<b>5417</b>	Scientific research and development services	126,531	20,126,387,806	159,063
<b>3399</b>	Other* miscellaneous manufacturing	45,865	7,070,698,505	154,165
<b>3254</b>	Pharmaceutical and medicine manufacturing	126,387	18,391,186,584	145,515
<b>541A</b>	Architectural, Engineering, and Related Services; Management, Scientific, and Technical Consulting Services	95,493	13,594,055,805	142,357
<b>7121</b>	Museums, historical sites, zoos, and parks	85,305	11,606,463,498	136,058
<b>721A</b>	Hotels (except Casino Hotels) and Motels; Bed-and-Breakfast Inns; Recreational and Vacation Camps (except Campgrounds); Rooming and Boarding Houses	185,763	22,094,236,938	118,937
<b>3391</b>	Medical equipment and supplies manufacturing	246,179	27,535,102,229	111,850
<b>7115</b>	Independent artists, writers, and performers	62,814	6,594,307,328	104,982
<b>5611</b>	Office administrative services	181,082	18,626,914,070	102,864

\*Jewelry, silverware, hollowware, lapidary work, costume, sporting and athletic goods, game, toy, children's vehicle, office supplies (except paper), gasket, packing, sealing device, musical instrument, button, pin, mop, broom, brush, burial casket manufacturing.

\*\*Other refers to Luggage, women's handbag, purse and personal leather good manufacturing.

**Table 5: Imperial County Clusters: Employment, Output and Productivity**

Cali-Baja Code	Cluster	Cluster Employment	Cluster Output (in 2008 USD)	Cluster Productivity (Output/Employment)
<b>11</b> <b>Aggregate</b>	Agriculture and animal production	25,038	3,910,127,242	156,170

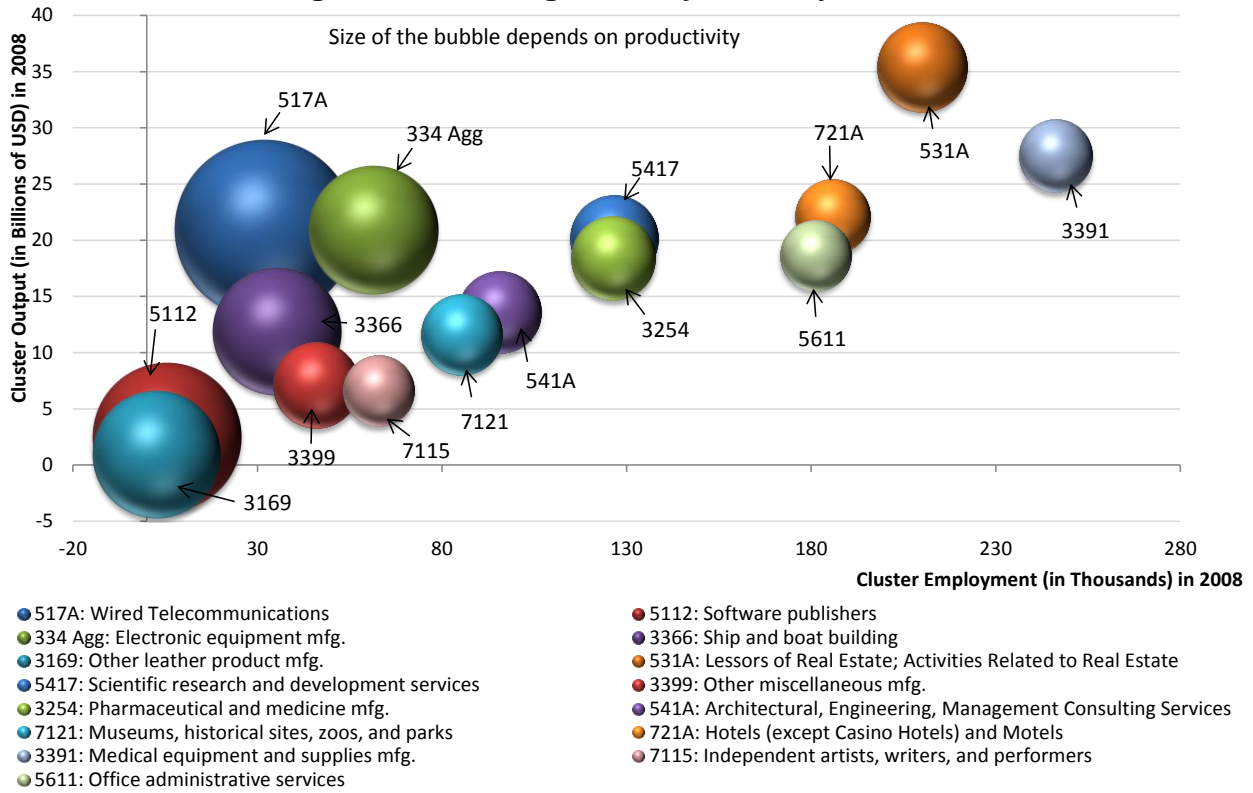
**Table 6: Baja California Industry Clusters: Employment, Output and Productivity**

Cali-Baja Code	Cluster	Cluster Employment	Cluster Output (in 2008 USD)	Cluster Productivity (Output/Employment)
<b>334</b> <b>Agg</b>	Audio and video equipment manufacturing	100,426	16,524,419,134	164,543
<b>335</b> <b>Agg</b>	Electrical equipment lighting manufacturing	8,175	1,002,246,378	122,601
<b>333</b> <b>Agg</b>	Machinery and equipment manufacturing	4,649	427,481,954	91,948
<b>3362</b>	Motor vehicle body and trailer manufacturing	891	73,908,432	82,966
<b>332</b> <b>Agg</b>	Hardware and metals manufacturing	27,605	1,782,950,588	64,587
<b>3399</b>	Other <sup>†</sup> miscellaneous manufacturing	26,339	1,455,326,388	55,253
<b>3391</b>	Medical equipment and supplies manufacturing	123,895	6,775,508,308	54,687
<b>3364</b>	Aerospace product and parts manufacturing	28,535	1,505,666,114	52,766
<b>3261</b>	Plastics product manufacturing	184,838	9,448,281,572	51,117
<b>5619</b>	Other <sup>††</sup> support services	325,574	11,603,049,809	35,639
<b>337</b> <b>Agg</b>	Furniture manufacturing	102,548	2,335,075,570	22,770
<b>7112</b>	Spectator sports	37,807	497,624,657	13,162

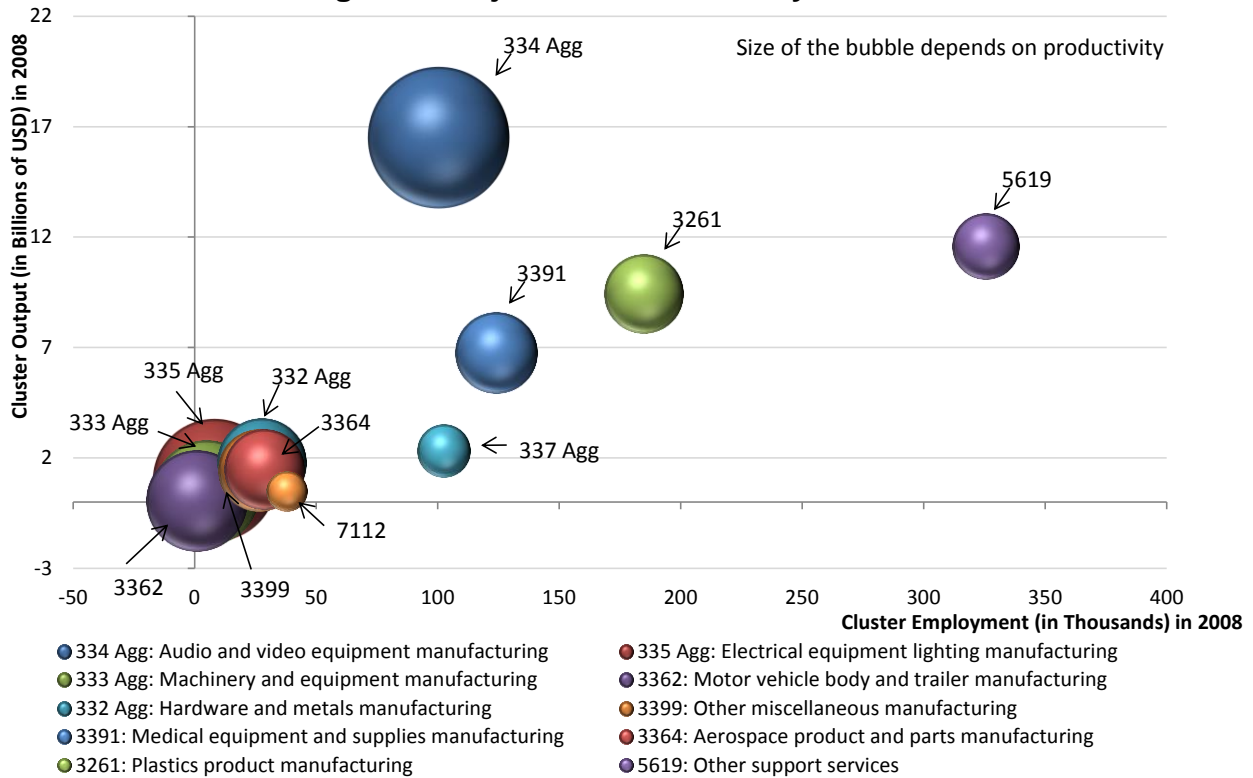
<sup>†</sup> Jewelry, silverware, hollowware, lapidary work, costume, sporting and athletic goods, game, toy, children's vehicle, office supplies (except paper), gasket, packing, sealing device, musical instrument, button, pin, mop, broom, brush, burial casket manufacturing.

<sup>††</sup> Packaging and Labeling Services, Convention and Trade Show Organizers.

**Figure 2: San Diego County Industry Clusters**



**Figure 3: Baja California Industry Clusters**



**Figure 4: Value Added Trade Data Matrices**

Intra and Interregional		Regions		Sales to Final Demand		Gross Regional Product
		BC	SD&I	BC	SD&I	
R e s i o n s	BC	$Z_{BC BC}$	$Z_{BC SD\&I}$	$Y_{BC BC}$	$Y_{BC SD\&I}$	$X_{BC}$
	SD&I	$Z_{SD\&I BC}$	$Z_{SD\&I SD\&I}$	$Y_{SD\&I BC}$	$Y_{SD\&I SD\&I}$	$X_{SD\&I}$
Added Value		$AV_{BC}$	$AV_{SD\&I}$			
GRP		$X_{BC}$	$X_{SD\&I}$			

## References

- Barajas, I.A., Sisto, N.P., Gaytán E.A., Cantú, J.C, and López, B.H. (2014). Trade Flows Between the United States and Mexico: NAFTA and the Border Region, *Journal of Urban Research*, 10 | 2014
- Koopman, R., Powers, W., Wang, Z., and Wei, S. (2010). Give Credit Where Credit is Due: Tracing Value Added In Global Production Chains. *National Bureau of Economic Research. Working Paper No. 16426*, Cambridge, MA.
- Porter, M. E. (1990). *The Competitive Advantage of Nations*. Macmillan, London
- Porter, M. E. (2000), Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly* 14(1), 15-34.
- SANDAG. (2008). Traded Industry Clusters in the San Diego Region. San Diego, CA.
- SANDAG. (2012). Traded Industry Clusters in the San Diego Region. San Diego, CA.
- UCSD Center for US-Mexican Studies. (2014). *Jobs Without Borders: Employment, Industry Concentrations, and Comparative Advantage in the Cali-Baja Region*. San Diego, CA.
- U.S. Department of Transportation, TransBorder Freight Data, Research and Innovative Technology Administration, Bureau of Transportation Statistics, 2012.
- Wilson Center. (2011). *Working Together: Economic Ties between the United States and Mexico*. Washington, D.C.: Wilson, C.
- Wilson Center. (2013). *The State of the Border: A Comprehensive Analysis of the US-Mexico Border*. Washington, D.C.: Wilson, C., Lee, E.

**Table 7: San Diego County Core Industry Clusters (Seed and Supporting Industries)**

San Diego Seed Industries (Crisp Clusters)									
Seed CaliBaja Code	Seed Name	Seed L.Q.	Supporting Industry CaliBaja Code	Supporting Industry Name	Purchase Magnitude	Sales Share	Transaction Amount in USD		
3169	Other leather product manufacturing (Luggage, women's handbag, purse and personal leather good (except women's handbag and purse) manufacturing)	1.68	Purchase (Seed as a buyer)						
			3256	Soap, cleaning compound, and toiletry mfg.	8.55	0.50%	788,427		
			3133	Textile and fabric finishing mills	5.95	1.43%	548,285		
			3325	Hardware manufacturing	4.53	0.69%	417,580		
			3161	Leather and hide tanning and finishing	4.23	20.40%	390,399		
			Sales (Seed as a supplier)				Sales Magnitude	Purchase share	Transaction Amount in USD
			3149	Other textile product mills	5.38	2.00%	564,448		
			3162	Footwear manufacturing	0.29	1.00%	30,018		
			112A	Other animal production	0.15	0.00%	15,844		
			3254	Pharmaceutical and medicine manufacturing	1.76	Purchase (Seed as a buyer)			
5511	Management of Companies and Enterprises	19.55				9.16%	239,376,129		
Sales (Seed as a supplier)							Sales Magnitude	Purchase share	Transaction Amount in USD
621A	Offices of Physicians, Dentists, and all Other Miscellaneous Health Practitioners	32.20				14.00%	191,347,707		
622A	General Medical, Surgical, Psychiatric and Substance Abuse, and Specialty Hospitals	18.12				11.00%	107,695,174		
621B	Outpatient Care Centers; Medical and Diagnostic Laboratories; Other Ambulatory Health Care Services	5.81				8.00%	34,498,541		
6216	Home health care services	1.51				14.00%	8,959,402		
623A	Nursing Care Facilities; Residential Mental Retardation, Mental Health and Substance Abuse Facilities; Community Care Facilities for the Elderly; Other Residential Care Facilities	1.17				4.00%	6,943,879		
3111	Animal food manufacturing	0.17				7.00%	984,783		
1123	Poultry and Egg Production	0.07				2.00%	387,133		
115A	Support Activities for Animal Production	0.07				7.00%	402,778		
334 Aggregate	Electronic equipment manufacturing	2.71							
3341	Computer and peripheral equipment mfg.	1.89				Purchase (Seed as a buyer)			
					Purchase Magnitude	Sales Share	Transaction Amount in USD		
3342	Communications equipment manufacturing	4.09	3344	Semiconductor and electronic component mfg.	24.03	55.45%	982,768,693		
3343	Audio and video equipment manufacturing	11.06	5415	Computer systems design and related services	4.49	25.90%	183,532,051		
3345	Electronic instrument manufacturing	2.15	Sales (Seed as a supplier)						
					Sales Magnitude	Purchase share	Transaction Amount in USD		
			3364	Aerospace product and parts manufacturing	9.65	6.71%	92,784,435		
			3329	Other fabricated metal product manufacturing	0.21	2.95%	2,012,394		
			3324	Boiler, tank, and shipping container mfg.	0.13	6.16%	1,286,894		
			3313	Alumina and aluminum production	0.10	11.05%	955,797		
3362	Motor vehicle body and trailer manufacturing	0.03	4.81%	267,507					
3361	Motor vehicle manufacturing	0.02	16.19%	219,795					



**Table 7: San Diego County Core Industry Clusters (Seed and Supporting Industries) (continued...)**

San Diego Seed Industries (Crisp Clusters)										
Seed CaliBaja Code	Seed Name	Seed L.Q.	Supporting Industry CaliBaja Code	Supporting Industry Name						
3366	Ship and boat building	5.46	Purchase (Seed as a buyer)		Purchase Magnitude	Sales Share	Transaction Amount in USD			
			3336	Turbine and power transmission equipment mfg.	7.04	55.40%	39,302,127			
			5331	Lessors of nonfinancial intangible assets	5.16	3.78%	28,807,785			
			3261	Plastics product manufacturing	4.55	4.09%	25,384,475			
			3312	Steel product mfg. from purchased steel	4.19	5.54%	23,377,220			
			Sales (Seed as a supplier)		Sales Magnitude	Purchase share	Transaction Amount in USD			
			1141	Fishing	8.78	45.31%	1,265,274			
			483A	Deep Sea, Coastal, and Great Lakes Water Transportation; Inland Water Transportation	7.23	21.85%	1,043,048			
			3353	Electrical equipment manufacturing	4.43	0.65%	638,727			
			3335	Metalworking machinery manufacturing	3.42	0.56%	493,592			
			3359	Other electrical equipment and component mfg.	2.75	0.19%	396,322			
			333A	Other General Purpose Machinery Manufacturing	2.57	0.14%	371,067			
			48XA	Scenic and Sightseeing Transportation, Support Activities for Transportation	1.77	0.53%	255,101			
			3121	Beverage manufacturing	1.69	0.05%	244,053			
			3333	Commercial and service industry machinery	1.41	0.10%	203,694			
			8113	Commercial machinery repair and maintenance	0.78	0.14%	112,386			
			3352	Household appliance manufacturing	0.71	0.36%	102,876			
			3334	HVAC and commercial refrigeration equipment	0.33	0.13%	48,003			
			3314	Other nonferrous metal production	0.29	0.03%	41,629			
			3331	Ag., construction, and mining machinery mfg.	0.25	0.08%	35,650			
			3151	Apparel knitting mills	0.18	0.17%	26,439			
			3115	Dairy product manufacturing	0.16	0.03%	23,438			
			3332	Industrial machinery manufacturing	0.16	0.36%	23,193			
			3351	Electric lighting equipment manufacturing	0.14	0.04%	20,212			
			3322	Cutlery and handtool manufacturing	0.06	0.07%	8,132			
			3113	Sugar and confectionery product manufacturing	0.03	0.03%	4,590			
			3311	Iron and steel mills and ferroalloy mfg.	0.03	0.04%	4,254			
			3112	Grain and oilseed milling	0.01	0.02%	909			
			3391	Medical equipment and supplies manufacturing	1.97	Purchase (Seed as a buyer)		Purchase Magnitude	Sales Share	Transaction Amount in USD
						4300	Wholesale Trade	20.50	2.01%	112,503,275
						Sales (Seed as a supplier)		Sales Magnitude	Purchase share	Transaction Amount in USD
			3279	Other nonmetallic mineral products	0.50	2.62%	1,221,706			

**Table 7: San Diego County Core Industry Clusters (Seed and Supporting Industries) (continued...)**

San Diego Seed Industries (Crisp Clusters)								
Seed CaliBaja Code	Seed Name	Seed L.Q.	Supporting Industry CaliBaja Code	Supporting Industry Name	Purchase Magnitude	Sales Share	Transaction Amount in USD	
3399	Other miscellaneous manufacturing (Jewelry, silverware, hollowware, lapidary work, costume, sporting and athletic goods, game, toy, children’s vehicle, office supplies (except paper), gasket, packing, sealing device, musical instrument, button, pin, mop, broom, brush, burial casket manufacturing)	1.95	Purchase (Seed as a buyer)					
			3251	Basic chemical manufacturing	13.67	3.72%	51,389,314	
			3327	Machine shops and threaded product mfg.	5.65	4.81%	21,225,183	
			Sales (Seed as a supplier)					
			8114	Household goods repair and maintenance	5.91	5.27%	6,041,423	
			8122	Death care services	4.71	20.13%	4,808,797	
			3152	Cut and sew apparel manufacturing	2.78	2.03%	2,837,961	
			6111	Elementary and secondary schools	2.07	2.26%	2,117,857	
			3363	Motor vehicle parts manufacturing	1.05	0.66%	1,076,960	
			8121	Personal care services	0.99	0.58%	1,010,709	
			3141	Textile furnishings mills	0.60	5.19%	610,335	
			8123	Drycleaning and laundry services	0.44	0.94%	446,285	
			3272	Glass and glass product manufacturing	0.34	1.26%	350,630	
			2131	Support activities for mining	0.04	0.40%	40,395	
	1142	Hunting and Trapping	0.00	0.42%	404			
5112	Software publishers	1.69	Purchase (Seed as a buyer)					
			Sales (Seed as a supplier)					
			3346	Magnetic media manufacturing and reproducing	2.29	27.31%	10,491,203	
			3369	Other transportation equipment manufacturing	0.63	4.52%	2,878,702	
			4821	Rail transportation	0.01	0.34%	59,877	
			Sales (Seed as a supplier)					
517A	Wired Telecommunications Carriers; Wireless Telecommunications Carriers (except Satellite); Satellite Telecommunications; All Other Telecommunications	2.04	Purchase (Seed as a buyer)					
			5419	Other professional and technical services	6.94	17.14%	293,657,335	
			Sales (Seed as a supplier)					
	481A	Scheduled Air Transportation; Nonscheduled Air Transportation	0.20	5.21%	5,846,019			

**Table 7: San Diego County Core Industry Clusters (Seed and Supporting Industries) (continued...)**

San Diego Seed Industries (Crisp Clusters)									
Seed CaliBaja Code	Seed Name	Seed L.Q.	Supporting Industry CaliBaja Code	Supporting Industry Name	Purchase Magnitude	Sales Share	Transaction Amount in USD		
531A	Lessors of Real Estate; Offices of Real Estate Agents and Brokers; Activities Related to Real Estate	1.71	Purchase (Seed as a buyer)						
			5617	Services to buildings and dwellings	8.95	17.03%	228,569,486		
			522A	Nondepository Credit Intermediation; Activities Related to Credit Intermediation	7.28	10.99%	186,110,948		
			2211	Power generation and supply	6.57	20.54%	167,941,567		
			562A	Waste Collection; Waste Treatment and Disposal; Remediation and Other Waste Management Services	6.57	44.19%	167,783,275		
			52XA	Monetary Authorities-Central Bank; Depository Credit Intermediation	6.38	7.32%	163,093,516		
			5411	Legal services	5.59	7.80%	142,817,002		
			Sales (Seed as a supplier)						
			8131	Religious organizations	2.20	18.52%	89,355,883		
			1114	Greenhouse, Nursery, and Floriculture Production	0.28	7.88%	11,516,589		
			1119	Other Crop Farming	0.22	22.72%	8,958,286		
			1112	Vegetable and Melon Farming	0.17	20.78%	7,095,451		
			1113	Fruit and Tree Nut Farming	0.15	7.67%	6,122,856		
			1121	Cattle Ranching and Farming	0.02	8.77%	842,065		
1111	Oilseed and Grain Farming	0.00	35.33%	91,749					
541A	Architectural, Engineering, and Related Services; Management, Scientific, and Technical Consulting Services	1.8	Purchase (Seed as a buyer)						
			Sales (Seed as a supplier)						
			2361	Residential Building Construction	6.68	8.29%	146,498,668		
			2221	Water, Sewage and Other Systems	0.03	17.53%	555,307		
			2122	Metal ore mining	0.00	3.76%	5,107		
			Purchase (Seed as a buyer)						
5417	Scientific research and development services	4.41	Purchase (Seed as a buyer)						
			2362	Nonresidential Building Construction	9.09	10.89%	99,864,829		
			Sales (Seed as a supplier)						
			611A	Junior Colleges; Colleges, Universities, and Professional Schools	2.72	4.71%	13,789,460		
			3259	Other chemical product and preparation mfg.	1.61	8.64%	8,164,005		
			3255	Paint, coating, and adhesive manufacturing	1.59	5.80%	8,072,764		
			3253	Agricultural chemical manufacturing	0.34	5.38%	1,716,668		
			3252	Resin, rubber, and artificial fibers mfg.	0.23	3.63%	1,140,422		
			3114	Fruit and vegetable preserving and specialty	0.15	0.52%	779,467		
			2111	Oil and gas extraction	0.09	1.03%	436,824		
			3241	Petroleum and coal products manufacturing	0.07	2.02%	363,753		
			2123	Nonmetallic mineral mining and quarrying	0.06	1.76%	288,197		
			3159	Accessories and other apparel manufacturing	0.04	2.38%	219,364		
			3122	Tobacco manufacturing	0.01	1.97%	75,205		
			3274	Lime and gypsum product manufacturing	0.00	0.69%	13,734		

**Table 7: San Diego County Core Industry Clusters (Seed and Supporting Industries) (continued...)**

San Diego Seed Industries (Crisp Clusters)										
Seed CaliBaja Code	Seed Name	Seed L.Q.	Supporting Industry CaliBaja Code	Supporting Industry Name	Purchase Magnitude	Sales Share	Transaction Amount in USD			
5611	Office administrative services	1.75	Purchase (Seed as a buyer)							
			5613	Employment services	10.09	0.89%	16,364,942			
			5412	Accounting and bookkeeping services	8.72	1.76%	14,141,465			
			5619	Other support services	7.45	2.31%	12,082,751			
			5191	Other information services	6.88	0.59%	11,164,933			
			523A	Investment Banking and Securities Dealing; Securities and Commodity Exchanges; Trust, Fiduciary, and Custody Activities	4.05	0.29%	6,577,049			
			Sales (Seed as a supplier)				Sales Magnitude	Purchase share	Transaction Amount in USD	
			5242	Insurance agencies and brokerages	5.96	3.17%	20,677,231			
			484A	General Freight Trucking; Specialized Freight Trucking	1.76	2.99%	6,107,104			
			611B	Business and Secretarial Schools; Other Technical and Trade Schools; Exam Preparation and Tutoring; Educational Support Services	1.36	1.55%	4,703,574			
			8112	Electronic equipment repair and maintenance	1.00	2.53%	3,458,121			
			6241	Individual and family services	0.91	1.96%	3,151,389			
			8111	Automotive repair and maintenance	0.90	0.76%	3,126,673			
			624A	Community Food and Housing, and Emergency and Other Relief Services; Vocational Rehabilitation Services	0.53	2.13%	1,827,168			
			5612	Facilities support services	0.42	5.52%	1,446,764			
			492A	Couriers and Express Delivery Services; Local Messengers and Local Delivery	0.42	2.45%	1,446,749			
			485A	Urban Transit Systems; Interurban and Rural Bus Transportation; Taxi and Limousine Service; School and Employee Bus Transportation; Charter Bus Industry; Other Transit and Ground Passenger Transportation	0.22	1.95%	752,077			
			486A	Pipeline Transportation of Crude Oil; Pipeline Transportation of Natural Gas; Other Pipeline Transportation	0.02	1.83%	80,036			
			7115	Independent artists, writers, and performers	2.46	Purchase (Seed as a buyer)				
						711A	Promoters of Performing Arts, Sports, and Similar Events; Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	32.35	15.94%	8,476,672
7112	Spectator sports	13.50				2.56%	3,537,947			
Sales (Seed as a supplier)							Sales Magnitude	Purchase share	Transaction Amount in USD	
8129	Other personal services	17.48				2.16%	13,148,984			
713A	Amusement Parks and Arcades; Gambling Industries; Other Amusement and Recreation Industries	16.38				0.98%	12,322,571			
7111	Performing arts companies	8.17				11.63%	6,145,615			
5121	Motion picture and video industries	6.69				3.53%	5,030,193			
5152	Cable and other subscription programming	1.85				5.09%	1,392,922			
6244	Child day care services	1.25				0.95%	937,636			
113A	Timber Tract Operations, Forest Nurseries and Gathering of Forest Products	0.01	0.85%	8,566						

**Table 7: San Diego County Core Industry Clusters (Seed and Supporting Industries)**

San Diego Seed Industries (Crisp Clusters)							
Seed CaliBaja Code	Seed Name	Seed L.Q.	Supporting Industry CaliBaja Code	Supporting Industry Name			
7121	Museums, historical sites, zoos, and parks	2.94	Purchase (Seed as a buyer)		Purchase Magnitude	Sales Share	Transaction Amount in USD
			3231	Printing and related support activities	6.07	0.39%	2,948,148
			Sales (Seed as a supplier)		Sales Magnitude	Purchase share	Transaction Amount in USD
			5324	Machinery and equipment rental and leasing	2.79	2.04%	9,098,739
			813A	Grantmaking Foundations; Other Social Advocacy Organizations	1.51	2.71%	4,939,178
			5321	Automotive equipment rental and leasing	1.43	1.79%	4,664,849
			5614	Business support services	1.32	2.32%	4,318,262
			5182	Data processing, hosting and related services	1.06	2.81%	3,471,426
			5616	Investigation and security services	0.97	2.66%	3,148,946
			813B	Civic and Social Organizations; Business, Professional, Labor, Political, and Similar Organizations	0.89	0.86%	2,890,706
			5414	Specialized design services	0.77	1.80%	2,517,911
			5615	Travel arrangement and reservation services	0.77	2.14%	2,499,488
			3118	Bakeries and tortilla manufacturing	0.69	1.21%	2,248,956
			525A	Insurance and Employee Benefit Funds; Other Investment Pools and Funds	0.59	0.22%	1,934,487
			3323	Architectural and structural metals mfg.	0.57	0.67%	1,850,832
			3273	Cement and concrete product manufacturing	0.44	0.85%	1,423,364
			532A	Consumer Goods Rental, General Rental Centers	0.43	1.32%	1,414,327
			5122	Sound recording industries	0.42	2.39%	1,356,864
			3222	Converted paper product manufacturing	0.20	0.94%	662,973
			3372	Office furniture and fixtures manufacturing	0.19	0.66%	621,527
			3321	Forging and stamping	0.16	1.06%	508,779
			3328	Coating, engraving, and heat treating metals	0.16	1.00%	535,346
			3219	Other wood product manufacturing	0.13	1.04%	410,391
			3119	Other food manufacturing	0.12	0.24%	383,521
			3212	Plywood and engineered wood product mfg.	0.10	1.40%	309,729
			3379	Other furniture related product manufacturing	0.10	0.94%	322,454
			3262	Rubber product manufacturing	0.06	0.52%	198,945
			3315	Foundries	0.03	0.48%	90,946
			3271	Clay product and refractory manufacturing	0.02	0.46%	69,195
			3132	Fabric mills	0.01	0.33%	32,682
			3211	Sawmills and wood preservation	0.01	0.37%	16,792
			3326	Spring and wire product manufacturing	0.01	0.71%	34,944
			3116	Animal slaughtering and processing	0.00	0.45%	4,837
3117	Seafood product preparation and packaging	0.00	0.43%	1,141			
3131	Fiber, yarn, and thread mills	0.00	0.16%	4,130			
721A	Hotels (except Casino Hotels) and Motels; Bed-and-Breakfast Inns; Recreational and Vacation Camps (except Campgrounds); Rooming and Boarding Houses	1.84	Purchase (Seed as a buyer)		Purchase Magnitude	Sales Share	Transaction Amount in USD
			722A	Full-Service Restaurants; Limited-Service Eating Places; Special Food Services; Drinking Places (Alcoholic Beverages)	12.68	3.81%	51,693,127
			5418	Advertising, PR, and related services	5.72	3.18%	23,343,933
			5151	Radio and television broadcasting	5.57	2.88%	22,725,826
			4911	Postal service	4.96	4.06%	20,223,250
			5111	Newspaper, book, and directory publishers	4.87	2.29%	19,872,258
			2222	Natural Gas Distribution	4.81	2.81%	19,630,932
			5241	Insurance carriers	3.97	1.47%	16,192,141
			Sales (Seed as a supplier)		Sales Magnitude	Purchase share	Transaction Amount in USD

**Table 8: Imperial County Core Industry Clusters (Seed and Supporting Industries)**

<b>Imperial County Seed Industries (Crisp Clusters)</b>							
Seed CaliBaja Code	Seed Name	Seed L.Q.	Candidate Member CaliBaja Code	Candidate Member Name			
11 Aggregate	Agriculture and animal production	32.91					
				Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
111	Agriculture	18.99					
112	Animal breeding and production	8.22	4300	Wholesale Trade	8.08	34.44%	59,628,156
115	Services related to agricultural and forestry activities	71.91	531A	Lessors of Real Estate; Offices of Real Estate Agents and Brokers; Activities Related to Real Estate	5.45	53.75%	40,206,557
			484A	General Freight Trucking; Specialized Freight Trucking	4.46	31.59%	32,905,281
			2111	Oil and gas extraction	0.01	7.18%	64,516
				Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
			3149	Other textile product mills	5.38	2.00%	564,448
			3162	Footwear manufacturing	0.29	1.00%	30,018
			112A	Other animal production	0.15	0.00%	15,844

**Table 9: Baja California Core Industry Clusters (Seed and Supporting Industries)**

Baja California Seed Industries (Crisp Clusters)							
Seed CaliBaja Code	Seed Name	Seed L.Q.	Supporting Industry CaliBaja Code	Supporting Industry Name	Purchase Magnitude	Sales Share	Transaction Amount in USD
3261	Plastics product manufacturing	2.81					
				Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
				Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
			3361	Motor vehicle manufacturing	24.43	14.00%	62,193,690
			3121	Beverage manufacturing	11.66	13.00%	29,675,714
			2361	Residential Building Construction	11.00	5.00%	27,999,424
			3118	Bakeries and tortilla manufacturing	5.03	5.00%	12,806,376
			3341	Computer and peripheral equipment mfg.	4.18	9.00%	10,642,021
332 Aggregate:	Hardware and metals manufacturing	6.42					
				Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
3325	Hardware manufacturing	7.80					
3328	Coating, engraving, and heat treating metals	4.09	3312	Steel product mfg. from purchased steel	38.92	16.31%	38,106,155
3329	Other fabricated metal product manufacturing	6.77		Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
			3323	Architectural and structural metals mfg.	8.91	8.62%	2,588,922
			333A	Other General Purpose Machinery Manufacturing	6.13	2.34%	1,779,255
333 Aggregate:	Machinery and equipment manufacturing	3.02					
				Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
3333	Commercial and service industry machinery	4.00					
3336	Turbine and power transmission equipment	2.49					
				Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
			48XA	Scenic and Sightseeing Transportation, Support Activities for Transportation	6.71	1.53%	509,993
334 Aggregate:	Audio and video equipment manufacturing	7.88					
				Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
3342	Communications equipment manufacturing	3.91					
3343	Audio and video equipment manufacturing	15.72	3222	Converted paper product manufacturing	10.73	26.18%	48,611,976
3344	Semiconductor and electronic component mfg.	6.45	3322	Cutlery and handtool manufacturing	4.14	63.13%	18,750,365
3345	Electronic instrument manufacturing	9.01	5411	Legal services	6.97	34.22%	31,578,064
3346	Magnetic media manufacturing and reproducing	6.22	5616	Investigation and security services	4.01	21.03%	18,159,938
				Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
			517A	Wired Telecommunications Carriers; Wireless Telecommunications Carriers (except Satellite); Satellite Telecommunications; All Other Telecommunications	9.47	4.06%	6,430,942

**Table 9: Baja California Core Industry Clusters (Seed and Supporting Industries) (continued...)**

Baja California Seed Industries (Crisp Clusters)							
Seed CaliBaja Code	Seed Name	Seed L.Q.	Supporting Industry CaliBaja Code	Supporting Industry Name			
335 Aggregate:	Electrical equipment lighting manufacturing	3.28					
				Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
3351	Electric lighting equipment manufacturing	2.84					
3353	Electrical equipment manufacturing	3.76					
3359	Other electrical equipment and component mfg.	2.86		Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
3362	Motor vehicle body and trailer manufacturing	2.41		Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
				Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
3364	Aerospace product and parts manufacturing	10.05		Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
			484A	General Freight Trucking; Specialized Freight Trucking	8.65	1.92%	4,030,277
				Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
337 Aggregate:	Furniture manufacturing	3.28					
				Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
3372	Office furniture and fixtures manufacturing	2.55					
3379	Other furniture related product manufacturing	4.4		Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
			2362	Nonresidential Building Construction	17.70	0.30%	1,586,677
3391	Medical equipment and supplies manufacturing	10.8		Purchase (Seed as a buyer)	Purchase Magnitude	Sales Share	Transaction Amount in USD
			541A	Architectural, Engineering, and Related Services; Management, Scientific, and Technical Consulting Services	12.81	11.04%	13,167,208
			2211	Power generation and supply	7.07	1.09%	7,270,579
			3272	Glass and glass product manufacturing	4.52	4.04%	4,651,152
			5412	Accounting and bookkeeping services	4.41	1.11%	4,533,207
				Sales (Seed as a supplier)	Sales Magnitude	Purchase share	Transaction Amount in USD
			621A	Offices of Physicians, Dentists, and all Other Miscellaneous Health Practitioners	26.24	3.50%	2,895,478
			622A	General Medical, Surgical, Psychiatric and Substance Abuse, and Specialty Hospitals	17.90	2.40%	1,975,157
			6111	Elementary and secondary schools	6.43	1.19%	709,646



**Table 9: Baja California Core Industry Clusters (Seed and Supporting Industries)**

<b>Baja California Seed Industries (Crisp Clusters)</b>							
<b>Seed CaliBaja Code</b>	<b>Seed Name</b>	<b>Seed L.Q.</b>	<b>Supporting Industry CaliBaja Code</b>	<b>Supporting Industry Name</b>			
3399	Other miscellaneous manufacturing (Jewelry, silverware, hollowware, lapidary work, costume, sporting and athletic goods, game, toy, children’s vehicle, office supplies (except paper), gasket, packing, sealing device, musical instrument, button, pin, mop, broom, brush, burial casket manufacturing)	3.54	Purchase (Seed as a buyer)		Purchase Magnitude	Sales Share	Transaction Amount in USD
			Sales (Seed as a supplier)		Sales Magnitude	Purchase share	Transaction Amount in USD
			721A	Hotels (except Casino Hotels) and Motels; Bed-and-Breakfast Inns; Recreational and Vacation Camps (except Campgrounds); Rooming and Boarding Houses	19.06	4.92%	3,247,486
			8123	Drycleaning and laundry services	10.09	23.93%	1,719,511
5619	Other support services (Packaging and Labeling Services, Convention and Trade Show Organizers, All Other Support Services)	2.29	Purchase (Seed as a buyer)		Purchase Magnitude	Sales Share	Transaction Amount in USD
			4300	Wholesale Trade	8.79	0.13%	2,212,607
			531A	Lessors of Real Estate; Offices of Real Estate Agents and Brokers; Activities Related to Real Estate	6.68	0.34%	1,682,415
			Sales (Seed as a supplier)		Sales Magnitude	Purchase share	Transaction Amount in USD
7112	Spectator sports	8.67	Purchase (Seed as a buyer)		Purchase Magnitude	Sales Share	Transaction Amount in USD
			5613	Employment services	9.54	0.99%	3,350,972
			3231	Printing and related support activities	4.84	3.74%	1,699,670
			Sales (Seed as a supplier)		Sales Magnitude	Purchase share	Transaction Amount in USD