NCDIDI

NORTH CAROLINA DEFENSE INDUSTRY DIVERSIFICATION INITIATIVE

2019 DEFENSE CLUSTER ANALYSIS

NC STATE
Industry Expansion Solutions

DEPARTMENT OF MILITARY AND VETERANS AFFAIRS
NAVY MARINES ARMY AIR FORCE COAST GUARD SECRETARY

DMVA

Secretary Larry D. Hall
North Carolina Department of
Military and Veterans Affairs

Executive Director Phil Mintz
Industry Expansion Solutions
North Carolina State University

North Carolina boasts significant defense assets. According to the United States Department of Defense Office of Economic Adjustment State by State Report, in fiscal year 2017, DoD spending in North Carolina totaled $3.3B, ranking the state 23rd nationally in total defense contracts spending. In addition, North Carolina is home to six active military installations, has over fifty percent of all Special Operations Forces and has the 3rd largest active duty presence in the nation.

With these active installations and a diverse industrial base, North Carolina has strong links to the military and the companies and people that support it. What North Carolina lacks, however, is a data-driven approach to quantifying the breadth of its defense sector – as well as its potential vulnerability and opportunities for enhancement and growth – amid a changing defense spending landscape.

In 2017, the North Carolina Defense Industry Diversification Initiative (NC DIDI) was established via a planning grant from the Department of Defense Office of Economic Adjustment (OEA). As Co-Chairs of the NCDIDI Advisory Board, it is our privilege to bring together partners and stakeholders from industry, government, and academia to improve the knowledge of the impact of the defense industry on North Carolina's economy.

As a preliminary step to helping local communities adapt to DoD program changes, expansions, and cutbacks, a DoD Supply Chain study was conducted in 2017-18. Today, data and information gathered for that study is being used to: 1) help identify suppliers and other sectors at risk in the event of a local company or plant closure; 2) identify potential new markets for these at risk firms; 3) identify local gaps in the supply chain where an OEM is using overseas suppliers and can help support reshoring efforts; 4) help point state, local and regional policy makers identify which existing assets can be aligned to respond to supply chain issues and opportunities.

We later traveled the state from Murphy to Manteo holding Supplier and Contractor Town Halls interviewing the states foremost authorities and stakeholders. Lastly, we sourced data from all the federal defense purchasing offices and federal spend records. All that has led us to having the state's most comprehensive defense cluster analysis, six regional defense industry profiles and a complete strategic plan. Our next task was to develop a commercialization project. We welcomed small-to-medium size manufacturers and service providers to apply to our commercialization program to receive services customized to suit their business. That successful work has expanded and continues.

This data-driven DoD supply chain initiative is critical to North Carolina. We know that defense program impacts come in all shapes and sizes and, when defense programs change or are cut, contractors and business and industry may be faced with budget cuts, staff layoffs, or closings. Via funding from OEA, NCDIDI is well positioned to implement a series of proven strategies at a statewide and regional level with a focus on regional job creation through business development, attraction and expansion, workforce development, and community economic diversification. We invite you to join us!

All the best,

Secretary Larry D. Hall
North Carolina Department of
Military and Veterans Affairs

Executive Director Phil Mintz
Industry Expansion Solutions
North Carolina State University

North Carolina Defense Cluster Analysis

Introduction

The North Carolina Defense Industry Diversification Initiative (NC DIDI) was developed in order to support diversification efforts of defense contractors in North Carolina by performing comprehensive supply chain analysis, conducting a SWOT/gap analysis to examine the State's competitiveness, and developing a written action plan. As part of the comprehensive supply chain analysis of North Carolina's defense services and manufacturing industries, a cluster analysis was performed.

Purpose

The purpose of the cluster analysis was to contribute to the comprehensive supply chain analysis. The results compiled in this report are intended to provide actionable information for implementing diversification and business support services on a broader scale across North Carolina.

Methodology and Approach

Focus

The methodology for achieving the purpose of the cluster analysis involved a primary focus on identifying:

- Clusters most prominent (regarding economic activity) in North Carolina
- Clusters containing a high percentage of all the defense contractors in North Carolina (related metric will be referred to as High Concentration (HC))
- Clusters in which a high percentage of the workforce is employed by defense contractors (related metric will be referred to as Defense Intensity (DI))

On a strategic level, identification of clusters with either a High Concentration or a high Defense Intensity provides an economic basis for:

- A more targeted and in-depth analysis of the defense supply chain relationships;
- Identifying potential defense industry vulnerabilities and opportunities for diversification;
- Providing insight into leveraging the state's defense industry as part of its broader economic development strategy

On a tactical level, identification of clusters with a High Concentration and/or a high Defense Intensity enables more targeted identification of defense contractors who could benefit from additional support in their diversification efforts.

Data collection and analysis

First, data from the U.S. Cluster Mapping Project (CMP) was used to assess North Carolina's clusters and sub-clusters, with special attention given to identifying those that are the most nationally competitive. The CMP has defined a standardized set of clusters and sub-clusters (aggregations of 6-digit NAICS codes) that can be benchmarked nationally. All clusters and sub-clusters are defined by a unique set of mutually exclusive 6-digit NAICS codes. By assessing size, growth, and employment location quotients for defined comparable regions (e.g., States, MSAs, and counties), the CMP analysis can be used to identify those clusters and sub-clusters for which North Carolina is nationally competitive.

The data assembled on North Carolina's defense contractors and subcontractors were then assessed regarding their distribution and concentrations among the state's clusters and sub-clusters, as well as how sensitive each cluster or sub-cluster might be to defense spending changes. This information enabled analysis of the strengths and weakness of the concentrations of defense contracting, which in turn helped identify not only potential vulnerabilities, but also discover key strengths upon which a diversification and development strategy can be built.

Terms/Definitions

This report refers to business clusters and sub-clusters as traded, local, strong, highly concentrated, or defense intensive. These terms, and others related to the analysis, are defined below:

Clusters are fundamental drivers of regional wealth creation. An industry cluster represents the entire value chain from suppliers to end products, including supporting services and specialized infrastructure. Cluster industries are geographically concentrated and inter-connected by the flow of goods and services.

Traded clusters or sub-clusters sell products or services across regions and countries, which brings in additional capital into the local economy. These clusters create wealth.

Local clusters or sub-clusters sell products and services primarily for the local market, and promote the exchange of capital within a region. Revenue growth generally depends on the additional capital brought in by the traded cluster or sub-cluster.

Strong clusters and sub-clusters were identified primarily by selecting the clusters with a high concentration of employment relative to other states, and secondarily by a high concentration of establishments relative to other states.

High Concentration (HC) clusters or sub-clusters have a disproportionately high share of all the defense-related economic activity across the state. Various measures of economic activity were used to measure economic activity, including measures related to number of defense-related establishments, DOD sales, or number of defense-related employees.

Defense Intensive (DI) clusters or sub-clusters are clusters such that defense-related establishments have a high share of all the employment in the cluster.

Figure 1 below illustrates the difference between HC and DI.

Cluster	Defense-Related or Not		Total (Defense- and Non-Defense-Related)
	Defense-Related	Not Defense-Related	
Cluster 1	300	700	1000
Cluster 2	150	200	350
Cluster 3	50	100	150
Total (All clusters)	500	1000	1500

Cell contents:
Number of employees

Used for calculating High Concentration for Cluster 1

Used for calculating Defense Intensity for Cluster 1

High Concentration values for :
Cluster 1 = 300/500 = 0.6
Cluster 2 = 150/500 = 0.3
Cluster 3 = 50/500 = 0.1

High Defense Intensity values for :
Cluster 1 = 300/1000 = 0.3
Cluster 2 = 150/350 = 0.43
Cluster 3 = 50/150 = 0.33

Note: HC calculations could use the following metrics instead of number of employees:
-Number of defense-related establishments; or
- DOD sales (in $)

Figure 1. Illustration of difference between HC and DI values

See Appendix for more detailed description of above Terms/Definitions.

Analysis

Clusters critical to North Carolina's economy

State Clusters and Sub-Clusters – Defense and Nondefense Companies

Clusters have been broadly categorized as being either a traded cluster (create wealth for area) or a local cluster (sell goods/services primarily to local market and depend on wealth brought in via traded clusters). The distribution of North Carolina employment in private firms is shown in Figure 2, and closely matches the distribution nationally.

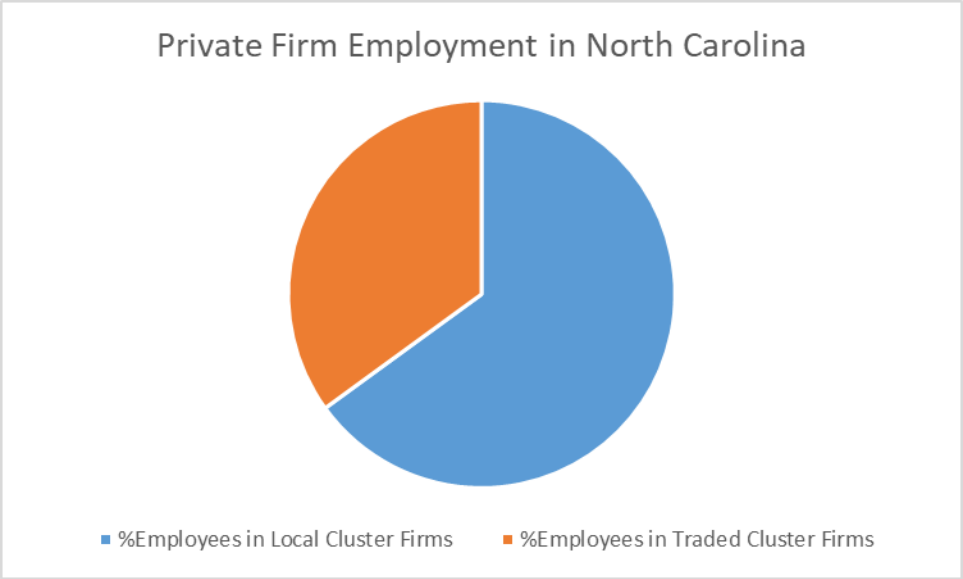

Figure 2. Private Firm Employment by Type of Cluster (Traded or Local)

Given that traded clusters have a higher propensity for wealth creation in the state, the focus will primarily be on traded clusters and sub-clusters.

State Level Traded and Competitive Clusters

In terms of private employment shares, North Carolina reflects the nation – 65% of employees work for firms in local clusters and 35% traded, compared to 64% local and 36% traded for the nation.

None of North Carolina's manufacturing dominant traded clusters employed more than 1.04% of total state private employment (Textiles Manufacturing was the highest).

North Carolina's 13 strong clusters employ 6.7% of the state's private employees. North Carolina's strong high-level clusters in 2015, ranked by employment were:

1. Textile Manufacturing
2. Livestock Processing
3. Furniture
4. Automotive
5. Plastics

6. Biopharmaceuticals
7. Paper and Packaging
8. Vulcanized and Fired Materials
9. Lighting and Electrical Equipment
10. Downstream Chemical Products
11. Tobacco
12. Apparel
13. Footwear

Some traded clusters were found to be strong regarding the state's private employment, whereas some relatively high employment was concentrated in sub-clusters not contained in a strong traded cluster. Therefore, the analysis results below consider both levels of categorization.

- Defense firms are active in 91% of the state's 67 clusters, and are active in 78% of the sub-clusters reporting economic activity.
- Defense firms, reported employees, and estimated sales are all more concentrated in traded clusters than in local clusters, just the reverse of the state and national patterns noted above.
- Policy should pay more attention to sub-cluster dynamics than to cluster dynamics.

State Level Local Clusters
North Carolina's top 10 local clusters in 2015, ranked by employment were:
1. Health Services
2. Hospitality Establishments
3. Commercial Services
4. Real Estate, Construction, and Development
5. Retailing of Clothing and General Merchandise
6. Motor Vehicle Products and Services
7. Food and Beverage Processing and Distribution
8. Community and Civic Organizations
9. Financial Services
10. Personal Services (non-Medical)

Defense industry relation to the strongest clusters

The state's defense industry is not concentrated in the state's strongest clusters.
To See a complete breakdown of the

Clusters and Sub-clusters with a High Concentration (high proportion of all defense-related firms in the state)

The following results relate to analyses of cluster and sub-cluster data, but only for the data set consisting of defense-related firms.

- Fifteen clusters, 60% of which were traded clusters, were identified as having a high concentration of the total defense activity in the state. These fifteen clusters account for:
    - 70% of all DOD firms
    - 72% of reported employees
    - 82% of fy 2017 sales
    - 81% of fy2013-17 DOD sales
- Only one high concentration cluster is also a strong cluster. In other words, only one cluster (the "Lighting & Electrical Equipment" cluster) accounted for a disproportionately high percentage of all defense-related activity in the state AND also accounted for a high concentration of employment and/or establishments relative to other states.

Using the same approach for sub-clusters, we found twenty-three sub-clusters with significant defense concentrations, 14 were traded and nine were local.

- The 23 HC sub-clusters accounted for:
    - 41% of all defense firms
    - 55% of reported employees
    - 68% of FY 2017 DOD sales
    - 64% of cumulative FY 2013-17 DOD sales

- For sub-clusters with a significant defense concentration, 61% were traded clusters (almost identical to comparable percentage at the cluster level). However, the large amount of base support and construction, much of which is classified as local, is thought to have decreased the economic activity attributed to the traded sub-clusters.
- Only four of the high concentration (HC) sub-clusters are manufacturing dominant:
    - Aircraft
    - Computers & Peripherals
    - Electrical Equipment
    - Construction Materials
- Only three high concentration sub-clusters are also strong sub-clusters. These three sub-clusters account for only small to modest shares of firms and employment, but significant shares of DOD sales.

Clusters with a high Defense Intensity

The cluster and sub-cluster analysis presented in this section focuses on what proportion of employment in a cluster is due to defense-related firms (i.e. Defense Intensity [DI]). Regarding clusters, defense related firms' employment represents a relatively strong 5.7 percent of total private employment across the state.

- Traded clusters have by far the highest defense intensity at 9.1%, while local clusters average 3.2% DI, indicating that defense-related firms' employment in traded clusters is

higher than in local clusters. Similarly, the traded sub-clusters had a higher percentage of defense-related employment than did the local sub-clusters.

- For the group of traded clusters with an above average DI, the defense related firms' employment represents 16% of total private employment across the state. These 28 traded clusters are particularly sensitive to defense spending fluctuations. For seven of these 28 clusters, employment exceeded 5,000.

A few individual High DI sub-clusters are worth calling out for special attention:

- Aircraft represents the single largest sub-cluster in terms of cumulative 2013-17 DOD Sales at $1.1b, though reporting only 801 employees in 2017.
    - 2017 was a low DOD awards year for this sub-cluster, although 2017 estimated sales still totaled $57m.
- Training Programs were the second largest in cumulative 2013-17 DOD sales at $383m, with 6,332 reported employees.
- The local sub-cluster, Natural Gas Distribution was the only other High-DI sub-cluster with cumulative 2013-17 DOD sale over $200m at $235m.
- Only three additional High DI sub-clusters had cumulative DOD sale over $100m:

    - Search & Navigation Equip at $105m
    - Communications Equip at $122m
    - Alternative Electric Power at $122m

These six High DI sub-clusters were top DOD earners over the five-year window covered in this project. Leaving out the two utilities, the health of individual firms in the remaining four sub-clusters should receive attention.

- Two are part of the state's targeted aerospace sector
- One overlaps with that sector and aligns with the states interest in information technology broadly defined
- The importance of the Training sub-cluster in DOD sales is not surprising, considering the military base and Command composition of North Carolina's military presence, but while the value of that incredible asset as potential leverage for economic development purposes simply did not emerge in interviews and focus group discussions, this avenue should be explored during Phase II of the DIA program

Synthesis of Analysis Results and Key Takeaways

Clusters and Sub-clusters with either a high Defense Intensity (DI) or a High Concentration (HC) are likely to contain groups of defense firms with significant potential for interaction - both within the defense industry and with the non-defense firms in the same clusters/sub-clusters.

One goal of Phase II should be to promote greater interaction among firms in the same cluster or sub-cluster.

Identifying and responding to missing links in a statewide value-added chain may involve a wide range of programs related to:

- Investment
- Business expansion, retention and attraction
- Infrastructure
- Education and training

It is possible that defense firms seeking assistance might help address these and other missing cluster or sub-cluster links.

In general:

- Since traded clusters are considered the wealth generators in a region, this type of cluster is often the primary focus of economic development organizations.

- On average, traded clusters and sub-clusters are significantly more defense concentrated and more dependent upon defense activity than local clusters and sub-clusters.

- DOD firms that are active in large traded clusters and sub-clusters, especially in strong clusters and sub-clusters, should be easier than others to leverage into the non-DOD value chains for diversification support within their respective clusters and sub-clusters.

Recommendations for use of cluster analysis results

Gap Analysis

Cluster analysis can be used in determining gaps in the value-added chain that exist in a State or region's economic drivers. One possible approach is described as follows:

1) Select some of the key clusters and sub-clusters identified in this report, those which are rated as strong by the Cluster Mapping Project and which also have a high DI or high HC.
2) For the selected clusters, drill down to the six-digit NAICS level, and identify what industries may be missing in the value added chain.
3) Unbundling targeted clusters to the six-digit level is an excellent strategy for identifying some of the best opportunities for either retention and expansion of an existing business or for recruiting a new one. Furthermore, for communities with a documented strong cluster, the suppliers, workforce, professional services, and infrastructure are already in place to recruit and support a company that could fill a missing niche.

Example
An example of a gap in the value-added "chain" can be illustrated by taking a hypothetical analysis of a single cluster. Let us assume, hypothetically, that the NC aerospace-manufacturing cluster lacks an adequate supply of local technical services (such as materials testing and failure analysis laboratories, often referred to as the Test and Evaluation industry or T&E). Such T&E capabilities are critical to advanced aerospace manufacturing (and many other advanced manufacturing sectors) and can be sourced locally or imported from out of the region. If analysis determines that the T&E industry is a key element of the aerospace manufacturing cluster and that the local concentration of this industry is below the national average, then a missing link in the regional value-added chain has been identified. In this instance, local aerospace manufacturers are demanding more T&E services than local suppliers can provide.

Focusing on these gaps in system connections allows government agencies and not-for-profits to design new policies in areas such as:

- Investment programs
- Business expansion, retention and attraction efforts
- Infrastructure decisions

The Use of Clusters in Other Areas

Clusters also serve as an important basis for the development of education and training programs that support existing high value employers and serve as an employee attraction tool for the region. Local economic development organizations can assist companies trying to attract employees by displaying the breadth, linkages and range of regional activity in their particular cluster in line with education and training support.

As part of a cluster based strategy, the state or regions could pursue the activation of competitive and especially emerging clusters. This would involve convening and facilitating the creation of cluster industry associations and organizations. Such organizations provide a comparative advantage to regional industries. They foster complementary relationships, increase industry cohesiveness and exposure, encourage a collective identity and strength. This approach has worked particularly well for the Life Sciences cluster in Indiana, the Optics cluster in Arizona, and the Software and Computer Services cluster in San Diego.

Cluster analysis is also useful for land-use and transportation planning. Combining industry clustering theory with spatial analysis is not a new approach. However, recent advances in technology using clusters in conjunction with a Geographic Information System (GIS) has greatly increased the potential for this type of coordination at reasonable cost even for smaller regional economic development organizations.

Other Comments and Additional Observations:

- Clusters with a large share of non-reporting firms or DOD sales associated with non-reporting firms and which also contain significant DOD activity, such as Production Technology & Heavy Machinery, deserve more in-depth investigation.
- Employees are concentrated in traded sub-clusters
- The shares of firms, employees and DOD sales in strong sub-clusters are significantly higher than found when assessing strong clusters
- Strong sub-clusters represent the largest shares of defense traded sub-cluster activity on all measures. This suggests that policy should pay closer attention to sub-cluster dynamics than to clusters.
- The variation in the different metrics used reveal the importance of not just concentrating on a single target for analysis.
    - The Aerospace Vehicles & Defense (Aerospace) cluster is a good example. In spite of having very small shares of DOD firms and employees, the cluster had a significant 10% share of cumulative 2013-17 DOD sales.
    - The Lighting & Electrical Equipment (L&EE) cluster is another good example. Like Aerospace, it has small shares of firms and employees, but the DOD sales patterns are the opposite from Aerospace's. 2013-17 L&EE DOD sales are a merely respectable 6.4% of total DOD sales. In 2017, however, the cluster share of 2017 DOD sales jumped to 25% of total DOD sales.

Data Quality Issues

Total state employment by sub-cluster is for 2015 from the U.S. Cluster Mapping project (based on the data underlying the BEA, County Business Patterns), and the defense related "Employees at Location" data is self-reported from Hoovers or USAspending.gov.

For highly cyclical clusters a two-year difference can be significant.

Further, we have found some entries in Hoovers for multi-location firms that report "total employees," rather than

Employees at Location.

- More important, however, is the likelihood of NAICS misallocation in the defense data
- USAspending does not report primary NAICS (the NAICS associated with a company)At best it reports a principal NAICS associated with a contract
- DOD contracts may not be in the same NAICS as the primary for the company
- Using the DUNS number for each defense firm, THE NC DIDI:
    1. First checked to see if a primary NAICS was provided in Hoovers.
    2. For firms not reported in the current Hoovers, we examined SAM, which filled in some gaps.
    3. For the rest we used a semi-manual process by reviewing the NAICS and PSCs associated with all awards
    4. We then selected a primary NAICS based on the majority or their contracts, an approach which has two potential sources of error
        - Contracting officers assign project (or Principal NAICS) and it is not uncommon for them to be wrong
        - Moreover, THE NC DIDI can easily assign an incorrect NAICS if the bulk of a contractor's work for DOD is not in its primary line of business
- 15.4% of all defense establishments did not report 2017 employees at the location of interest. These non-reporting firms accounted for 6.0% of 2017 estimated DOD sales and 9.0% of cumulative 2013-17 DOD sales. On average, non-reporters represent a modest share of DOD firms with relatively low DOD sales.

North Carolina's Business Clusters

This section describes the clusters for the State of North Carolina based on the tools and data available from the U.S. Cluster Mapping Project.

State Level Traded and Competitive Clusters

This section leverages the data provided by the U.S. Cluster Mapping Project to identify North Carolina's traded business clusters and among them the most competitive traded clusters. An important qualification to note is that the state is not always the best geography to assess economic clusters. Nonetheless, the state is a key analytical geography for which the CMP provides competitive and benchmarking information.

Table 1 below provides a summary of *Employment by Traded Cluster* in 2015 (the most recent year available). The indicators *Strong Cluster* and *National Employment Rank* are based on comparisons among the 50 states. Those identified as strong clusters are those which are deemed by the CMP to be highly competitive nationally, based on relative size, growth, and location quotient analysis.

North Carolina's strong high-level clusters in 2015, ranked by employment were:

1. Textile Manufacturing
2. Livestock Processing
3. Furniture
4. Automotive
5. Plastics
6. Biopharmaceuticals
7. Paper and Packaging
8. Vulcanized and Fired Materials
9. Lighting and Electrical Equipment
10. Downstream Chemical Products
11. Tobacco
12. Apparel
13. Footwear

Table 1: North Carolina Traded Clusters, 2015			
Cluster Name	**2015 Employment**	**Strong Cluster**	**National Employment Rank**
Business Services	341,730		11
Distribution and Electronic Commerce	167,639		10
Education and Knowledge Creation	93,358		11
Hospitality and Tourism	67,630		14
Transportation and Logistics	47,357		11
Financial Services	39,204		17
Textile Manufacturing	38,205	TRUE	2
Production Technology and Heavy	36,360		11
Insurance Services	35,637		18
Livestock Processing	32,602	TRUE	3
Furniture	32,456	TRUE	1
Automotive	28,456	TRUE	12
Plastics	27,224	TRUE	9
Information Technology and Analytical	26,673		12
Construction Products and Services	23,877		9
Marketing, Design, and Publishing	23,558		16
Food Processing and Manufacturing	20,729		19
Biopharmaceuticals	18,428	TRUE	3
Wood Products	17,561		6
Paper and Packaging	17,135	TRUE	6
Vulcanized and Fired Materials	14,400	TRUE	2
Lighting and Electrical Equipment	13,278	TRUE	7
Printing Services	12,673		17
Downstream Chemical Products	10,932	TRUE	9
Communications Equipment and Services	10,720		12
Downstream Metal Products	10,404		15
Upstream Metal Manufacturing	9,281		13
Metalworking Technology	8,458		15
Performing Arts	7,465		12
Tobacco	6,507	TRUE	1
Medical Devices	6,475		15
Electric Power Generation and	5,853		10
Apparel	4,636	TRUE	5
Aerospace Vehicles and Defense	4,203		28
Upstream Chemical Products	4,032		15
Recreational and Small Electric Goods	3,902		14
Water Transportation	3,387		23
Forestry	3,288		7

Nonmetal Mining	2,591		10
Trailers, Motor Homes, and Appliances	2,275		18
Environmental Services	1,808		15
Agricultural Inputs and Services	1,796		15
Video Production and Distribution	1,257		14
Leather and Related Products	823		11
Footwear	680	TRUE	7
Oil and Gas Production and	441		40
Music and Sound Recording	245		16
Fishing and Fishing Products	150		21
Jewelry and Precious Metals	80		31
Coal Mining	60		28
Metal Mining	20		32

State Level Local Clusters

Table 2 below provides a summary of Employment by Local Cluster in 2015 (the most recent year available) and cluster totals. No strong clusters are noted. Strong clusters, by definition, are a subset of traded clusters.

Table 2: North Carolina Local Clusters, 2015		
Cluster Name	**2015 Employment**	**National Employment Rank**
Local Health Services	516,308	9
Local Hospitality Establishments	393,264	9
Local Commercial Services	264,743	11
Local Real Estate, Construction, and	246,693	8
Local Retailing of Clothing and General	148,353	10
Local Motor Vehicle Products and Services	131,923	10
Local Food and Beverage Processing and	125,209	10
Local Community and Civic Organizations	124,024	9
Local Financial Services	111,289	8
Local Personal Services (Non-Medical)	77,752	12
Local Logistical Services	55,096	13
Local Household Goods and Services	54,080	8
Local Utilities	43,082	11
Local Entertainment and Media	37,510	10
Local Education and Training	37,193	12
Local Industrial Products and Services	13,680	12
Total Strong Clusters	244,939	
North Carolina Total Employees	3,668,138	
North Carolina Totals (Traded Cluster)	1,287,939	
North Carolina Totals (Local Cluster)	2,380,199	

General Cluster Observations

In terms of private employment shares, North Carolina has close to the same pattern as the nation – 65% local and 35% traded, compared to 64% local and 36% traded for the nation.

North Carolina's 13 strong clusters, all traded, employ 6.7% of the state's private employees.

None of the manufacturing dominant traded clusters employed more than 1.04% of total statewide private employment (Textiles Manufacturing was the highest).

Defense Firm Alignment with North Carolina's Clusters and Sub-Clusters

North Carolina Defense Cluster and Sub-Cluster Profile

Clusters

Following are select, underlying data issues that impact interpretation and need to be noted:

1. Not all defense firms report employees at this location to Hoovers, so the reported employee totals are below actual
2. *Employees at this Location* data are for all employees, not just those working on defense contracts
3. DOD does not report payments to firms, only awards and modifications
    - As a result, there is no way to know precisely when DOD revenue was received by a company.
    - To deal with this problem, each contract was calculated and totaled for "base and obligated amount," which included all modifications, extensions, cancellations, etc. over the life of the contract and then created a per diem revenue value. Multiple contracts for same company were combined into the annual revenue total.
    - No contract is ever paid in this fashion, but this assumption gives us an estimate of cash flow, which we call *estimated DOD sales*.
4. Reported are FY 2017 estimated DOD sales and cumulative FY 2013-17 estimated DOD sales
    - The former provides a short term look at current sales for only some of the total population of defense firms. The latter smooths out some of the variability and reflects the sales patterns over a five-year period for the entire defense firm population

Tables 3 and 4 provide a profile of how the defense industry maps into the state's high-level clusters. For each cluster Table 3 eports:

- The number of defense firms active in that cluster between 2013 and 2017
- The number of employees reported by those firms in 2017
- The estimated values of DOD sales in FY 2017
- The cumulative estimate of DOD sales over cumulative FY 2013-17

Table 4 also pulls the strong cluster designations from statewide analysis above.

Select Cluster Observations:

- Defense firms are active in 61 of the state's 67 clusters

- Defense firms reported employees and estimated sales are all more concentrated in traded clusters than in local clusters
    - This is the reverse of the state and national patterns noted above
- The state's defense industry is not concentrated in the state's strongest clusters.
    - The strong cluster share of defense employment is well below the state's strong cluster share of total employment (6.6% versus 12.5%)

Table 3: North Carolina Defense Industry Profile: Firms, Employees and Sales by Cluster

Cluster	Number DOD Firms	Employees at Location	2017 Estimated DOD Sales	Cum FY 2013-17 Estimated DOD Sales	Strong Cluster Designation
Traded Clusters					
Aerospace Vehicles &	38	1,766	$79,590,575	$1,231,905,412	
Agricultural Inputs & Services	3	57	$ -	($384,027)	
Apparel	29	1,623	$23,120,401	$83,003,366	TRUE
Automotive	30	1,910	$35,872,574	$212,590,798	TRUE
Biopharmaceuticals	8	251	$5,649,955	$61,143,726	TRUE
Business Services	421	9,043	$341,100,976	$1,557,580,484	
Communications Equipment	31	3,684	61,049,528	279,242,564	
Construction Products &	44	7,982	$62,637,205	$129,236,137	
Distribution & Electronic	404	12,921	$94,607,428	$479,687,451	
Downstream Chemical	11	756	$2,863,803	$6,581,783	TRUE
Downstream Metal Products	44	1,977	$13,407,204	$40,494,700	
Education & Knowledge	144	26,755	$87,082,476	$649,224,509	
Electric Power Generation &	5	2,172	$68,060,576	$122,065,677	
Environmental Services	12	244	$477,510	$33,014,986	
Financial Services	6	347	$20,060	$549,697	
Food Processing &	7	896	$813,942	$6,916,173	
Footwear	2	145	$ -	$85,934	TRUE
Forestry	4	37	$44,976	$28,659	
Furniture	41	3,101	$7,872,079	$45,581,185	TRUE
Hospitality & Tourism	151	6,402	$1,844,297	$8,830,563	
Info Tech & Analytical	106	13,846	$36,320,759	$139,790,715	
Leather & Related Products	6	113	$801,875	$14,314,210	
Lighting & Electrical	46	1,549	$720,840,395	$781,092,156	TRUE
Livestock Processing	1	1	$ -	$ -	TRUE
Marketing, Design, &	56	2,742	$60,487,770	$281,301,362	
Medical Devices	23	1,338	$1,027,976	$8,157,589	
Metalworking Technology	27	678	$1,282,602	$10,053,144	
Music & Sound Recording	2	4	$19,680	$167,541	
Nonmetal Mining	3	218	$836,831	$3,089,893	
Oil & Gas Production &	7	58	$1,657,743	$19,280,162	
Paper & Packaging	5	111	$300,000	$351,152	TRUE

Performing Arts	23	198	$91,755	$891,400	
Plastics	16	1,006	$22,477,887	$35,499,843	TRUE
Printing Services	5	50	$4,180	$591,482	
Production Technology &	96	4,202	$64,324,633	$339,172,929	
Recreational & Small Electric	15	460	$1,373,448	$5,479,565	
Textile Manufacturing	34	2,458	$60,159,585	$250,063,686	TRUE
Tobacco					TRUE
Trailers, Motor Homes, &	2	30	$547,877	$565,763	
Transportation & Logistics	36	541	$10,398,588	$31,498,955	
Upstream Chemical Products	9	2,276	$441,073	$3,454,919	
Upstream Metal	13	1,105	$991,512	$4,530,241	
Video Production &	8	17	$366,816	$1,121,244	
Vulcanized & Fired Materials	17	685	$13,635,413	$32,866,871	TRUE
Water Transportation	13	980	$13,532,896	$136,579,333	
Wood Products	11	171	$533,787	$4,942,729	
Local Clusters					
Local Commercial Services	282	5,649	$92,742,116	$417,318,684	
Local Community & Civic	40	389	$1,805,644	$6,356,020	
Local Education & Training	29	2,278	$96,082,636	$472,928,965	
Local Entertainment & Media	31	573	$1,779,387	$9,559,966	
Local Financial Services	1	300	$11,864	$24,042	
Local Food & Beverage	13	1,051	$28,411,714	$56,081,918	
Local Health Services	96	36,240	$63,805,403	$296,680,640	
Local Hospitality	52	2,610	$43,713,093	$154,726,598	
Local Household Goods &	72	854	$14,424,774	$145,902,956	
Local Industrial Products &	47	917	$5,947,204	$30,144,344	
Local Logistical Services	55	877	$4,408,597	$28,761,802	
Local Motor Vehicle Products	63	1,742	$2,039,632	$50,839,564	
Local Personal Services (Non-	61	702	$1,355,304	$7,717,499	
Local Real Estate,	566	18,876	$371,432,841	$2,742,714,513	
Local Retailing of Clothing &	15	618	$135,671,097	$223,597,555	
Local Utilities	36	1,793	$119,653,596	$457,002,410	
Totals					
Traded Clusters	2,015	116,906	$1,898,570,646	$7,052,236,659	
Local Clusters	1,459	75,469	$983,284,902	$5,100,357,475	
Strong Clusters	240	13,596	$892,792,092	$1,508,860,498	
#N/A	50	14,962	$6,940,290	$39,816,499	
Grand Total	3,524	207,337	$2,888,795,839	$12,192,410,634	

Table 4: North Carolina Defense Industry, Percent Distribution of Firms, Employees, and DOD Sales by Cluster				
Cluster	**Share DOD Firms**	**Share Employees at Location**	**FY 2017 Estimated DOD Sales Share**	**Cum 2013-17 Estimated DOD Sales Share**
Traded Clusters				
Aerospace Vehicles & Defense	1.10%	0.90%	2.80%	10.10%
Agricultural Inputs & Services	0.10%	0.00%	0.00%	0.00%
Apparel	0.80%	0.80%	0.80%	0.70%
Automotive	0.90%	0.90%	1.20%	1.70%
Biopharmaceuticals	0.20%	0.10%	0.20%	0.50%
Business Services	11.90%	4.40%	11.80%	12.80%
Communications Equipment & Services	0.90%	1.80%	2.10%	2.30%
Construction Products & Services	1.20%	3.80%	2.20%	1.10%
Distribution & Electronic Commerce	11.50%	6.20%	3.30%	3.90%
Downstream Chemical Products	0.30%	0.40%	0.10%	0.10%
Downstream Metal Products	1.20%	1.00%	0.50%	0.30%
Education & Knowledge Creation	4.10%	12.90%	3.00%	5.30%
Electric Power Generation & Transmission	0.10%	1.00%	2.40%	1.00%
Environmental Services	0.30%	0.10%	0.00%	0.30%
Financial Services	0.20%	0.20%	0.00%	0.00%
Food Processing & Manufacturing	0.20%	0.40%	0.00%	0.10%
Footwear	0.10%	0.10%	0.00%	0.00%
Forestry	0.10%	0.00%	0.00%	0.00%
Furniture	1.20%	1.50%	0.30%	0.40%
Hospitality & Tourism	4.30%	3.10%	0.10%	0.10%
Information Tech & Analytical Instruments	3.00%	6.70%	1.30%	1.10%
Leather & Related Products	0.20%	0.10%	0.00%	0.10%
Lighting & Electrical Equipment	1.30%	0.70%	25.00%	6.40%
Livestock Processing	0.00%	0.00%	0.00%	0.00%
Marketing, Design, & Publishing	1.60%	1.30%	2.10%	2.30%
Medical Devices	0.70%	0.60%	0.00%	0.10%
Metalworking Technology	0.80%	0.30%	0.00%	0.10%
Music & Sound Recording	0.10%	0.00%	0.00%	0.00%
Nonmetal Mining	0.10%	0.10%	0.00%	0.00%
Oil & Gas Production & Transportation	0.20%	0.00%	0.10%	0.20%
Paper & Packaging	0.10%	0.10%	0.00%	0.00%
Performing Arts	0.70%	0.10%	0.00%	0.00%
Plastics	0.50%	0.50%	0.80%	0.30%
Printing Services	0.10%	0.00%	0.00%	0.00%
Production Technology & Heavy	2.70%	2.00%	2.20%	2.80%

Recreational & Small Electric Goods	0.40%	0.20%	0.00%	0.00%
Textile Manufacturing	1.00%	1.20%	2.10%	2.10%
Tobacco				
Trailers, Motor Homes, & Appliances	0.10%	0.00%	0.00%	0.00%
Transportation & Logistics	1.00%	0.30%	0.40%	0.30%
Upstream Chemical Products	0.30%	1.10%	0.00%	0.00%
Upstream Metal Manufacturing	0.40%	0.50%	0.00%	0.00%
Video Production & Distribution	0.20%	0.00%	0.00%	0.00%
Vulcanized & Fired Materials	0.50%	0.30%	0.50%	0.30%
Water Transportation	0.40%	0.50%	0.50%	1.10%
Wood Products	0.30%	0.10%	0.00%	0.00%
Local Clusters				
Local Commercial Services	8.00%	2.70%	3.20%	3.40%
Local Community & Civic Organizations	1.10%	0.20%	0.10%	0.10%
Local Education & Training	0.80%	1.10%	3.30%	3.90%
Local Entertainment & Media	0.90%	0.30%	0.10%	0.10%
Local Financial Services	0.00%	0.10%	0.00%	0.00%
Local Food & Beverage Processing & Distr.	0.40%	0.50%	1.00%	0.50%
Local Health Services	2.70%	17.50%	2.20%	2.40%
Local Hospitality Establishments	1.50%	1.30%	1.50%	1.30%
Local Household Goods & Services	2.00%	0.40%	0.50%	1.20%
Local Industrial Products & Services	1.30%	0.40%	0.20%	0.20%
Local Logistical Services	1.60%	0.40%	0.20%	0.20%
Local Motor Vehicle Products & Services	1.80%	0.80%	0.10%	0.40%
Local Personal Services (Non-Medical)	1.70%	0.30%	0.00%	0.10%
Local Real Estate, Construction, & Dev.	16.10%	9.10%	12.90%	22.50%
Local Retailing of Clothing & General	0.40%	0.30%	4.70%	1.80%
Local Utilities	1.00%	0.90%	4.10%	3.70%
Totals				
Traded Clusters	57.20%	56.40%	65.70%	57.80%
Local Clusters	41.40%	36.40%	34.00%	41.80%
Strong Clusters	6.80%	6.60%	30.90%	12.40%
#N/A	1.40%	7.20%	0.20%	0.30%
Grand Total	100.00%	100.00%	100.00%	100.00%

Appendix

Terms/Definitions

This report refers to business clusters and sub-clusters as traded, local, strong, highly concentrated, or defense intensive. These terms, and others related to the analysis, are defined below:

Clusters are fundamental drivers of regional wealth creation. An industry cluster is different from the classic definition of an industry sector because it represents the entire value chain from suppliers to end products, including supporting services and specialized infrastructure. Cluster industries are geographically concentrated and inter-connected by the flow of goods and services, which is stronger than the flows linking them to the rest of the economy.

Traded clusters or sub-clusters are those that concentrate in particular regions that provide competitive advantages but sell products or services across regions and countries. These clusters, therefore, export goods which brings in additional capital into the local economy. These clusters create wealth.

Local clusters or sub-clusters sell products and services primarily for the local market. They generally do not bring additional capital to the local economy but exchange capital for goods or services within it. Revenue growth for local clusters or sub-clusters generally depend on the additional capital brought in by the traded cluster or sub-cluster.

Strong clusters and sub-clusters were identified using the U.S. Cluster Mapping Project data and system for North Carolina, where they are defined as follows:

1. Primary criterion: Location Quotient of Cluster Employment must be greater than the 75th percentile when measured across all Economic Areas (in this case, states)
2. Secondary criterion to differentiate marginal cases: Location Quotient of Cluster Employment must be greater than an LQ of 1.0, Share of National Cluster Employment greater than the 25th percentile, and Share of National Cluster Establishments greater than the 25th percentile

High Concentration (HC) clusters or sub-clusters are created through a ratio that provides a percent value. Four HC ratios are calculated for each cluster or sub-cluster with the following numerators and denominators:

1. The total of defense-related establishments in a given cluster or sub-cluster over the total of defense related establishments for the state
2. The total DOD sales in a given cluster or sub-cluster over the total estimated DOD sales for the state for FY 2017

3. The total DOD sales in a given cluster or sub-cluster over the total estimated DOD sales for the state for cumulative FY 2013-17
4. The sum of defense-related "employees at this location" as reported in a given cluster or sub-cluster over the total of defense related "employees at this location" as reported for the state

Clusters or sub-clusters with at least one of the four ratios above the cutoff point are considered to be HC and are subjected to more detailed analysis.

Defense Intensive (DI) clusters or sub-clusters are identified by a ratio which provides a percent value. A DI ratio is calculated for each cluster or sub-cluster with the following numerator and denominator:
1. The sum of "employees at this location" reported by defense-related establishments in a given cluster or sub-cluster over the total employment (defense and nondefense businesses) in the same cluster or sub-cluster.

To be considered a DI cluster or sub-cluster, the DI percentage must exceed an arbitrary cutoff point selected based on the actual data.

The HC and DI ratios are both indicators of relative strength but in very different contexts:

- The category HC covers establishments, sales, and employment
- The category DI covers only employment

The HC denominator consists of data from all defense related businesses in the entire state, and the ratio is an estimate of state cluster or sub-cluster strength within the defense sector. The DI denominator includes data from all businesses (again statewide), both defense and nondefense, within the cluster or sub-cluster and is, therefore, an estimate of defense strength relative to all the businesses within a single cluster or sub-cluster.

Location Quotient: "Location quotient (LQ) is a valuable way of quantifying how concentrated a particular industry, cluster, occupation, or demographic group is in a region as compared to the nation. It can reveal what makes a particular region "unique" in comparison to the national average." (Retrieved from https://www.economicmodeling.com/2011/10/14/understanding-location-quotient-2/ on 12/05/18). LQ values greater than 1.0 indicate a high concentration for the cluster of interest, with an increasingly higher concentration indicated by an increasingly higher LQ value.

*Strategy-Focused Version Compiled from the Strategic Development Group's Data-Detailed Report. This report provides a compilation of results from the detailed cluster analysis report produced by SDG, a consulting firm engaged to conduct the comprehensive supply chain analysis.

North Carolina Defense Industry Diversification Advisory Board

Secretary Larry D. Hall, Co-Chair
NC Department of Military and Veterans Affairs

Phil Mintz, Executive Director, Co-Chair
North Carolina State University Industry Expansion Solutions

Dr. Fiona Baxter, Associate Executive Director
North Carolina State University Industry Expansion Solutions

Scott Dorney, Executive Director
North Carolina Military Business Center

Tammy Everett, Executive Director
North Carolina Defense Business Association

Scott Daugherty, Assistant Vice Chancellor and State Director
Small Business Technology Development Center

Will Best, Military Affairs Liaison
North Carolina Department of Commerce

Tom White, Director
Economic Development Partnership at North C State University

Annette Stevenson, Vice President
North Carolina Veterans Business Association

Mark Trexler, President
Survival Innovations

John Loyack, Vice President, Global Business Services
North Carolina Economic Development Partnership

Tenette Prevatte, Academic Dean Computer & Information Technology Programs
Fayetteville Technical Community College

Marty Ray Zapata, Vice President Strategy & Planning
Zapata Engineering

CONTACT US:

IES applies tailored business solutions that enable companies to improve their operations and their bottom line. Let IES craft a solution that fits your specific needs. Feel free to contact:
Michael Mullins, Director of the North Carolina Defense Industry Diversification Initiative
Director, North Carolina Defense Industry Diversification Initiative
Military Segment Manager
Industry Expansion Solutions
North Carolina State University
mrmulli2@ncsu.edu

The NC DIDI will be making presentations statewide and sharing information about the initiative. Are you interested in receiving information about upcoming events, scheduling a speaker for your next lunch and learn, or allowing us to set up a booth at your next conference? Feel Free to Contact:
Nimasheena Burns
Director of Communications and Project Management
NC Department of Military and Veterans Affairs
Nimasheena.burns@milvets.nc.gov

Perhaps your company might be interested in taking part in the Universal Production Growth Resiliency and Diversification Extension Program? Feel free to contact:
Rex Raiford, Regional Manager and Pilot Project Manager
Industry Expansion Solutions
North Carolina State University
Rex_raiford@ncsu.edu

Laura Rogers
Client Relations Manager
NC State University - Industry Expansion Solutions
Ldrodger@ncsu.edu

Jason Yearwood
Communications and Program Specialist
North Carolina Department of Military and Veterans Affairs
Jason.Yearwood@milvets.nc.gov

Lacey McEwen
DoD Grant Coordinator
NC State University
Industry Expansion Solutions
Lacey_mcewen@ncsu.edu

NOTES

NCDIDI

NORTH CAROLINA DEFENSE INDUSTRY DIVERSIFICATION INITIATIVE

CONNECTING THE DOTS, EXPANDING OPPORTUNITIES

2019 North Carolina Defense Cluster Analysis

NC STATE

Industry Expansion Solutions

DMVA

www.NCDIDI.com