Cluster Analysis – CURIS Region

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Introduction

The competitive advantage concept developed by Porter (1990) has been used as a framework to assess regional economic development potential. A competitive advantage of a region is higher when specific industries, related to each other, are located within a geographic area. This geographic proximity generates intense rivalry, but also cooperation, among businesses within the same industry, which in turn spurs innovation and increases productivity. Related and supporting industries will then locate in the same region as those highly competitive and innovative firms sharing the same infrastructure, workforce, and research/training facilities.

A cluster, for purposes of this study, will be simply defined as the geographical concentration of related industries. A cluster analysis, regardless of the industry, has the potential of providing crucial information for public policy regarding industry recruitment, workforce development, and infrastructure related incentives.

Important to keep in mind is that there are several dimensions to a cluster (Enright, 2003). One of these dimensions is the type of relationships between the industries in the cluster. The relationships can be vertical or horizontal. The latter refers to the related industries within a cluster and whether that cluster contains some or all steps in the supply chain (includes buyers and suppliers); the former refers to the concentration of establishments in the same industry (direct competitors).

This study is exploratory in nature and has the following objectives: (1) show the existence of clusters in particular industries within the CURIS region and (2) identify vertical relationships, if any, within these particular clusters. This in turn can provide information on recruiting industries and designing incentives that could help the cluster upgrade.

Methodology

Data was obtained from the 2007 County Business Patterns and the 2007 Census of Agriculture at the six-digit level. Six-digit level establishments were utilized to avoid spurious relationships (Porter, 2003). The following industries were selected per request of the Center for Urban Rural Interface Studies (CURIS) keeping in mind that farms were treated as establishments: vegetable and potato farming; blueberry (tame) farming; livestock (cattle); finfish fishing; shellfish fishing; and timber tract operations. The unit of analysis was the 20 counties in the CURIS region.

In an effort to determine competing horizontal links and the level of concentration of these particular industries, the location quotient technique was utilized[1]. The location quotient technique compares a region's share of employment with that of the state or nation. The result is a ratio that if higher than 1.25 signifies the industry is more than likely to be concentrated and thus export its products or services outside of the region. This also may indicate a potential horizontal cluster exists.

For this particular study however, number of establishments rather than total employed was utilized to calculate the location quotients for three reasons: (1) data availability; (2) since agriculture production is highly mechanized, number of farms/establishments was considered to be more accurate instead of total employment; and (3) since clusters are all about competition and cooperation, more so between firms and not between workers, the number of establishments can yield more accurate results.

In an effort to uncover any vertical relationships within a particular cluster, locational correlation using Pearson's r was utilized. This correlation coefficient shows the probability that two particular industries will co-locate in the same county depicting vertical linkages as opposed to competing horizontal links (Goetz, Shields, Wand, 2004).

[1] Total farms were added to the total number of establishments and used as the denominator to calculate the location quotients.

Results and Analysis

Location Quotient Analysis

The location quotient (LQ) was calculated comparing the share of establishments in a particular industry with those in the nation. As discussed previously, if the result is a number higher than 1.25 this more than likely signifies that a potential cluster exists. The southeast region is also shown for sake of comparison.

Figure 1. Vegetable and Potato Farming Establishment Location Quotients

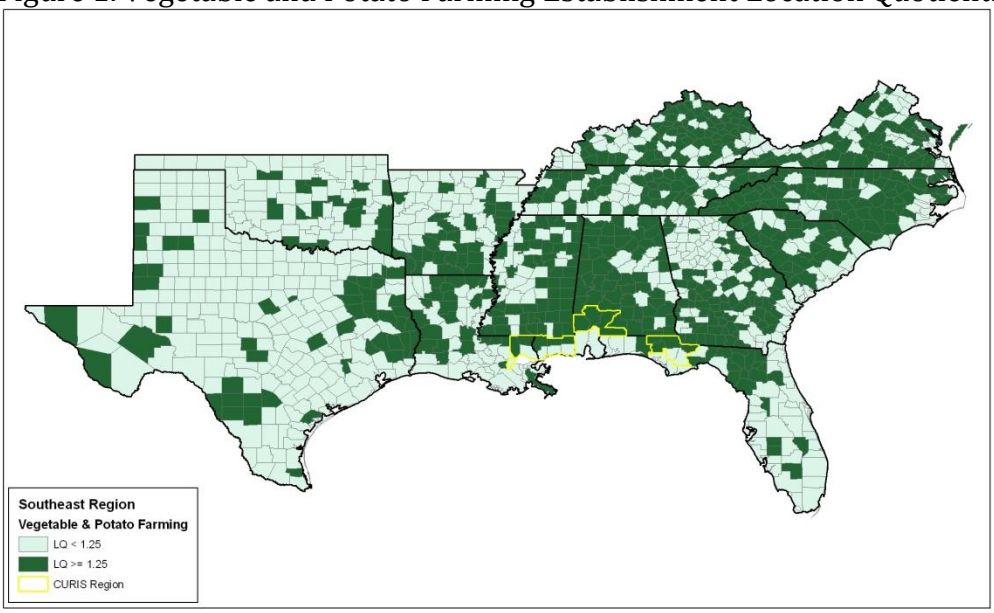

Figure 1 shows that vegetable and potato farming establishment location quotients are higher than 1.25 in most of the counties in the CURIS region. All of the CURIS counties in Alabama for example have location quotients higher or equal to 1.25 in this particular industry when compared to the nation.

Figure 2. Blueberry (Tame) Farming Establishment Location Quotients

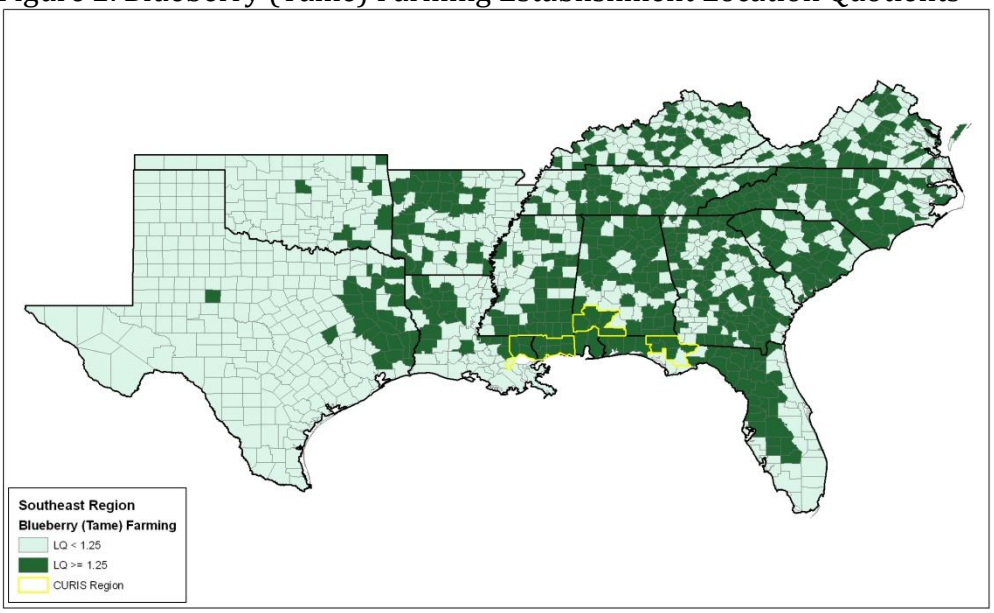

Figure 2 shows that blueberry (tame) farming establishment location quotients are higher than 1.25 in most if not all of the counties in the CURIS region. All of the CURIS counties in Mississippi have location quotients higher or equal to 1.25 in this particular industry when compared to the nation.

Figure 3. Livestock (Cattle) Raising Establishment Location Quotients

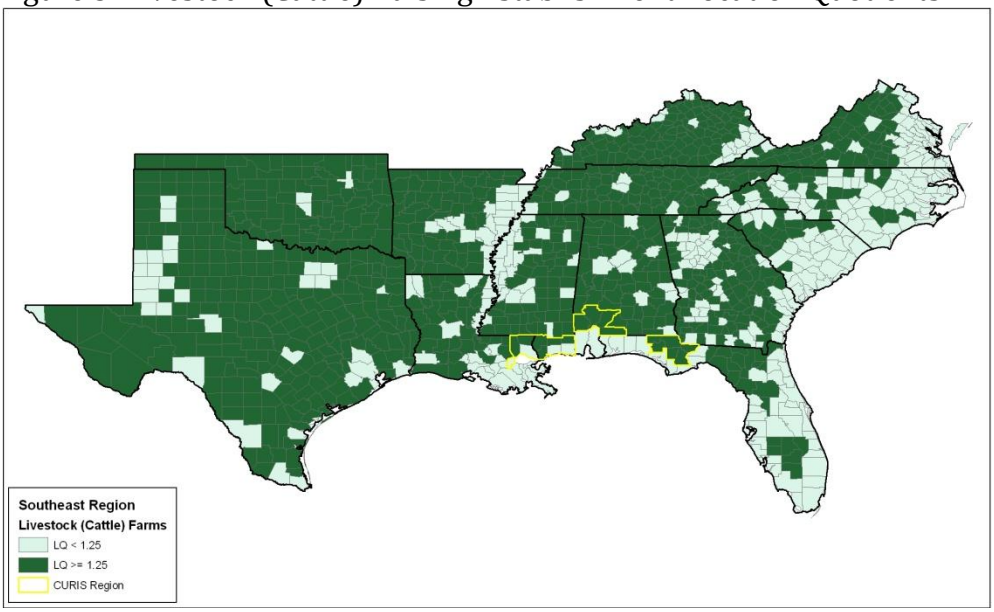

Figure 3 shows that livestock (cattle) farming establishment location quotients are higher than 1.25 in most if not all of the counties in the CURIS region. All CURIS counties in Alabama and Florida have location quotients higher or equal to 1.25 in this particular industry when compared to the nation.

Figure 4. Finfish Fishing Establishment Location Quotients

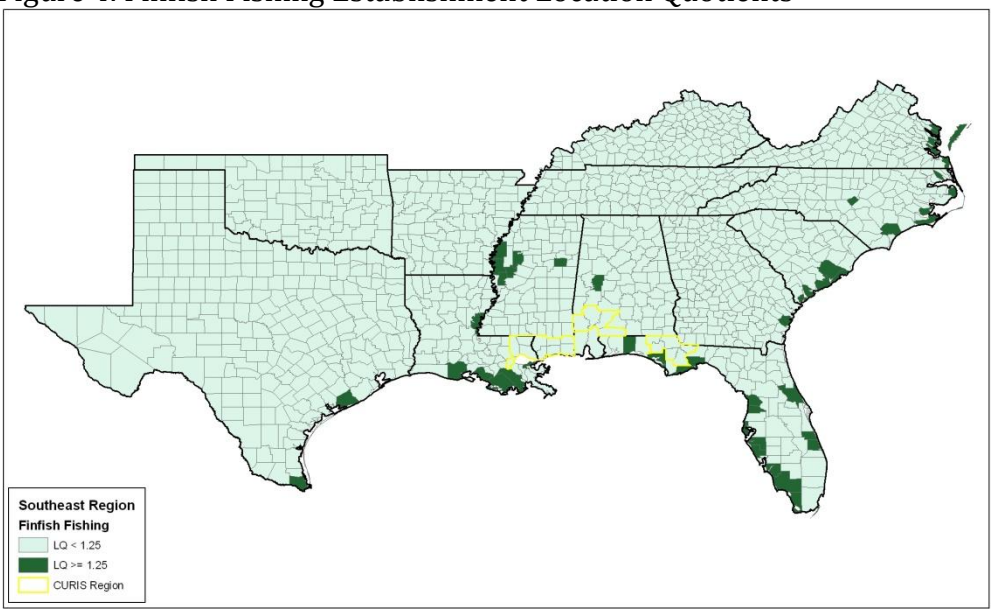

Figure 4 shows that finfish fishing establishment location quotients are lower than 1.25 in most if not all of the counties in the CURIS region. None of the counties in the CURIS region has a location quotient higher or equal to 1.25 in this particular industry when compared to the nation.

Figure 5. Shellfish Fishing Establishment Location Quotients

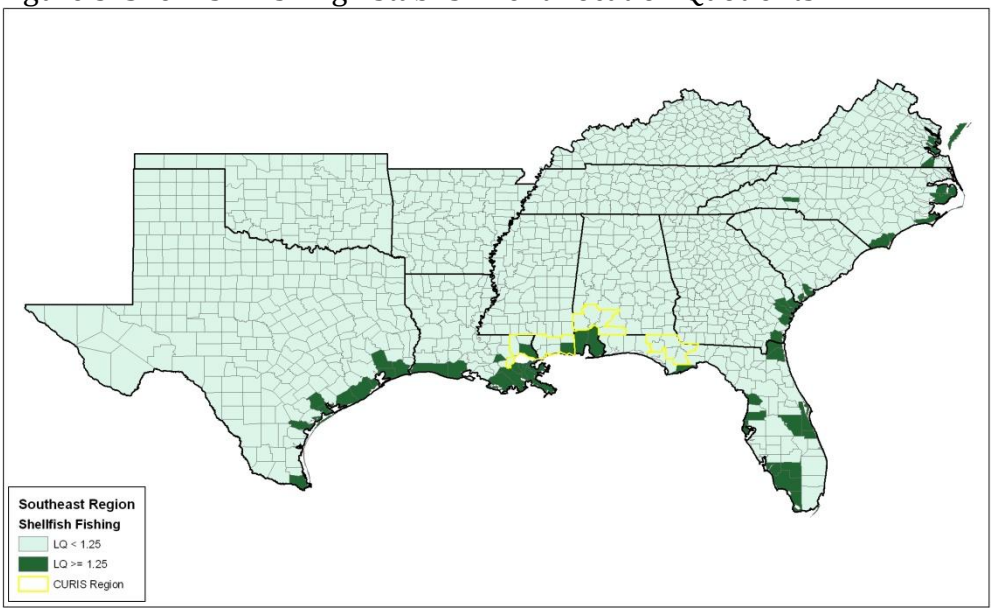

Figure 5 shows that shellfish fishing establishment location quotients are lower than 1.25 in most if not all of the counties in the CURIS region. A couple of Louisiana and Mississippi counties in the CURIS region have location quotients higher than 1.25 in this particular industry when compared to the nation.

Figure 6. Timber Tract Operations Establishment Location Quotients

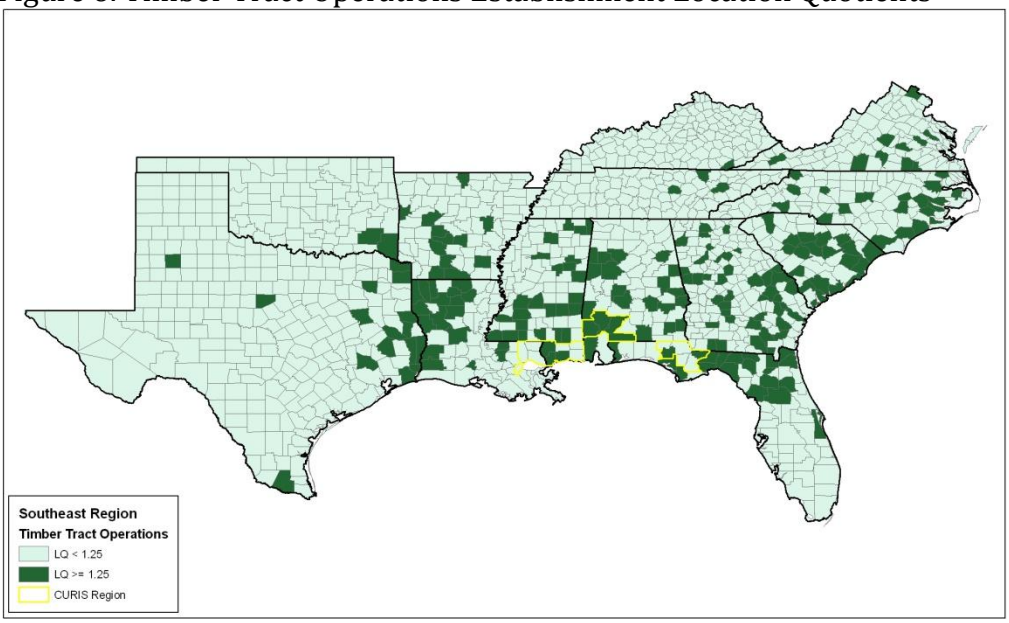

Figure 6 shows that timber tract operations establishment location quotients are higher than 1.25 in some of the counties in the CURIS region. All of the Alabama counties in the CURIS region have a location quotient higher than 1.25 in this particular industry when compare to the nation.

Table 1. Number of CURIS region counties with a LQ >= 1.25 by industry.

Industry	**No. of Counties**
Vegetable and Potato Farming	13
Blueberry (Tame) Farming	18
Livestock (Cattle)	16
Finfish Fishing	0
Shellfish Fishing	2
Timber Tract Operations	9

Table 1 shows the number of counties in the CURIS region with a LQ>=1.25 per industry. Based on table 1, there is a high concentration of establishments (considered high when at least half or ten counties in the CURIS region had a LQ>=1.25) in three out of the six industries analyzed.

This high concentration of establishments in the region may indicate potential clusters with horizontal (competing) linkages. Blueberry (tame) farming had the highest number of counties with a LQ>=1.25 in the CURIS region.

Locational Correlation

Based on the location quotient analysis, this section will conduct locational correlations using Pearson's r in an effort to uncover vertical linkages within the more concentrated industries identified in the previous section. The industries analyzed in this particular section are: vegetable and potato farming; blueberry (tame) farming; and livestock (cattle).

Each particular supporting and related industry has been grouped to better understand the "role" it plays in the supply chain. These lists are not intended to be comprehensive. Rather, the objective of these lists is to show the strength of some of the obvious vertical linkages expected in the particular cluster.

Table 2. Vegetable & Fruit Farming Supporting and Related Industries

NAICS	**Agriculture - Fruits & Vegetables**	
	Production (PROD)	**Source**
111211	Vegetable and Potato Farming	NASS
111334	Berry (except Strawberry) Farming - Tame	NASS
	Supporting and related industries	
	Manufacturing/Processing (PROC)	
115114	Postharvest Crop Activities (except cotton ginning)	CBP
311340	Nonchocolate confectionery manufacturing	CBP
311411	Frozen Fruit, Juice, and Vegetable Manufacturing	CBP
311421	Fruit and vegetable canning	CBP
311423	Dried and Dehydrated Food Manufacturing	
	Management Services (MGMT)	
115115	Farm labor contractors and crew leaders	CBP
115116	Farm management services	CBP
	Machinery (MACH)	
333111	Farm machinery and equipment manufacturing	CBP
333294	Food product machinery manufacturing	CBP
811310	Commercial machinery repair and maintenance	CBP
	Irrigation (IRRIG)	
221310	Water supply and irrigation systems	CBP
	Finance (FINAN)	
522110	Commercial Banking	CBP
522220	Sales Financing	CBP
523110	Investment Banking	CBP
	Fertilizers/Pesticides (FERT)	
325311	Nitrogenous fertilizer manufacturing	CBP
325312	Phosphatic fertilizer manufacturing	CBP
325314	Fertilizer, mixing only, manufacturing	CBP
325320	Pesticide and other ag. chemical mfg.	CBP
	Transportation (TRANSP)	
483211	Inland water freight transportation	CBP
484110	General freight trucking, local	CBP
484121	General freight trucking, long-distance TL	CBP
484122	General freight trucking, long-distance LTL	CBP

484220	Other specialized trucking, local	CBP
484230	Other specialized trucking, long-distance	CBP
	Storage/Distribution (STOR)	
423820	Farm and garden equipment merchant wholesalers	CBP
424420	Packaged Frozen Food Merchant Wholesalers	CBP
424480	Fresh Fruit and Vegetable Merchant Wholesalers	CBP
424490	Other Grocery and Related Products Merchant Wholesalers	CBP
424910	Farm supplies merchant wholesalers	CBP
493130	Farm product warehousing and storage	CBP
	Univ./Associations/Research Centers/Marketing (SERV)	
541710	Agriculture & Chemical Research and Development	CBP
541820	Public relations agencies (includes lobbyists)	CBP
611210	Community Colleges	CBP
611310	Colleges, Universities, and professional schools	CBP
813910	Business Associations	CBP
813920	Professional Associations	CBP

Table 3. Livestock (Cattle) Supporting and Related Industries

NAICS	**Agriculture - Livestock (Cattle)**	
	Production (PROD)	**Source**
112111	Beef Cattle Ranching and Farming	NASS
	Supporting and related industries	
	Manufacturing/Processing (PROC)	
311412	Frozen specialty food manufacturing	CBP
311611	Animal, except poultry, slaughtering	CBP
311612	Meat processed from carcasses	CBP
311613	Rendering and meat byproduct processing	CBP
	Management Services (MGMT)	
115115	Farm labor contractors and crew leaders	CBP
115116	Farm management services	CBP
	Machinery (MACH)	
333111	Farm machinery and equipment manufacturing	CBP
333294	Food product machinery manufacturing	CBP
811310	Commercial machinery repair and maintenance	CBP
	Irrigation (IRRIG)	
221310	Water supply and irrigation systems	CBP
	Finance (FINAN)	
522110	Commercial Banking	CBP
522220	Sales Financing	CBP
523110	Investment Banking	CBP
	Transportation (TRANSP)	
483211	Inland water freight transportation	CBP
484110	General freight trucking, local	CBP
484121	General freight trucking, long-distance TL	CBP
484122	General freight trucking, long-distance LTL	CBP
484220	Other specialized trucking, local	CBP
484230	Other specialized trucking, long-distance	CBP
	Storage/Distribution (STOR)	
423820	Farm and garden equip. merchant wholesalers	CBP
424510	Grain and field bean merchant wholesalers	CBP

424520	Livestock merchant wholesalers	CBP
424590	Other farm product raw material merch. whls.	CBP
424910	Farm supplies merchant wholesalers	CBP
493130	Farm product warehousing and storage	CBP
	Univ./Associations/Research Centers/Marketing (SERV)	
541710	Agriculture & Chemical Research and Development	CBP
541820	Public relations agencies (includes lobbyists)	CBP
611210	Community Colleges	CBP
611310	Colleges, Universities, and professional schools	CBP
813910	Business Associations	CBP
813920	Professional Associations	CBP

Tables 2 and 3 show the supporting and related industries for the vegetable and potato farming, blueberry farming, and livestock (cattle) industries. Both vegetable and potato and blueberry farming were analyzed together because they are very similar industries and share several vertical linkages.

Table 4. Co-location Probabilities for Vegetable & Fruits Supporting and Related Industries in the CURIS Region (n=20)

	111211	111334
111211	1.00	
111334	0.28	1.00
115114	0.66	0.03
311340	-0.08	0.41
311411	N.A.	N.A.
311421	N.A.	N.A.
311423	N.A.	N.A.
115115	0.38	0.13
115116	N.A.	N.A.
333111	-0.06	-0.11
333294	N.A.	N.A.
811310	0.09	0.67
221310	0.09	0.49
522110	-0.02	0.70
522220	-0.18	0.61
523110	-0.06	0.42
325311	N.A.	N.A.
325312	-0.12	0.27
325314	-0.24	-0.24
325320	0.26	-0.04
483211	-0.20	0.33
484110	-0.03	0.33
484121	0.30	0.24
484122	-0.17	0.38
484220	-0.11	0.49
484230	0.28	0.40
423820	0.26	-0.04

424420	-0.12	0.50
424480	0.00	0.50
424490	0.01	0.55
424910	0.48	0.32
493130	0.19	0.14
541710	-0.25	0.43
541820	-0.23	0.29
611210	N.A.	N.A.
611310	0.04	0.36
813910	0.13	0.73
813920	-0.03	0.13

N.A. = no establishments in that particular industry

As shown in table 4 the top five strongest vertical links, measured by the probability of locating in the same county, between vegetable and potato farming establishments (NAICS 111211) are: postharvest crop activities establishments (NAICS 115114)) with 66%; farm supplies merchant wholesalers establishments (NAICS 424910) with 48%; farm labor contractors and crew leaders establishments (NAICS 115115) with 38%; general freight trucking long-distance (NAICS 484121) with 30%; and blueberry farming establishments (NAICS 111334) and other specialized trucking long-distance (NAICS 484230) with 28%.

Regarding vertical links with the blueberry (tame) farming establishments, table 4 shows that business associations (NAICS 813910) will co-locate in the same county as blueberry farming establishments 73% of the time followed by commercial banking establishments (NAICS 522110) with 70%, commercial machinery repair and maintenance (NAICS 811310) with 67%, sales financing establishments (NAICS 522220) with 61%, and other grocery and related products merchant wholesalers establishments (NAICS 424490) with 55%.

For example, according to table 4, there seems to be stronger vertical linkages between blueberry farming establishments and storage/distribution related establishments compared to vegetable and potato farming. Packaged frozen food merchant wholesalers establishments (NAICS 424420) and fresh fruit and vegetables merchant wholesalers (NAICS 424480) tend to co-locate in the same county as blueberry farming establishments 50% of the time compared to -12% and 0% respectively in regards to vegetable and potato farming in the CURIS region.

Table 5. Co-location probabilities by industry groups

	PROD	PROC	MGMT	MACH	IRRIG	FINAN	FERT	TRANSP	STOR	SERV
PROD	1.00									
PROC	0.54	1.00								
MGMT	0.36	-0.07	1.00							
MACH	0.35	0.28	0.09	1.00						
IRRIG	0.27	0.12	-0.09	0.66	1.00					
FINAN	0.26	0.31	-0.10	0.94	0.74	1.00				
FERT	-0.13	-0.18	-0.13	0.11	-0.13	0.01	1.00			
TRANSP	0.23	0.28	-0.06	0.85	0.75	0.87	0.09	1.00		
STOR	0.32	0.66	0.14	-0.04	-0.13	-0.05	-0.28	-0.13	1.00	
SERV	0.19	0.33	-0.07	0.86	0.63	0.92	-0.11	0.73	-0.02	1.00

In an effort to better visualize the supply chain, or vertical linkages within the cluster, table 5 shows the locational correlation of the different industries by groups. As expected, manufacturing/processing establishments tend to co-locate 55% of the time in the same county as the production establishments.

Furthermore, manufacturing/processing establishments tend to locate 66% of the time in the same county as storage/distribution establishments. The weakest vertical link in the potential cluster is that of service establishments with production establishments other than the negative correlation with fertilizer producing establishments.

According to the data shown on tables 3 and 4 it can be inferred that the blueberry farming cluster is more mature and is in the process of being upgraded compared to the vegetable and potato farming establishments. However, table 5 shows that overall, service establishments tend to co-locate 19% of the time in the same county as production establishments (both vegetable and potato farming and blueberry farming). This weak link with service establishments needs to be strengthened since these types of establishments help upgrade the cluster making it more innovative and productive. Linkages to processing (54%) and management (36%) could be further strengthened as well.

In summary, certain supply chain steps in the vegetable and potato and blueberry farming clusters need to be strengthened. This opens the door to strategically target these types of industries for two main reasons. First, a horizontal competing core cluster is potentially in place making the recruitment easier and second, particular infrastructure and workforce needs of these industries are already in place serving the existing establishments.

Table 6. Co-location Probabilities for Livestock (Cattle) Supporting and Related Industries in the CURIS Region (n=20)

	112111
112111	1.00
311412	N.A.
311611	0.48
311612	0.38
311613	-0.05
115115	0.36
115116	N.A.
333111	-0.16
333294	N.A.
811310	0.26
221310	0.19
522110	0.11
522220	-0.04
523110	0.06
483211	-0.18
484110	0.20
484121	0.38
484122	-0.06
484220	0.04
484230	0.49
423820	0.42
424510	-0.09
424520	0.52
424590	-0.14
424910	0.52
493130	-0.02
541710	-0.16
541820	-0.14
611210	N.A.
611310	-0.07
813910	0.19
813920	0.23

Table 6 shows that some vertical links between livestock (cattle) farms and other establishments exist. The stronger linkages are with livestock merchant wholesalers establishments (NAICS 424520) and farm supplies merchant wholesalers (NAICS 424910) co-locating in the same county 52% of the time followed by other specialized long-distance trucking establishments (NAICS 484230) with 49%, animal - except poultry - slaughtering establishments (NAICS 311611) with 48%, farm and garden equipment merchant wholesalers establishments (NAICS 423820) with 42%, and meat processed from carcasses (NAICS 311612) and general freight long-distance trucking TL (NAICS 484121) with 38%.

Table 7. Co-location probabilities by industry groups

	PROD	PROC	MGMT	MACH	IRRIG	FINAN	TRANSP	STOR	SERV
PROD	1.00								
PROC	0.60	1.00							
MGMT	0.36	0.36	1.00						
MACH	0.26	0.37	0.09	1.00					
IRRIG	0.19	0.26	-0.09	0.66	1.00				
FINAN	0.10	0.22	-0.10	0.94	0.74	1.00			
TRANSP	0.22	0.38	-0.06	0.85	0.75	0.87	1.00		
STOR	0.47	0.31	0.01	0.76	0.51	0.70	0.73	1.00	
SERV	0.00	0.07	-0.07	0.86	0.63	0.92	0.73	0.58	1.00

As shown in table 7, a vertical linkage (60%) exists between production and processing, as was to be expected. Similarly, storage/distribution related establishments tend to co-locate in the same county as cattle farms 47% of the time in the CURIS region. Interesting to note is that there is no correlation between services related establishments and cattle farms in the CURIS region, which may be interpreted as the potential to upgrade the cluster by developing or attracting research facilities, trade/business associations, and other establishments that could increase innovation and productivity.

Conclusions

As discussed throughout the report, potential clusters in specific industries exist in the CURIS region. Some vertical linkages exist within these potential clusters identified through a location quotient analysis. Attracting businesses in those particular industries into the region may strengthen these vertical linkages. Having a horizontal cluster already in the region should help in attracting these industries.

A limitation must be mentioned however. Because only quantitative data was used to conduct this analysis, interpreting the results of this study should be done with caution. More in-depth qualitative studies need to be conducted in order to verify the existence of clusters and the type of relationships between their firms as well as more quantitative techniques in addition to the location quotient and locational correlation analysis. Gathering more data, market share, employment, and income variables should be analyzed as well.

Nonetheless, this study opens the door for future research. Semi-structured interviews can be conducted with key industry leaders, professional associations, and local economic developers to obtain more in-depth knowledge of these potential clusters. Similarly, a quantitative cross-sectional study should be conducted to see if the potential clusters, along with their vertical linkages, have remained, strengthened, or weakened over time. This should provide crucial information when designing public policy and incentive programs.

References

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