THE UNIVERSITY OF SOUTHERN MISSISSIPPI

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Southwest Mississippi Cluster Analysis

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ECONOMIC DEVELOPMENT AND TOURISM DEPARTMENT
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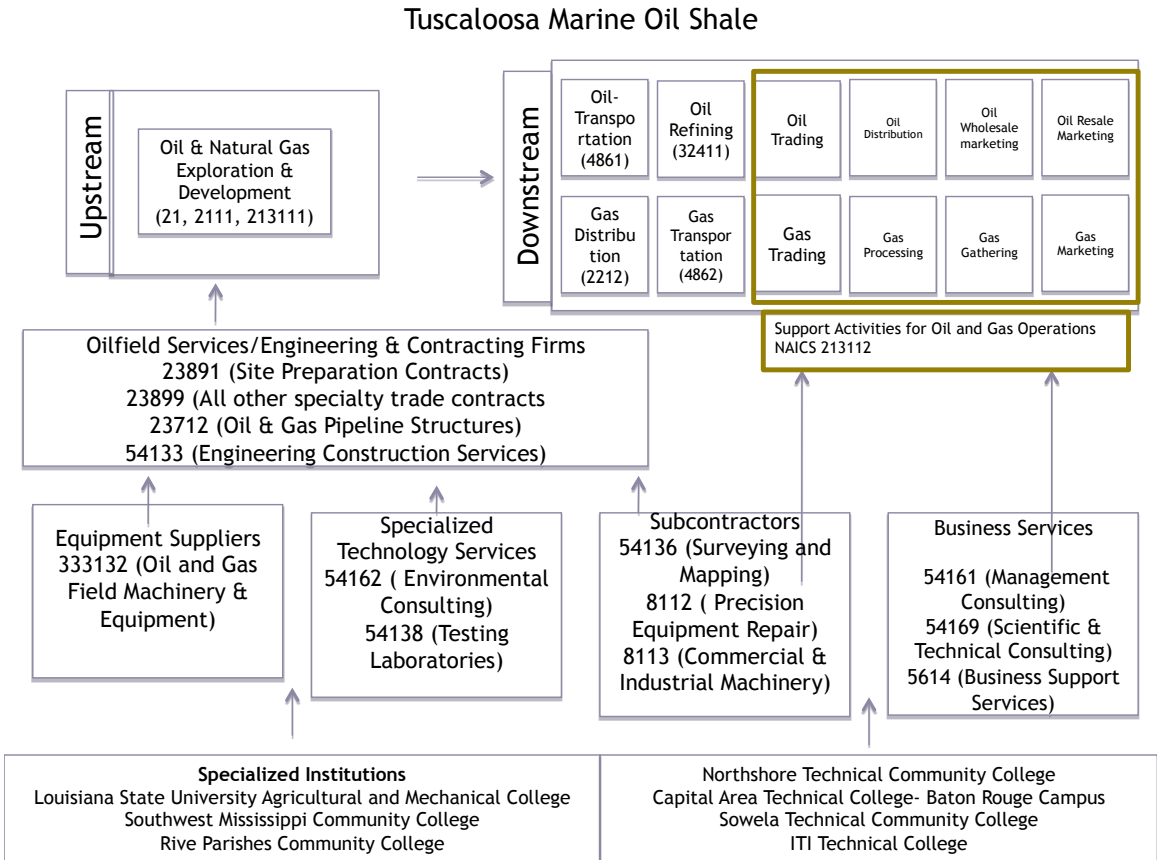
Executive Summary

The University of Southern Mississippi was commissioned by the Southwest Mississippi Partnership and Entergy to conduct a cluster analysis of the oil and gas industry in the southwestern region of Mississippi and eastern region of Louisiana. This report focuses on the petroleum extraction industry and the related petrochemical industry in the region that includes the Mississippi counties of Adams, Amite, Claiborne, Franklin, Jefferson, Lawrence, Lincoln, Pike, Walthall and Wilkinson and the Louisiana parishes of Catahoula, Concordia, East Baton Rouge, East Feliciana, St. Helena, Tangipahoa, Tensas, Washington, West Baton Rouge, West Feliciana, Ascension, Livingston and St. Tammany. This study was conducted in order to understand the industries in the region, the clustering effect of the petroleum extraction and petrochemical industries, and identify gaps in the clusters that can be filled through industrial recruiting or internal development. It will follow the methodology developed by Mayer (2005) along with a gap analysis using input/output tables. This report is primarily based on secondary data analysis and further primary data analysis is needed to present a complete cluster analysis for the region.

The team found that there is significant potential for an oil and gas cluster to exist in the region particularly with the advent of fracturing technology. Key findings are provided at the beginning of each section and summarized at the beginning of the report to assist decision makers in determining the types of companies that should be attracted or developed in the region to fill gaps in the clusters. Additionally, the team makes recommendations for policies, actions, and infrastructure development that are important for economic development.

Summary of Findings

- A quantitative cluster analysis of the region's industries (at the six digit level) showed that crude petroleum and natural gas extraction industry, natural gas liquid industry, all other basic organic chemical manufacturing industry have the indicators of being nationally competitive clusters. More qualitative analysis is needed to confirm this.
- A shift share analysis revealed that the hydraulic fracturing industry in the study region is growing slightly faster than expected, and the growth rate for the region (12%) is higher than the national growth rate (4%).
- The following cluster map is useful for understanding the components of a fully developed oil and gas cluster.



- There are implications for industry attraction including:
  - Support Activities for Oil and Gas Operations (213112) had positive growth for the study region (26%) but far less than the comparative regions (141%, 262%) so this is a potential area for development. This sector is strong in parts of Louisiana so these companies could be recruited to the study area.
  - Economic developers and decision makers should consider attracting service companies, including drilling, mud logging, and trucking.
  - Oil and Gas Pipeline Structures (23712) has a high regional LQ and low job growth so demand appears to need time to catch up with supply for this sector.

    - Chemical manufacturing, especially for products in which natural gas is a feedstock, could be attracted to the region. The top five include 1) phosphate fertilizer manufacturing, 2) polish and other sanitation good manufacturing, 3) all other miscellaneous chemical product and preparation manufacturing, 4) plastics bottle manufacturing, 5) and all other rubber product manufacturing.
- Economic developers should meet regularly with local community college and WIN job center leaders to develop a rapport and become familiar with the details of relevant programs. Learning about the strengths and weaknesses of each program will help better match companies with workforce training. This will allow the Southwest Mississippi Partnership to:
    - Match graduates with hiring companies
    - Develop customized training as an incentive for attraction efforts
    - Assist community colleges with improving their programming
- Economic developers should conduct existing industry surveys annually with local oil and gas companies. While this study failed to garner the interest of local companies, practitioners must create open communication between themselves and their businesses. This will allow the Southwest Mississippi Partnership to:
    - Educate company leaders on incentives available to them
    - Learn about current issues and problems with the local industry
    - Foster an environment of collaboration in their business community
- Economic developers should begin a strategic marketing campaign for the oil and gas industry in Southwest Mississippi. This campaign should include:
    - Consistent branding
    - Trade show attendance and sponsorship
    - Advertisements in industry publications
    - Literature outlining local assets to relocating or expanding companies
- Economic developers should create a periodic meeting between business leaders and elected officials. This will allow the Southwest Mississippi Partnership to:
    - Engage their companies in the community
    - Voice local concerns to policy makers
    - Establish further credibility with both business leaders and elected officials
- Workforce Development;
    - Due to the potential growth in oil and gas production envisaged around the study area and because there is a need for adequate supply of skilled labor in areas such as transportation, training of work force in trucking and pipeline transportation systems makes sense. This can be done by organizing formal training by collaborating with tertiary institutions and organizations in the area.
    - Hydraulic fracturing led to lots of employment growth. By the second half of 2012 the industry has slowed down some in other regions (due to the historically low price of natural gas and not due to any government environmental

regulations). In Texas, they are now seeing some contraction (layoffs) in the natural gas fracking industry. Labor market data is always backward looking so that needs to be considered in this analysis.

- There needs to be programs to train and attract locals to the oil and gas industry. In Texas, the workers are a mix of out-of-state workers with limited experience who move in looking for a job and local workers who get limited OSHA safety training and other training at their local community college – and the worker turnover rates for both groups are especially high.

- Collaborative Research and Leveraging Regional University Research;
  - There is a need for collaborative research in the region's oil and gas, chemical and advance materials and polymer clusters, together with the TMS. This research should bring together institutions of higher learning and relevant organizations to seek and find out best ways of improving the economic viability of the regions resources.
  - Examples of University Research that could be leveraged.
    - The National Center for Intermodal Transportation for Economic Competitiveness (NCITEC) is sponsoring a project 'Effective Utilization of Innovation Techniques within Mississippi's Intermodal Professional Workforce' that entails summits, which focus on enhancing the professional workforce within Mississippi's transportation industry. The Mississippi State University, University of Southern Mississippi, and Innovate Mississippi Inc. could hold a summit specifically for the transportation issues of the Tuscaloosa Marine Shale (TMS) and the oil and gas cluster of the region can be held to proffer answers to the transportation challenges of region.
    - The National Center for Freight and Infrastructure Research and Education (CFIRE) is planning to model the impact of the increased use of hydraulic fracturing (fracking) in domestic energy production on freight transportation (highway, rail, marine, pipeline) distribution patterns.
- Regulatory Environment;
  - The industry concerned in this study deals principally with hazardous or toxic products, or products that could degrade the environment. A critical look at the transportation means and their effects on the environment is required. There is a need for an effective regulatory environment of the cluster and the TMS. Regulations to minimize spillage by transport modes and incentives for eco-friendly transportation could be effective in improving environmental safety in relation to transportation.
- Transportation Infrastructure Development;

    - There is a need to devise optional sources of funds for road improvement at the TMS. Instruments as road tolls for the excessive truck traffic and public private partnerships for infrastructural development could be viable options.
- Tie incentives on severance tax to state resident employment for a two to five year period.
- Incentivize companies that would support or benefit from the oil and gas industry.
- Institute a 1% impact fee for transportation, water and sewer purposes (applicable after capital investment is recovered).
- Localities should consider instituting an impact fee for local resources that are accessed
- Require disclosure of chemical and fluids used in the extraction process.
- Track Federal legislation that would benefit or negate the industry and build on those proposals.

Introduction

This project, while having multifaceted research and reporting requirements, is principally aimed at providing policy makers, economic developers, scholars and other stakeholders with up-to-date information about the petroleum extraction and petrochemical industries located in the study region. The research team will use cluster methodology to provide information for economic developers and other stakeholders. Gaps identified in the potential cluster aid in determining industrial recruitment strategies and internal decision making in the region.

"The concept of industry clusters is not just a method to analyze the economy but also a way to organize and conduct policies and programs that involve certain principles for cluster-based economic development" (Mayer, 2005, p. 40). Cluster-based economic development is built on the theory that as firms or industries locate in the same geographical area and undertake certain common activities in alignment with one another, output generated from the region leads to increasing return to scale (Hill & Brennan, 2000). Michael Porter (1998) defined a cluster as the interdependence among a group of companies and associated institutions created as a result of geographical proximity.

Historical Background of the Region's Clusters
James Dickens

Research has shown that clusters have an historical path dependency. To understand where a cluster is going, economic developers need to understand the trends of the past (Miller, Richard, & Arora, 2011). History matters for cluster development because over time patterns of knowledge specialization evolve. The outcome of the economic development process depends on its past history, on the entire sequence of decisions made by agents and resulting outcomes, and not just on contemporary conditions. The economy in the geographic region included in this study has a rich historical past driven by abundant natural resources, the Mississippi river's transportation advantages, and low government regulation. These are the historical characteristics of the region in which economic developers and key decision makers need to build upon or attempt to redirect.

Key Points of this section:

- Timber, agriculture, and shipping ushered the region into the Twentieth Century.
- Federal funding directed at increasing processing capabilities along the lower Mississippi supplemented rapid economic growth in oil and gas.
- The region has the required building blocks of petrochemicals to include: salt, water, oil, and natural gas.
- The Mississippi River's rapid discharge rate allowed industries to be less concerned with regulations following the Federal Water Quality Act.
- Louisiana's focus on its infrastructure allowed the region to connect with rural areas and more easily transport goods.

The Mississippi River has long been a key asset of both Louisiana and Mississippi's economic ventures. By the 1820s, the lower stretch of the Mississippi River region had established itself as the southern commercial center (Reed, 1963). Driving the agricultural success was climate and soil well suited for growth of cotton, sugar, and rice along the Mississippi banks. The growth of the agricultural industry and the well-located port ballooned New Orleans' population into the fourth largest city in the nation, and it even competed with New York for the leading exporter title by 1840 (Reed, 1963). Growth brought to the region through shipping, timber, and agriculture continued to drive the region's economy into the twentieth century, but the introduction of oil and gas extraction set the region on a path of accelerated economic growth.

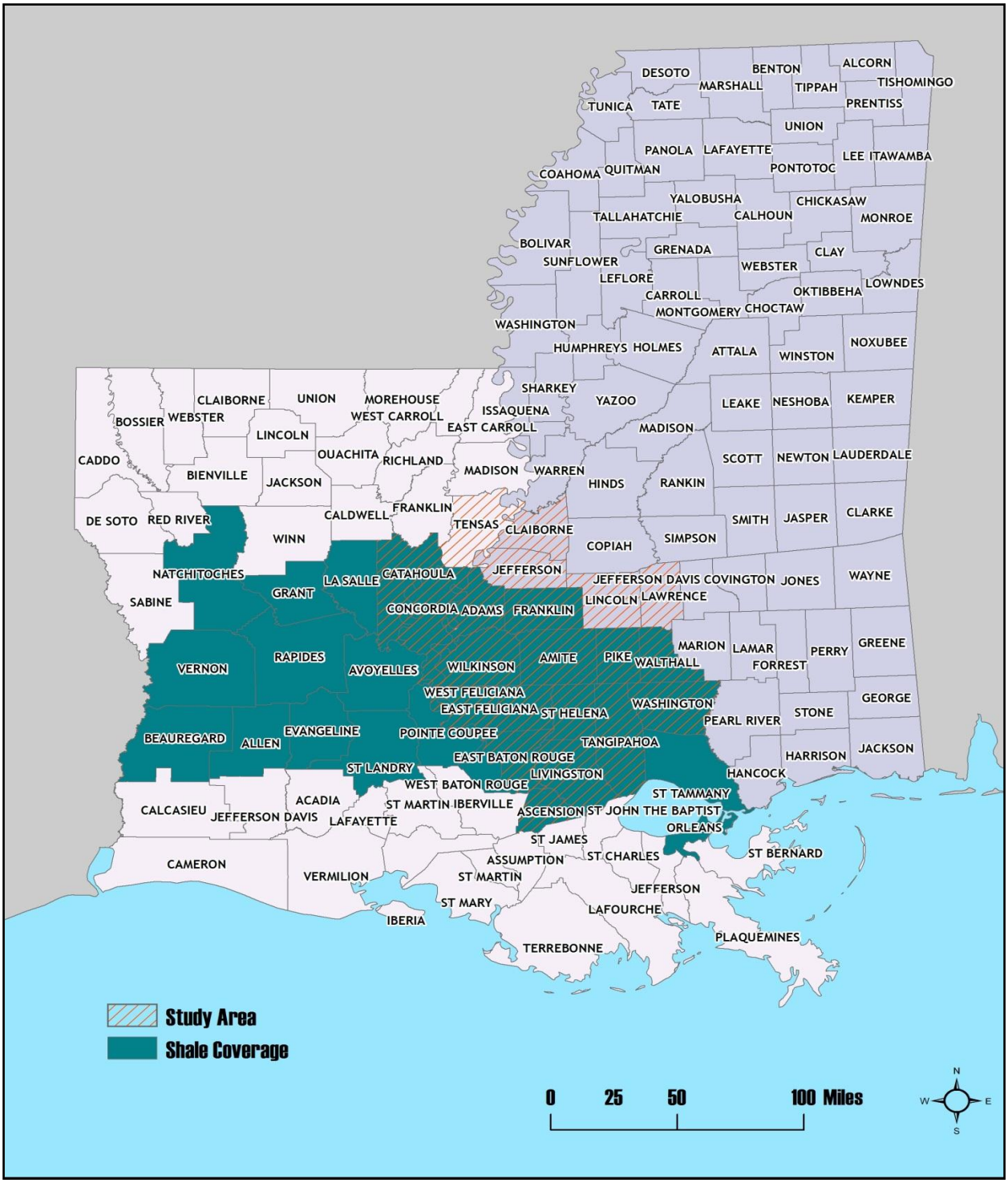
Oil and gas extraction arrived in Louisiana in the early 1900s in the form of production and refineries (Allen, 2006; Colten, 2012; Ko & Day, 2004). The implementation of oil and gas into the region had a large economic impact. In fact, only Alaska has historically produced more than Louisiana (Ko & Day, 2004). The region's petroleum infrastructure helped it survive the Great Depression better than other areas and sectors of the national economy. Following the economic woes of the 1930s, the petrochemical industry grew rapidly during World War II in large part due to federal funding aimed at increasing the "… processing capacity along the lower Mississippi" (Colten, 2012). The infrastructure buildup from the 1940 - 1970s placed the region in a unique position to take advantage of later oil and gas discoveries and new technologies needed to harvest them.

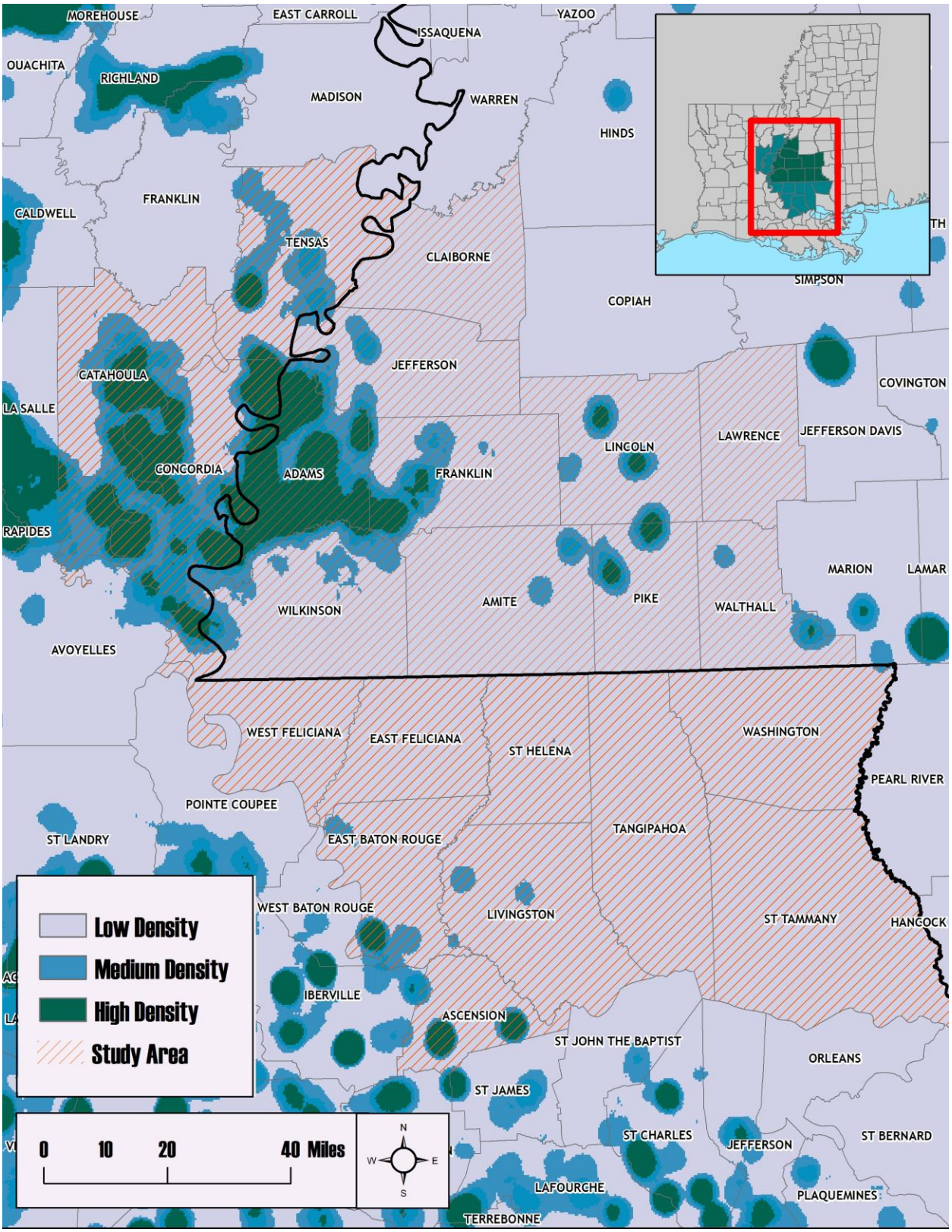
Through the 1960s, the development of the Louisiana chemical cluster and its rapid growth was attributed to a robust collection of natural resources, a "no politics" approach by local government, the development of transportation infrastructure, and the federal government's

investments in the region (Allen, 2003). Petrochemical production required salt, water, oil, and natural gas, all of which were found in the region. Another major advantage that the Louisiana cluster possessed was the Mississippi River and its rapid discharge rate that made pollution less of a concern after the 1966 Federal Water Quality Act. The high volume of water discharged allowed companies to locate to the area with less fear of future regulations.

Hydraulic fracturing, commonly referred to as fracking, and horizontal drilling improvements and innovations have propelled the United States towards more energy independence by releasing more domestic energy potential. In a mere decade, the nation has gone from importing natural gas to posturing itself to export. This economic transformation can be seen in places like North Dakota and promises to transform the global market place. The Tuscaloosa Marine Shale stretches across the Louisiana parishes of Ascension, Catahoula, Concordia, East Baton Rouge, East Feliciana, Livingston, St. Helena, Tangipahoa, Tensas, Washington, and West Feliciana. It also encompasses the counties in Mississippi of Adams, Amite, Claiborne, Franklin, Jefferson, Lawrence, Lincoln, Pike, Walthall, and Wilkinson (see Figure 1).

Figure 1. Shale Coverage and Oil/Gas Well Density in Study Region

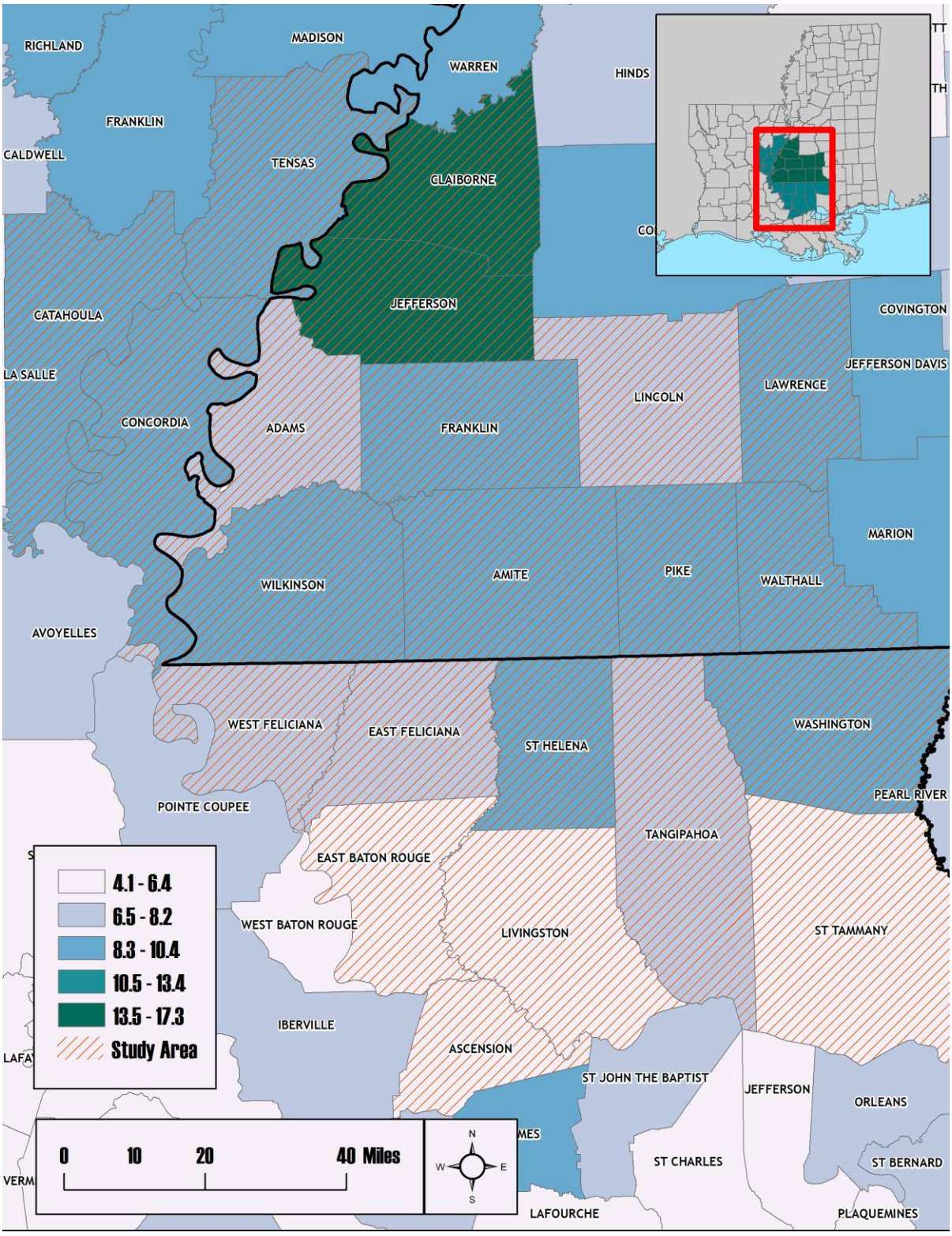



MOREHOUSE
EAST CARROLL
YAZOO
ISSAQUENA
OUACHITA
RICHLAND
MADISON
WARREN
HINDS
FRANKLIN
CALDWELL
TENSAS
CLAIBORNE
SIMPSON
COPIAH
JEFFERSON
CATAHOULA
COVINGTON
LA SALLE
LAWRENCE
JEFFERSON DAVIS
LINCOLN
CONCORDIA
ADAMS
FRANKLIN
RAPIDES
MARION
LAMAR
WILKINSON
AMITE
PIKE
WALTHALL
AVOYELLES
WEST FELICIANA
EAST FELICIANA
ST HELENA
WASHINGTON
PEARL RIVER
POINTE COUPEE
ST LANDRY
EAST BATON ROUGE
TANGIPAHOA
WEST BATON ROUGE
LIVINGSTON
ST TAMMANY
HANCOCK
IBERVILLE
ASCENSION
ST JOHN THE BAPTIST
ORLEANS
ST JAMES
ST CHARLES
JEFFERSON
ST BERNARD
LAFOURCHE
PLAQUEMINES
TERREBONNE
Low Density
Medium Density
High Density
Study Area
0
10
20
40 Miles
N
W
E
S

The Tuscaloosa Marine Shale deposit and its estimated seven billion barrels of oil (John , Jones, Moncrief, Bourgeois, & Harder, n.d.) is welcome news from the perspective of job creation and energy independence in the study region. According to the Department of Energy, natural gas production is steadily rising and seems poised to dethrone coal, "… as the leading domestic fossil fuel" (Marsa, 2011). Despite environmental concerns with fracking, natural gas releases only around half the carbon dioxide as coal and is seen by many as the bridge to a more environmentally friendly and renewable energy future (Marsa, 2011).

Oil and gas extraction along with chemicals/polymers is a possible route for the region to overcome its economic problems. The area has higher than average unemployment levels (See Figure 2) and needs an economic strategy that is suitable for its workforce. With proper community leadership and careful planning, the region appears to be poised to build on its assets and follow a path to equitable and sustainable development.

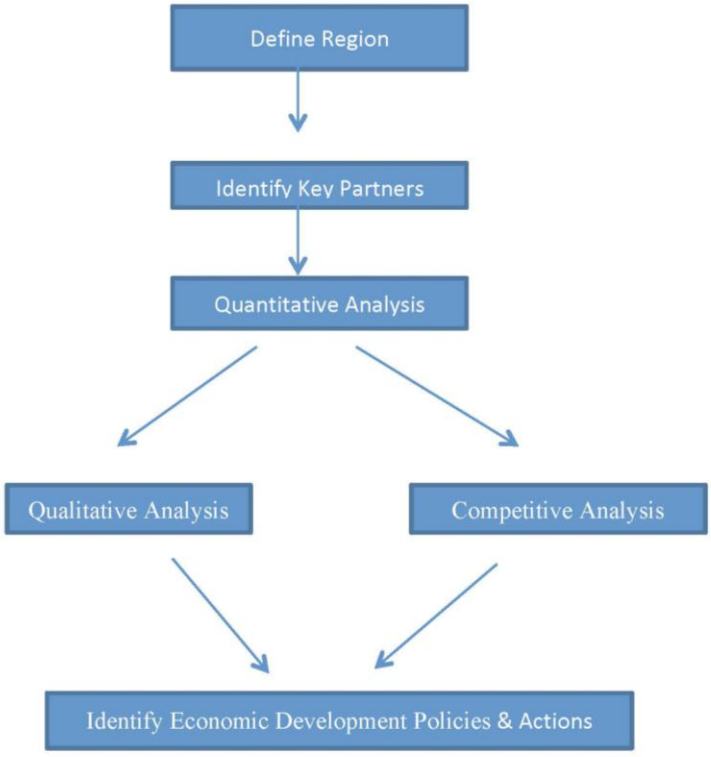
Figure 2. County Unemployment Rates as of April 2013



Methodology
Daniel Assamah

Industry cluster analysis serves as a tool in developing economic development plans and strategies providing relevant information about a regions' economic strength. The methodology employed by Mayer (2005) was used in this study. Figure 3 shows the research plan used in the southwest Mississippi cluster identification and analysis.

Figure 3. Mayer's Methodological Framework for Analyzing Industry Clusters

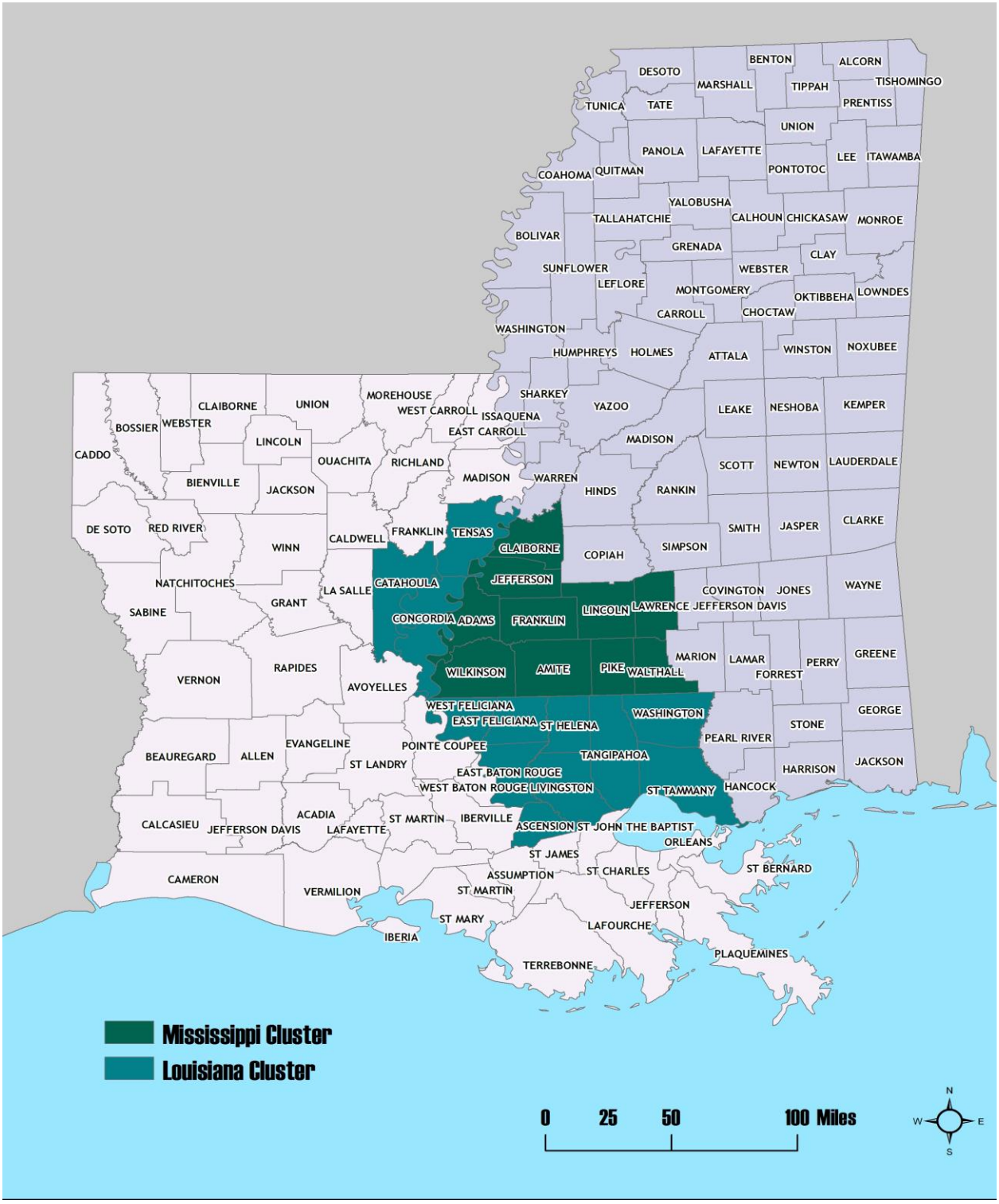


The methodology framework identifies data sources, identifies candidate clusters, differentiates types of clusters, and suggests economic development strategies.

The first step in the framework is to define the region. Figure 4 provides a geographic representation of the defined region of which the Southwest Mississippi Partnership included

these counties in Mississippi: Adams, Amite, Claiborne, Franklin, Jefferson, Lawrence, Lincoln, Pike, Walthall and Wilkinson. The following parishes were included in the region: Catahoula, Concordia, East Baton Rouge, East Feliciana, St. Helena, Tangipahoa, Tensas, Washington, West Baton Rouge, West Feliciana, Ascension, Livingston and St. Tammany.

Figure 4. The Study Region



The second step of the framework is to identify key partners such as trade associations, professional networks, educational institutions, and venture capitalist to facilitate the process of gathering key information needed to determine if a cluster exists. Some companies and associations contacted for this cluster analysis include Southwest Mississippi Partnership, U.S. Oil and Gas Association, Mississippi Development Authority, and Louisiana Oil and Gas Association.

After identifying key partners, the next step is to identify candidate clusters through quantitative analysis. Candidate clusters consist of industry sectors that have competitive advantages based on wages, employment and industry growth rates. Mayer (2005) outlined three criteria for cluster identification and analysis. For an industry to be a candidate cluster, it must meet the criteria below.

1. Location quotient must be greater than 1.25.
2. Average wage should be above 10 percent of national wage.
3. The industry's growth rate in the region should be higher than the national growth rate.

These criteria were used in the Southwest Mississippi Partnership cluster identification. The data analysis section of this report gives more detailed results and analysis of these measures. This step revealed the important industries that fall into four categories of classification: industries that require attention; important growth industries; industries of little promise; and lastly potential emerging industries.

The quantitative analysis step is limited to describing the industries at the broad North American Industrial Classification System (NAICS) level. The next step in the framework model defines the need for a qualitative analysis in which researchers collect primary data through interviews or surveys with industry representatives. The qualitative analysis step allows

researchers to differentiate among existing clusters, emerging clusters, and target industries. This stage provides a more in-depth understanding about individual firms and their interdependence within a given industry.

The Mayer's Cluster Framework next defines the competitive analysis stage where the researchers compare the study region to other similar regions. Mayer (2005) identifies different variables that can be used for the comparison:

- Gain in employment (shift share analysis)
- Knowledge creation as evidenced by patents
- Major firms and their products
- Venture capital investment
- New firms started
- Entrepreneurial activity
- Federal funding for science and technology
- Data analysis on talent.

For the purpose of this study, researchers focused only on the shift share methodology to analyze the growth rate between the local economy (study region) and the national economy. Details of the shift share methodology are provided in the overall quantitative section. Ideally cluster analysis helps to:

1. Understand the economy
2. Build better relationships among firms
3. Identify the strength of a local economy
4. Understand the economic geography by varying industry

5. Attract required labor into the economy
6. Promote a healthy relationship between the private sector and the public sector, which fosters good leadership.

Through cluster analysis, decision makers learn from gaps and missing links among firms to determine policies and actions that can be adopted to address such deficiencies.

Quantitative Analysis of Regional Clusters
Daniel Assamah

The cluster identification is based on the three-digit North American Industrial Classification System (NAICS). Employment data for all the industries in the region was extracted from Economic Modeling Specialist International (EMSI analyst) software system. After extracting employment data for the region, the quantitative analysis was conducted to get a broad stroke determination of the major types of industries that exist within the region based on location quotient, average wages, and industry growth rate.

Key Points of this section:

- At the three digit level, nationally competitive clusters where identified in utilities, construction of building, heavy and civil engineering, specialty trade contractors, wood products, petroleum and coal products, building materials and garden equipment and supplies, general merchandise, and water, as well as, pipeline transportation.
- Clustering was identified in the following industries: paper manufacturing, warehousing and storage, waste management and remediation services, and state government, which have high location quotient but their growth rate is lower than that of the nation.
- A more detailed analysis of the industries (at the six digit level) showed that crude petroleum and natural gas extraction industry, natural gas liquid industry, all other basic organic chemical manufacturing industry are also nationally competitive.

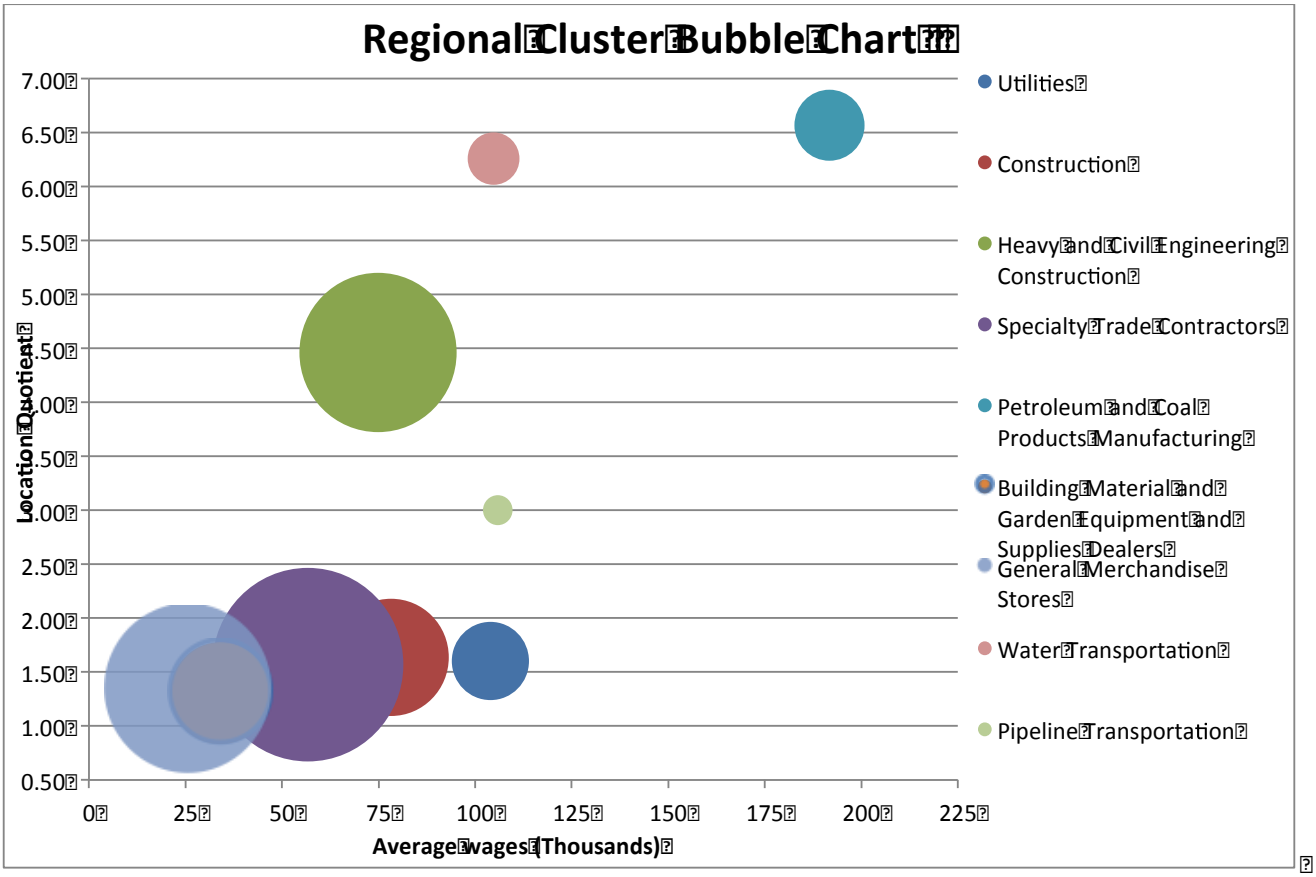
The quantitative analysis indicated that the following industries might be clusters: utilities, construction of building, heavy and civil engineering, specialty trade contractors, wood product, petroleum and coal products, building material and garden equipment and supplies, general merchandise, water transportation, and pipeline transportation.

Within the study region other industries did not indicate a cluster because they have low growth rates compared to the nation. These industries have location quotients greater than 1.25 but less than 3.0. These industries are paper manufacturing, warehousing and storage, waste management and remediation services, and state government. They appear to not be good target industries for cluster development.

The following industries have average wages over ten percent of the national wages but are not highly concentrated in the region. These are furniture and related product, miscellaneous manufacturing, wholesale electronic markets and brokers, broadcasting, data processing, hosting and related services, monetary authorities, securities, commodity contracts and other financial, insurance carriers and related activities, funds, trusts and other financial vehicles, and lastly real estate. These industries were not included because either their location quotient is less than 1.25 or their growth rate is lower than that of the national rate.

Figure 5 is a bubble chart pictorially revealing the most competitive industrial clusters found in the study region. The x-axis represents the average wages whereas the y-axis represents the location quotient. The size of the bubble is a representation of the number of employees in that industry. Using the criteria outlined in the methodology section, petroleum and coal products is an existing cluster because it has high average wages and high location quotient. Other clustering industries include water transportation, pipeline transportation and utilities. The construction industry for instance, though its average wage is encouraging, has a low location quotient.

Figure 5. Competitive Clusters in the Study Region



The quantitative analysis of the regional industries gives more details to the various clusters in the study region, and the full numbers for this analysis can be found in Table 1.

Table 1. Three Digit Level Employment Analysis (EMSI 2013)

NAICS Code	Industrial Change	Growth Rate of Industries in Southwest Region	Growth Rate of Industries National	2012 Earnings ($)	2012 State Earnings ($)	2012 National Earnings ($)	% Difference between SWMP and State	% Difference between SWMP and Nation
324	-0.08	0.02	-0.01	191,745	193,845	195,323	-1.08%	-1.83%
483	0.20	0.15	0.02	104,798	100,680	103,753	4.09%	1.01%
237	-0.14	0.00	-0.02	74,881	68,016	75,441	10.09%	-0.74%
113	-0.28	-0.05	-0.04	45,133	47,680	50,298	-5.34%	-10.27%
486	-0.04	0.10	0.00	105,867	105,185	147,749	0.65%	-28.35%
902	0.02	0.00	0.00	63,209	60,643	67,840	4.23%	-6.83%
325	-0.18	-0.04	-0.02	144,849	115,306	114,681	25.62%	26.31%
562	0.15	0.05	0.02	55,836	53,967	64,569	3.46%	-13.53%
321	-0.41	-0.05	-0.06	45,284	49,188	48,341	-7.94%	-6.32%
236	-0.23	-0.02	-0.03	78,274	62,579	68,047	25.08%	15.03%
213	0.81	0.07	0.07	80,868	88,016	93,615	-8.12%	-13.62%
221	-0.08	0.00	-0.01	103,987	98,723	129,481	5.33%	-19.69%
447	-0.10	-0.02	-0.01	22,424	21,631	22,906	3.67%	-2.10%
238	-0.19	0.02	-0.02	56,740	53,301	58,851	6.45%	-3.59%
322	-0.33	-0.06	-0.04	99,583	82,915	77,208	20.10%	28.98%
488	0.06	0.00	0.01	60,511	72,219	60,789	-16.21%	-0.46%
493	0.27	0.01	0.03	46,184	50,467	52,251	-8.49%	-11.61%
452	0.10	0.02	0.01	25,644	25,182	27,026	1.83%	-5.11%
444	0.01	0.02	0.00	34,035	35,991	37,213	-5.43%	-8.54%
532	-0.25	-0.02	-0.03	56,129	63,154	53,655	-11.12%	4.61%
624	0.36	0.07	0.03	20,700	21,396	28,354	-3.25%	-26.99%
811	-0.07	0.00	-0.01	47,925	45,132	44,840	6.19%	6.88%
441	-0.09	0.01	-0.01	47,829	47,023	51,530	1.71%	-7.18%
451	-0.11	0.04	-0.01	22,176	21,971	24,484	0.93%	-9.43%
903	0.05	0.01	0.01	49,867	47,617	59,515	4.73%	-16.21%
722	0.16	0.03	0.02	15,739	16,743	18,673	-6.00%	-15.71%
621	0.38	0.05	0.04	60,104	60,891	67,856	-1.29%	-11.42%
446	0.05	0.02	0.01	37,273	40,566	42,500	-8.12%	-12.30%
515	-0.16	-0.01	-0.02	70,263	54,204	91,864	29.63%	-23.51%
453	-0.21	-0.02	-0.03	29,369	29,126	29,069	0.83%	1.03%
713	0.08	0.00	0.01	22,706	23,964	23,920	-5.25%	-5.08%
312	-0.11	0.02	-0.01	69,260	59,413	78,980	16.57%	-12.31%
442	-0.19	-0.01	-0.02	34,709	34,012	37,163	2.05%	-6.60%
448	0.02	0.00	0.00	18,981	19,553	23,870	-2.93%	-20.48%
812	0.03	-0.01	0.00	24,454	25,789	27,809	-5.18%	-12.06%
423	-0.11	0.00	-0.01	68,720	63,134	77,809	8.85%	-11.68%
524	-0.03	0.04	0.00	81,151	72,687	89,507	11.64%	-9.34%
445	-0.04	-0.01	0.00	24,785	24,400	27,835	1.58%	-10.96%
522	-0.02	0.00	0.00	56,916	53,327	78,436	6.73%	-27.44%
443	-0.09	0.05	-0.01	36,416	37,379	50,357	-2.58%	-27.68%
551	0.12	-0.01	0.01	83,899	84,121	124,327	-0.26%	-32.52%
424	-0.04	-0.01	0.00	56,781	58,703	70,201	-3.27%	-19.12%
622	0.17	0.05	0.02	52,792	56,625	67,530	-6.77%	-21.82%
533	-0.18	0.11	-0.02	76,621	73,370	101,458	4.43%	-24.48%
327	-0.33	-0.01	-0.04	56,207	57,676	64,173	-2.55%	-12.41%
517	-0.39	-0.02	-0.05	70,497	67,392	96,441	4.61%	-26.90%
484	-0.06	-0.03	-0.01	56,566	53,787	56,267	5.17%	0.53%

332	-0.20	-0.03	-0.02	63,654	64,237	63,541	-0.91%	0.18%
541	0.12	0.03	0.01	73,368	70,573	95,004	3.96%	-22.77%
623	0.19	0.00	0.02	29,089	28,856	33,877	0.81%	-14.13%
425	0.39	0.00	0.04	93,276	81,885	99,816	13.91%	-6.55%
999	-0.32	0.37	-0.04	32,798	43,775	62,191	-25.08%	-47.26%
518	-0.22	0.03	-0.03	78,927	66,069	104,050	19.46%	-24.15%
487	-0.11	0.19	-0.01	43,840	37,981	36,017	15.43%	21.72%
561	-0.01	0.01	0.00	36,349	33,843	40,141	7.40%	-9.45%
531	0.03	0.02	0.00	39,092	38,026	55,616	2.80%	-29.71%
311	-0.06	-0.03	-0.01	34,766	38,973	51,932	-10.79%	-33.05%
813	0.03	0.01	0.00	38,929	38,982	43,597	-0.14%	-10.71%
485	0.16	0.09	0.02	21,363	28,720	32,265	-25.62%	-33.79%
611	0.35	0.06	0.03	33,968	46,095	52,884	-26.31%	-35.77%
721	-0.02	0.00	0.00	20,220	30,093	31,661	-32.81%	-36.14%
492	-0.13	-0.01	-0.01	51,525	50,963	56,717	1.10%	-9.15%
211	0.38	-0.01	0.04	188,030	138,651	179,928	35.61%	4.50%
331	-0.32	-0.04	-0.04	82,421	78,283	79,782	5.29%	3.31%
336	-0.28	0.05	-0.04	63,409	72,933	88,738	-13.06%	-28.54%
112	0.14	-0.02	0.01	38,135	36,858	36,630	3.46%	4.11%
212	-0.03	-0.02	0.00	52,929	73,233	86,738	-27.73%	-38.98%
339	-0.19	0.00	-0.02	64,875	54,921	80,988	18.12%	-19.90%
323	-0.39	-0.01	-0.05	49,085	43,783	54,932	12.11%	-10.64%
712	0.14	0.03	0.02	20,508	30,468	37,047	-32.69%	-44.64%
511	-0.27	-0.02	-0.03	55,553	49,234	104,300	12.83%	-46.74%
512	-0.01	0.04	0.00	19,209	49,058	80,010	-60.84%	-75.99%
315	-0.64	-0.18	-0.11	37,556	35,626	46,183	5.42%	-18.68%
314	-0.45	-0.02	-0.06	33,875	35,285	45,124	-4.00%	-24.93%
901	0.04	0.00	0.00	89,317	96,081	108,354	-7.04%	-17.57%
326	-0.29	-0.05	-0.04	52,862	58,354	59,938	-9.41%	-11.81%
454	-0.10	-0.06	-0.01	43,274	42,087	58,595	2.82%	-26.15%
333	-0.23	-0.04	-0.03	68,694	67,202	79,760	2.22%	-13.87%
523	-0.02	-0.01	0.00	141,224	126,104	222,963	11.99%	-36.66%
115	0.06	-0.06	0.01	42,216	44,349	32,990	-4.81%	27.97%
491	1.28	0.00	0.10	24,565	28,936	37,560	-15.11%	-34.60%
525	0.03	0.07	0.00	126,314	99,556	206,466	26.88%	-38.82%
111	-0.06	-0.09	-0.01	33,023	30,631	31,537	7.81%	4.71%
711	0.06	-0.06	0.01	30,106	80,844	90,704	-62.76%	-66.81%
337	-0.46	-0.04	-0.07	43,636	38,217	48,565	14.18%	-10.15%
814	0.48	-0.06	0.04	25,509	23,142	17,641	10.23%	44.60%
313	-0.64	-0.03	-0.11	48,629	53,090	48,825	-8.40%	-0.40%
114	-0.26	-0.07	-0.03	23,130	35,525	88,114	-34.89%	-73.75%
481	-0.26	0.03	-0.03	81,094	77,276	83,540	4.94%	-2.93%
334	-0.37	0.01	-0.05	66,972	65,220	120,054	2.69%	-44.22%
519	0.46	-0.08	0.04	51,942	56,615	129,333	-8.25%	-59.84%
335	-0.34	0.02	-0.04	66,973	65,566	84,470	2.15%	-20.71%
521	-0.19		-0.02	117,270	71,591	114,441	63.81%	2.47%
316	-0.51	0.00	-0.08	52,978	48,046	47,492	10.27%	11.55%
482	1.12		0.09	-	-	61,316		-100.00%

NAICS Code	Industrial Change	Growth Rate of Industries in Southwest Region	Growth Rate of Industries National	2012 Earnings ($)	2012 State Earnings ($)	2012 National Earnings ($)	% Difference between SWMP and State	% Difference between SWMP and Nation
324	-0.08	0.02	-0.01	191,745	193,845	195,323	-1.08%	-1.83%
483	0.20	0.15	0.02	104,798	100,680	103,753	4.09%	1.01%
237	-0.14	0.00	-0.02	74,881	68,016	75,441	10.09%	-0.74%
113	-0.28	-0.05	-0.04	45,133	47,680	50,298	-5.34%	-10.27%
486	-0.04	0.10	0.00	105,867	105,185	147,749	0.65%	-28.35%
902	0.02	0.00	0.00	63,209	60,643	67,840	4.23%	-6.83%
325	-0.18	-0.04	-0.02	144,849	115,306	114,681	25.62%	26.31%
562	0.15	0.05	0.02	55,836	53,967	64,569	3.46%	-13.53%
321	-0.41	-0.05	-0.06	45,284	49,188	48,341	-7.94%	-6.32%
236	-0.23	-0.02	-0.03	78,274	62,579	68,047	25.08%	15.03%
213	0.81	0.07	0.07	80,868	88,016	93,615	-8.12%	-13.62%
221	-0.08	0.00	-0.01	103,987	98,723	129,481	5.33%	-19.69%
447	-0.10	-0.02	-0.01	22,424	21,631	22,906	3.67%	-2.10%
238	-0.19	0.02	-0.02	56,740	53,301	58,851	6.45%	-3.59%
322	-0.33	-0.06	-0.04	99,583	82,915	77,208	20.10%	28.98%
488	0.06	0.00	0.01	60,511	72,219	60,789	-16.21%	-0.46%
493	0.27	0.01	0.03	46,184	50,467	52,251	-8.49%	-11.61%
452	0.10	0.02	0.01	25,644	25,182	27,026	1.83%	-5.11%
444	0.01	0.02	0.00	34,035	35,991	37,213	-5.43%	-8.54%
532	-0.25	-0.02	-0.03	56,129	63,154	53,655	-11.12%	4.61%
624	0.36	0.07	0.03	20,700	21,396	28,354	-3.25%	-26.99%
811	-0.07	0.00	-0.01	47,925	45,132	44,840	6.19%	6.88%
441	-0.09	0.01	-0.01	47,829	47,023	51,530	1.71%	-7.18%
451	-0.11	0.04	-0.01	22,176	21,971	24,484	0.93%	-9.43%
903	0.05	0.01	0.01	49,867	47,617	59,515	4.73%	-16.21%
722	0.16	0.03	0.02	15,739	16,743	18,673	-6.00%	-15.71%
621	0.38	0.05	0.04	60,104	60,891	67,856	-1.29%	-11.42%
446	0.05	0.02	0.01	37,273	40,566	42,500	-8.12%	-12.30%
515	-0.16	-0.01	-0.02	70,263	54,204	91,864	29.63%	-23.51%
453	-0.21	-0.02	-0.03	29,369	29,126	29,069	0.83%	1.03%
713	0.08	0.00	0.01	22,706	23,964	23,920	-5.25%	-5.08%
312	-0.11	0.02	-0.01	69,260	59,413	78,980	16.57%	-12.31%
442	-0.19	-0.01	-0.02	34,709	34,012	37,163	2.05%	-6.60%
448	0.02	0.00	0.00	18,981	19,553	23,870	-2.93%	-20.48%
812	0.03	-0.01	0.00	24,454	25,789	27,809	-5.18%	-12.06%
423	-0.11	0.00	-0.01	68,720	63,134	77,809	8.85%	-11.68%
524	-0.03	0.04	0.00	81,151	72,687	89,507	11.64%	-9.34%
445	-0.04	-0.01	0.00	24,785	24,400	27,835	1.58%	-10.96%
522	-0.02	0.00	0.00	56,916	53,327	78,436	6.73%	-27.44%
443	-0.09	0.05	-0.01	36,416	37,379	50,357	-2.58%	-27.68%
551	0.12	-0.01	0.01	83,899	84,121	124,327	-0.26%	-32.52%
424	-0.04	-0.01	0.00	56,781	58,703	70,201	-3.27%	-19.12%
622	0.17	0.05	0.02	52,792	56,625	67,530	-6.77%	-21.82%
533	-0.18	0.11	-0.02	76,621	73,370	101,458	4.43%	-24.48%
327	-0.33	-0.01	-0.04	56,207	57,676	64,173	-2.55%	-12.41%
517	-0.39	-0.02	-0.05	70,497	67,392	96,441	4.61%	-26.90%
484	-0.06	-0.03	-0.01	56,566	53,787	56,267	5.17%	0.53%

332	-0.20	-0.03	-0.02	63,654	64,237	63,541	-0.91%	0.18%
541	0.12	0.03	0.01	73,368	70,573	95,004	3.96%	-22.77%
623	0.19	0.00	0.02	29,089	28,856	33,877	0.81%	-14.13%
425	0.39	0.00	0.04	93,276	81,885	99,816	13.91%	-6.55%
999	-0.32	0.37	-0.04	32,798	43,775	62,191	-25.08%	-47.26%
518	-0.22	0.03	-0.03	78,927	66,069	104,050	19.46%	-24.15%
487	-0.11	0.19	-0.01	43,840	37,981	36,017	15.43%	21.72%
561	-0.01	0.01	0.00	36,349	33,843	40,141	7.40%	-9.45%
531	0.03	0.02	0.00	39,092	38,026	55,616	2.80%	-29.71%
311	-0.06	-0.03	-0.01	34,766	38,973	51,932	-10.79%	-33.05%
813	0.03	0.01	0.00	38,929	38,982	43,597	-0.14%	-10.71%
485	0.16	0.09	0.02	21,363	28,720	32,265	-25.62%	-33.79%
611	0.35	0.06	0.03	33,968	46,095	52,884	-26.31%	-35.77%
721	-0.02	0.00	0.00	20,220	30,093	31,661	-32.81%	-36.14%
492	-0.13	-0.01	-0.01	51,525	50,963	56,717	1.10%	-9.15%
211	0.38	-0.01	0.04	188,030	138,651	179,928	35.61%	4.50%
331	-0.32	-0.04	-0.04	82,421	78,283	79,782	5.29%	3.31%
336	-0.28	0.05	-0.04	63,409	72,933	88,738	-13.06%	-28.54%
112	0.14	-0.02	0.01	38,135	36,858	36,630	3.46%	4.11%
212	-0.03	-0.02	0.00	52,929	73,233	86,738	-27.73%	-38.98%
339	-0.19	0.00	-0.02	64,875	54,921	80,988	18.12%	-19.90%
323	-0.39	-0.01	-0.05	49,085	43,783	54,932	12.11%	-10.64%
712	0.14	0.03	0.02	20,508	30,468	37,047	-32.69%	-44.64%
511	-0.27	-0.02	-0.03	55,553	49,234	104,300	12.83%	-46.74%
512	-0.01	0.04	0.00	19,209	49,058	80,010	-60.84%	-75.99%
315	-0.64	-0.18	-0.11	37,556	35,626	46,183	5.42%	-18.68%
314	-0.45	-0.02	-0.06	33,875	35,285	45,124	-4.00%	-24.93%
901	0.04	0.00	0.00	89,317	96,081	108,354	-7.04%	-17.57%
326	-0.29	-0.05	-0.04	52,862	58,354	59,938	-9.41%	-11.81%
454	-0.10	-0.06	-0.01	43,274	42,087	58,595	2.82%	-26.15%
333	-0.23	-0.04	-0.03	68,694	67,202	79,760	2.22%	-13.87%
523	-0.02	-0.01	0.00	141,224	126,104	222,963	11.99%	-36.66%
115	0.06	-0.06	0.01	42,216	44,349	32,990	-4.81%	27.97%
491	1.28	0.00	0.10	24,565	28,936	37,560	-15.11%	-34.60%
525	0.03	0.07	0.00	126,314	99,556	206,466	26.88%	-38.82%
111	-0.06	-0.09	-0.01	33,023	30,631	31,537	7.81%	4.71%
711	0.06	-0.06	0.01	30,106	80,844	90,704	-62.76%	-66.81%
337	-0.46	-0.04	-0.07	43,636	38,217	48,565	14.18%	-10.15%
814	0.48	-0.06	0.04	25,509	23,142	17,641	10.23%	44.60%
313	-0.64	-0.03	-0.11	48,629	53,090	48,825	-8.40%	-0.40%
114	-0.26	-0.07	-0.03	23,130	35,525	88,114	-34.89%	-73.75%
481	-0.26	0.03	-0.03	81,094	77,276	83,540	4.94%	-2.93%
334	-0.37	0.01	-0.05	66,972	65,220	120,054	2.69%	-44.22%
519	0.46	-0.08	0.04	51,942	56,615	129,333	-8.25%	-59.84%
335	-0.34	0.02	-0.04	66,973	65,566	84,470	2.15%	-20.71%
521	-0.19		-0.02	117,270	71,591	114,441	63.81%	2.47%
316	-0.51	0.00	-0.08	52,978	48,046	47,492	10.27%	11.55%
482	1.12		0.09	-	-	61,316		-100.00%

Cluster Mapping of Benchmark Industries Providing Support and Education for Oil and Gas Regions
Golda Sharpe

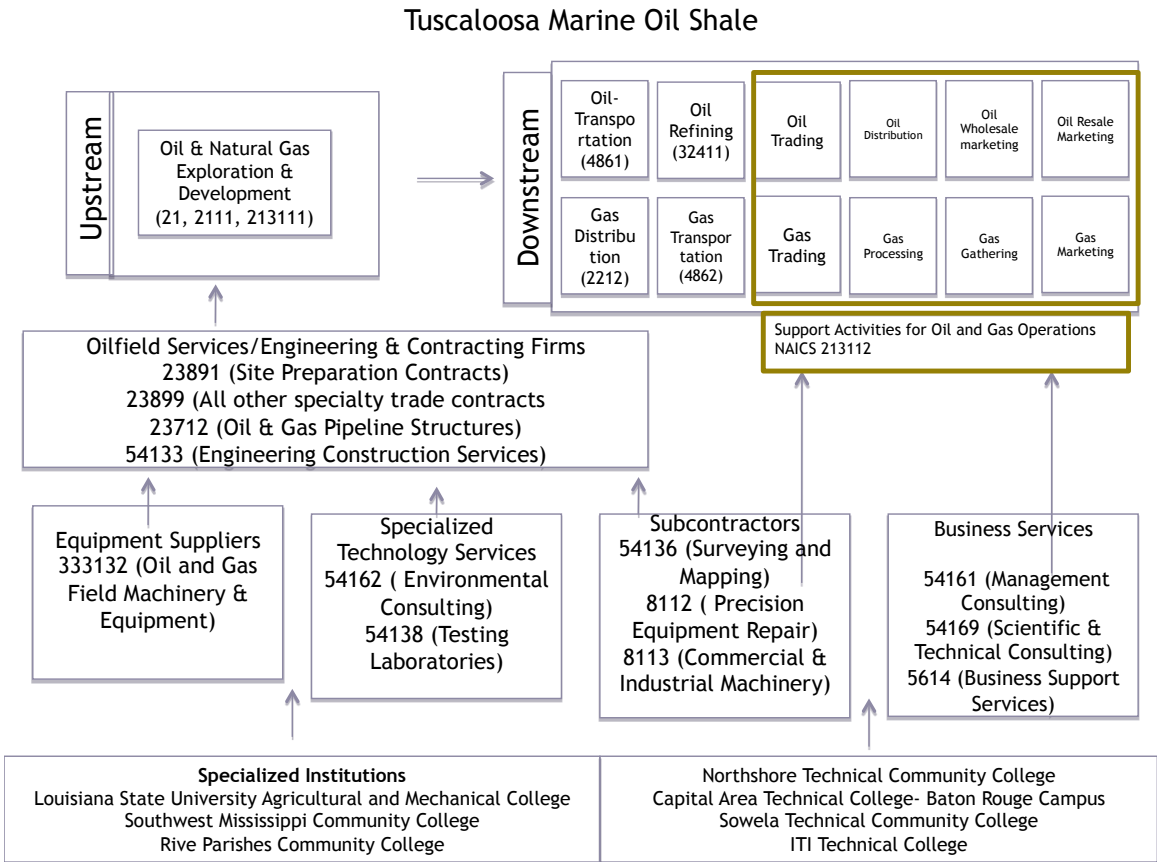
This section uses a cluster mapping approach and workforce characteristics to compare the target region's oil and gas linkages to more developed oil shale industry linkages. It compares and contrasts the south Texas Eagle Ford Shale play and the southwestern Arkansas Haynesville shale play. These two shale plays are then compared to the Tuscaloosa Marine shale area.

Key Points of this section:

- There is an abundant concentration of support and supply industries available in the Eagle Ford and Haynesville oil shale areas as well as the Tuscaloosa oil shale area. Although there have been decreases in certain sectors of the economy, the employment levels remain relatively consistent.
- Oil and Gas Field Machinery and Equipment (33132) had the highest percentage of growth in Tuscaloosa with 584% growth from 2001-2011.
- Scientific and Technical Consulting (54169) showed significant growth in Haynesville with 547% growth between 2001 and 2011 as compared to 202% growth in Tuscaloosa and 175% in Eagle Ford.
- Oil and Gas Pipeline Structures (23712) showed significant growth in Eagle Ford with 378% growth between 2001 and 2011 as compared to 256% growth in Haynesville. However, there was an 18% decline in the study region.
- On the whole, Support Activities for Oil and Gas Operations (213112) had positive growth for the study region (26%) but far less than the comparative regions (141%, 262%).

- There is an abundant supply of four-year institutions, community colleges, and technical schools in the target area. However, there is a need for partnering with institutions to train and development a stronger workforce in areas supporting oil shale development.
- Figure 6 shows the components of a fully developed oil and gas cluster for the study region.

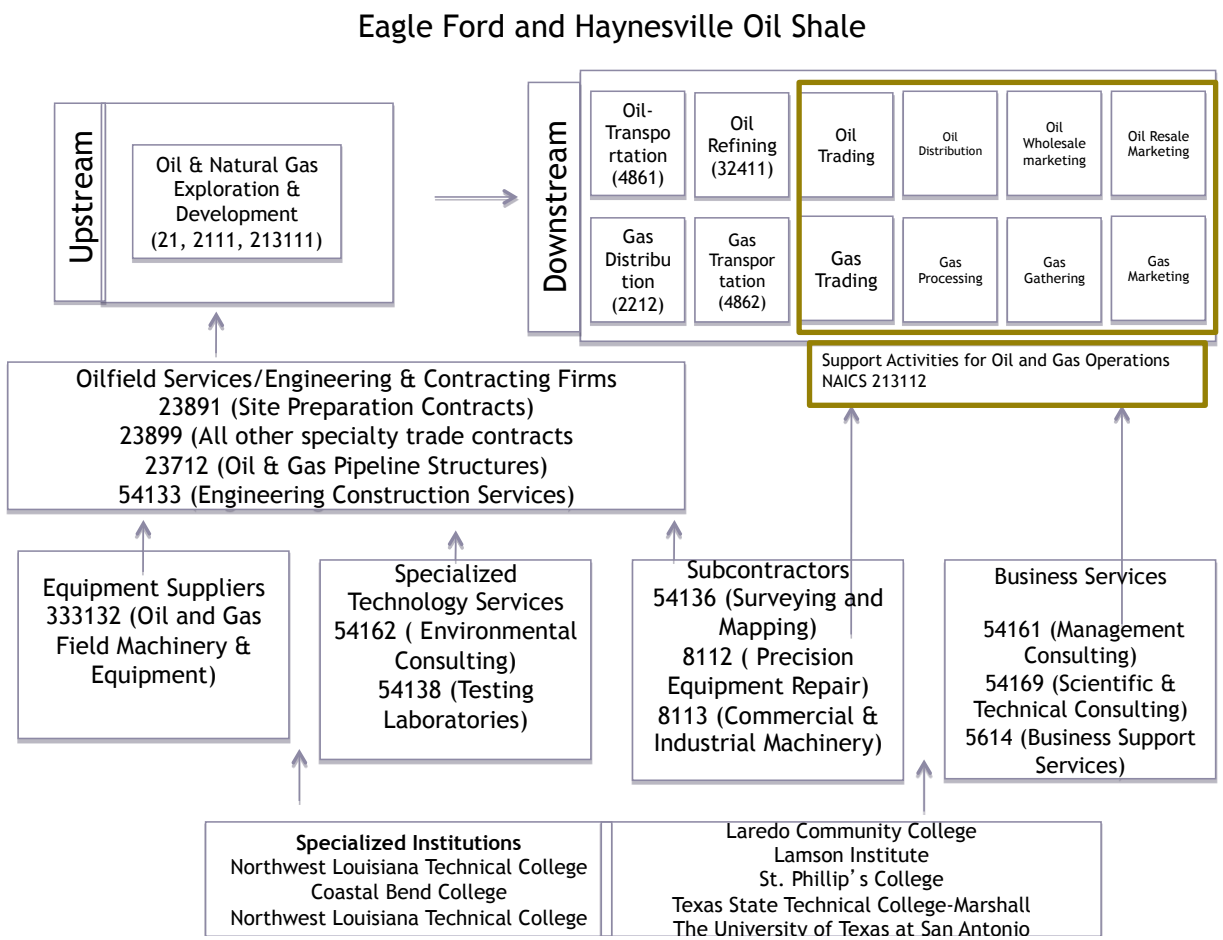
Figure 6. Developed Oil & Gas Cluster Map



Overall, there are numerous industries present in the target area to support the production process of the oil shale industry from exploration and development to distribution through related support industries. The economic landscape of related businesses and services

significantly contributes to the possibility of creating and sustaining the success of the Eagle Ford, Haynesville, and Tuscaloosa oil shale plays. The availability of natural resources and presence of supporting industries in the area enables goods to be produced and ultimately exported to other markets for sale. This section summarizes the supporting industries and educational pipelines available in the Eagle Ford, Haynesville, and Tuscaloosa oil shale plays. Additionally, the visual representation of the industries through cluster mapping illustrates the complete picture of related industries (see Figure 7) and their NAICS code and where an industry lies in the overall production of oil and gas.

Figure 7. Cluster Map of Developed Benchmark Oil Shale Clusters



The Eagle Ford and Haynesville have several specialized institutions to continue to train and supply a highly trained workforce into sectors associated with the oil shale industry. Post-secondary educational institutions in the study area consist of various community colleges, technical schools, and both public and private four-year institutions. Due to the amount of post-secondary education options, there is a constant workforce supply available to enter other intermediate sectors needed in the oil shale industry.

Currently, there are approximately 917 jobs in oil and gas field machinery (NAICS 333132) and equipment manufacturing. There are also several other specialized technology services present such as surveying (NAICS 541360) and contracting services (NAICS 54162). Economic Modeling Specialists Incorporated (EMSI) software analytical tool identified the 2011 employment data having approximately 5,000 oil and gas-related jobs in the Eagle Ford and Haynesville areas spread among 826 business establishments.

Additionally, the presence of subcontractors (NAICS 54136, 8112, 8113) also plays a vital role in supporting the oil shale industry. Subcontracting careers include surveying and mapping, precision equipment repair and maintenance, and industrial machinery and equipment repair. In the Eagle Ford and Haynesville areas there are 182 people employed specializing in surveying and mapping. There are also over 1,800 people employed in 320 establishments whose services include repair and maintenance of commercial and industrial equipment.

Table 2. Comparative Oil Shale Region Employment Growth Rates

			Local Industry Growth Rate		
Industry	**NAICS Code**	**National Industry GR**	**Eagle Ford**	**Tuscaloosa**	**Haynesville**
Site Preparation Contracts	23891	-10%	-17%	65%	61%
All other specialty trade contracts	23899	-10%	-10%	61%	37%
Oil and Gas Pipeline Structures	23712	40%	**378%**	-18%	256%
Engineering Construction Services	54133	9%	35%	43%	-13%
Oil and Gas Field Machinery and Equipment	333132	43%	-9%	**584%**	66%
Environmental Consulting	54162	32%	174%	101%	61%
Testing Laboratories	54138	8%	23%	18%	61%
Surveying and Mapping	54136	29%	113%	248%	78%
Precision Equipment and Repair	8112	-8%	10%	-3%	-22%
Commercial and Industrial Machinery	8113	15%	68%	54%	55%
Management Consulting	54161	34%	150%	27%	2%
Scientific and Technical Consulting	54169	284%	175%	202%	**547%**
Business Support Services	5614	5%	1%	-53%	277%
Support Activities for oil and gas operations	213112	96%	141%	26%	262%
Oil transportation	4861	15%	Unavailable	Unavailable	Unavailable
Gas Distribution	2212	-8%	-15%	-33%	57%
Oil Refining	32411	-5%	-22%	10%	-91%
Gas Transportation	4862	-14%	-16%	141%	239%

In the study region several industries had high ten-year growth rates. Oil and Gas Field Machinery and Equipment (331132) experienced a 584% growth rate from 2001 to 2011 (see Table 2). There are also about three hundred employees in thirteen firms in the study region. Environmental (101%) and Scientific and Technical Consulting (202%) both experienced positive growth and consist of 1,151 employees. Subcontractors are an important component of

the oil shale industry, and within this industry surveying and mapping had the greatest amount of growth at 248%. These industries are doing well so might not need extra targeting.

In the Tuscaloosa Marine shale region, business services sector employs 3,814 individuals with some parts of this sector experiencing growth. However, business support services in general (5614) shrank 53%, while nationally the sector grew 5% and Haynesville experienced 277% growth in business support services. Oilfield and engineering services sector employs approximately 16,000 individuals across 867 established firms. Continuing down the industry pipeline, the only sector that experienced negative growth was gas distribution. The region's drop in this sector was greater than the national rate. Support activities for oil and gas operations and gas transportation received the highest rates of growth, 26% and 141% respectively. Comparing the region's sectorial growth rates to the nation and comparative region areas will be further supplemented by comparing earnings and Location Quotient (LQs).

According to Mayer (2005), skilled workers in clusters are expected to earn at least 10% more than the national average, however, none of the sectors in the study region paid more than 10% of the national average (see Table 3). This was similar to the comparative regions where only the Oil Transportation workers (4861) in Eagle Ford and Specialty Trade Contractors (23899) in Haynesville met this criterion. These three regions appear to have low cost wages for the time being, but this is likely to change as demand for these workers increases. The wages in the study region were generally higher than Eagle Ford or Haynesville so this could mean the TMS region needs to attract workers from outside the area with higher wages.

Table 3. Comparative Oil Shale Region Sectorial Earnings

		2012 Local Earnings as Percentage National Earnings		
Industry	**NAICS Code**	**Eagle Ford**	**Tuscaloosa**	**Haynesville**
Site Preparation Contracts	23891	81%	100.6%	98.1%
All other specialty trade contracts	23899	87.80%	101.0%	118.4%
Oil and Gas Pipeline Structures	23712	88.40%	97.6%	72.3%
Engineering Construction Services	54133	74.50%	103.8%	75.7%
Oil and Gas Field Machinery and Equipment	333132	74.40%	81.3%	54.5%
Environmental Consulting	54162	101%	97.1%	83.5%
Testing Laboratories	54138	75%	77.7%	88.4%
Surveying and Mapping	54136	70.70%	97.5%	57.2%
Precision Equipment and Repair	8112	78%	83.7%	86.3%
Commercial and Industrial Machinery	8113	94.30%	104.1%	88.8%
Management Consulting	54161	78.60%	52.9%	64.4%
Scientific and Technical Consulting	54169	92.70%	97.5%	68.4%
Business Support Services	5614	81.40%	71.1%	54.9%
Support Activities for oil and gas operations	213112	84.50%	96.7%	88.4%
Oil transportation	4861	128.60%	85.6%	78.7%
Gas Distribution	2212	75%	59.5%	82.8%
Oil Refining	32411	57%	89.5%	62.7%
Gas Transportation	4862	103.60%	63.0%	69.8%

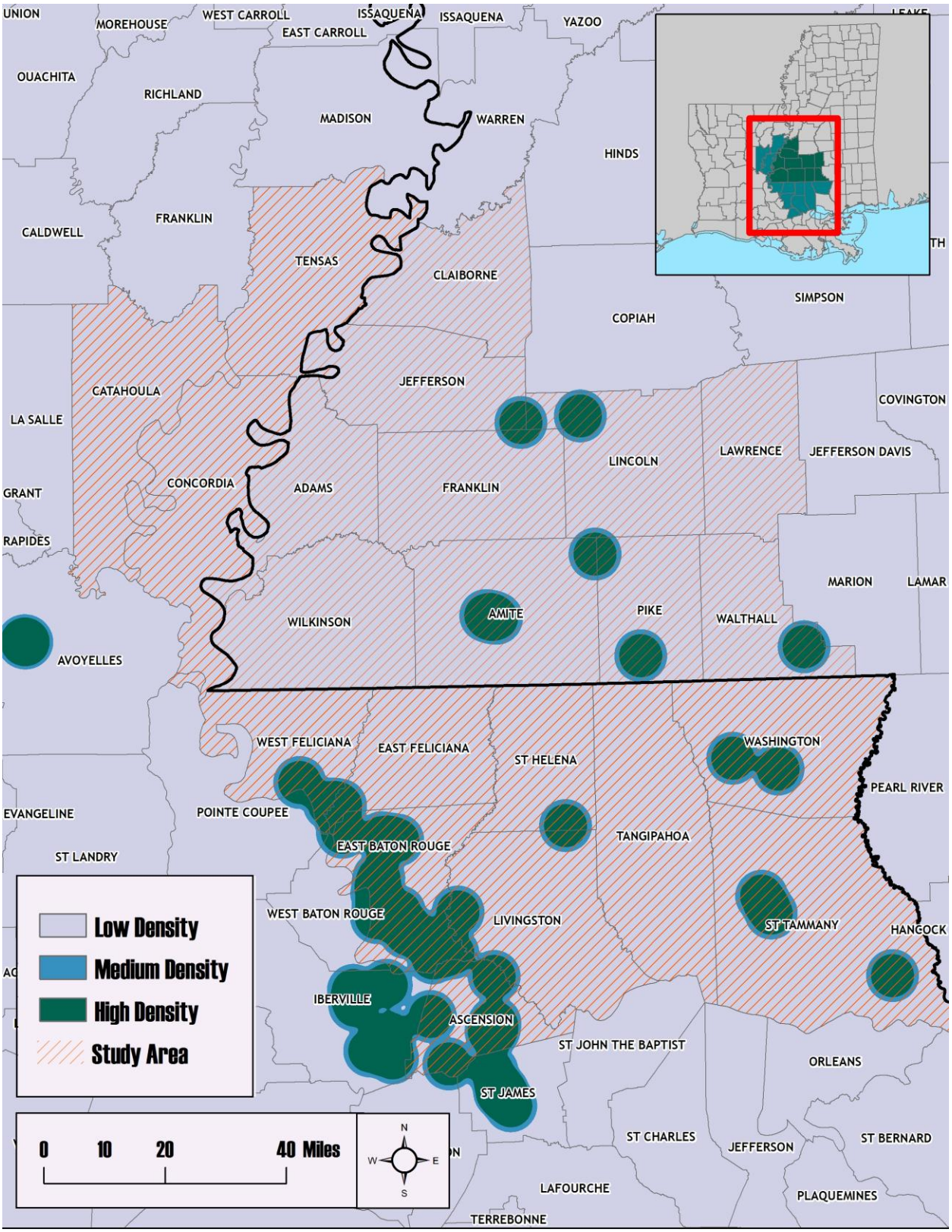
Location Quotient (LQs) are measures of industry concentration and it is expected that these measures would be large (above 1.25) in developed clusters, however even the more developed Eagle Ford and Haynesville oil shale region, the LQs were low for most sectors. Only Gas Transportation (4862) and Oil and Gas Pipeline Structures (23712) were highly concentrated in all three regions (see Table 4). Each region had most LQs below expectations. For the study region, Support Activities for Oil and Gas Operations (213112), Business Support Services (5614), and Oil and Gas Field Machinery and Equipment (333132) were less than the comparative regions. These are sectors that should be targeted.

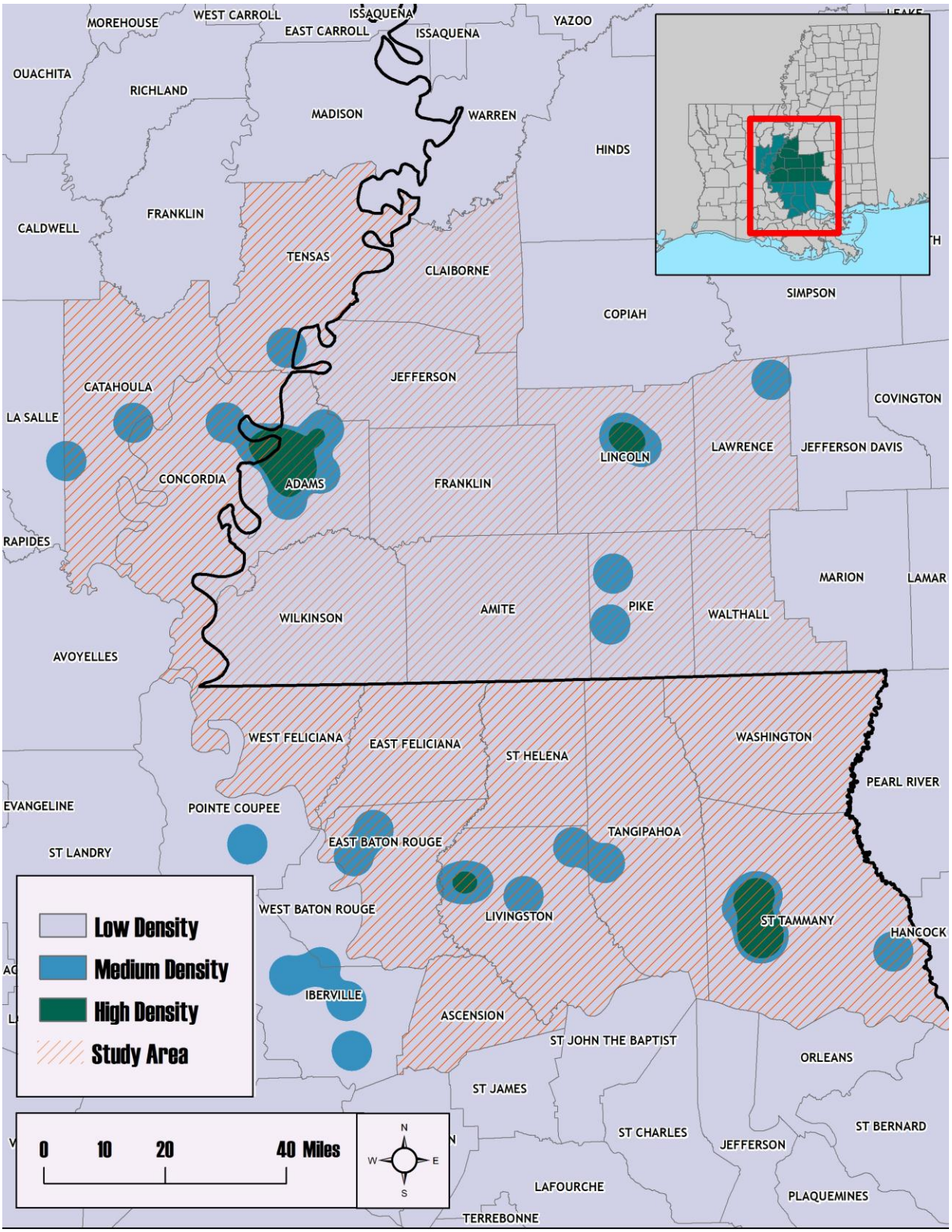
Table 4. Comparative Oil Shale Region Sectorial LQs

		Location Quotient		
Industry	**NAICS Code**	**Eagle Ford**	**Tuscaloosa**	**Haynesville**
Site Preparation Contracts	23891	0.62	1.48	2.77
All other specialty trade contracts	23899	1.1	2.96	1.68
Oil and Gas Pipeline Structures	23712	1.5	13.96	11.83
Engineering Construction Services	54133	1.04	1.66	0.29
Oil and Gas Field Machinery and Equipment	333132	1.34	1.09	1.82
Environmental Consulting	54162	0.75	2.61	0.64
Testing Laboratories	54138	0.63	1.21	0.91
Surveying and Mapping	54136	0.86	2.43	2.09
Precision Equipment and Repair	8112	1.05	1.08	0.61
Commercial and Industrial Machinery	8113	0.88	2.50	2.07
Management Consulting	54161	0.78	0.44	0.26
Scientific and Technical Consulting	54169	0.33	0.65	0.83
Business Support Services	5614	1.86	0.58	1.51
Support Activities for oil and gas operations	213112	3.1	1.04	13.95
Oil transportation	4861	0.25	2.87	Unavailable
Gas Distribution	2212	0.19	0.63	3.17
Oil Refining	32411	0.74	7.97	0.4
Gas Transportation	4862	4.14	3.04	11.47

Geographically, support service industries are fairly widespread across the region. However, Louisiana has a concentration of oil and gas extraction (NAICS 211), and Natchez has a concentration of pipeline (NAICS 486) (Figure 8). There is a gap in the middle of the region in Wilkinson and Franklin counties. The research did not clarify why the gap exists, but it could be due to the presence of the Homochitto National Forest.

Figure 8. Density of Oil/Gas Extraction and Pipeline Companies




MOREHOUSE
WEST CARROLL
ISSAQUENA
EAST CARROLL
ISSAQUENA
YAZOO
OUACHITA
RICHLAND
MADISON
WARREN
HINDS
FRANKLIN
CALDWELL
TENSAS
CLAIBORNE
SIMPSON
COPIAH
CATAHOULA
JEFFERSON
COVINGTON
LA SALLE
LINCOLN
LAWRENCE
JEFFERSON DAVIS
CONCORDIA
ADAMS
FRANKLIN
RAPIDES
MARION
LAMAR
WILKINSON
AMITE
PIKE
WALTHALL
AVOYELLES
WEST FELICIANA
EAST FELICIANA
ST HELENA
WASHINGTON
PEARL RIVER
EVANGELINE
POINTE COUPEE
TANGIPAHOA
EAST BATON ROUGE
ST LANDRY
WEST BATON ROUGE
LIVINGSTON
ST TAMMANY
HANCOCK
IBERVILLE
ASCENSION
ST JOHN THE BAPTIST
ORLEANS
ST JAMES
ST CHARLES
JEFFERSON
ST BERNARD
LAFOURCHE
PLAQUEMINES
TERREBONNE
Low Density
Medium Density
High Density
Study Area
0
10
20
40 Miles
N
W
E
S

Gap Analysis
Wuyang Wang

This section uses input/output inter-industry purchasing relationships and cluster maps developed in the previous section to identify supply-demand linkages and gaps for both the Tuscaloosa Marine Shale and polymer/chemicals cluster in the study region.

Key Points of this section:

- The cluster gap analysis shows industry expansion opportunities on exports.
- Using the input/output supply chain analysis, Industries that provide support services for oil and gas operations (3029) rank at the top of the supply chain for Tuscaloosa Marine Shale region with its production output amounts of $74.8 million in southwest Mississippi (2008) and $1 billion in Louisiana (2010).
- Refined petroleum products (3115) industry is the top supplier industry for polymer/chemicals cluster to expand, with production outputs in the amount of $22 million in southwest Mississippi (2008) and $46 billion in Louisiana (2010).
- Industries, which offer equipment, tool accessories, device manufacturing, adhesives manufacturing and graphite manufacturing industries should be considered for attraction to the region
- Iron, steel and ferroalloy products industry (3170) is the top supplier industry for Tuscaloosa Marine Shale to attract, with production outputs of $520 thousand (SWMS, 2008).
- Carbon and graphite products industry (3274) is the top supplier industry for polymer/chemical cluster to attract, with production outputs of $1.9 million (LA, 2010).

Industrial cluster development has been a widely used strategy to generate economic growth and development. A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities (Porter, 1998, p.199). Regional clusters are comprised of buyer-supplier relationships, common market factors (including infrastructure, knowledge resources and labor), and common goods markets (Luger, 2007, p. 156). Clusters produce higher synergies through their geographic proximity and their interdependence (Rosenfeld, 1997). It is easier to identify opportunities for convergence, encourage innovation, and build collaborative effects in a cluster. The functions of clusters show the concentrations of interconnected companies in a specific region. This is also called business 'agglomeration' (Weber, 1929). The process of concentration, both horizontally and vertically, result in significant competitive advantages such as logistics and promotion of international trade (Iordache, Ciochină, & Asandei, 2010).

An industry cluster not only refers to companies within a single industry, it also consists of a central industry working as the 'driver' along with many other support and supply industries. Examples of support industries include transportation suppliers, financial institutions, and professional service providers. Examples of supply industries include raw material suppliers and equipment suppliers.

In the ideal circumstance, the companies of the central industry meet their purchasing demands from the complete regional supply chain within the cluster that keeps the capital flow within the region. In reality, however, it is not practical to make every dollar stay in the region. Some of the services and materials have to be imported from other regions.

On one hand, the support and supply industries may not be capable of filling all the demands of a region due to lack of local natural resources, company scale, and volume of

production. On the other hand, some of the demands may not be satisfied within the region because the cost of import is lower than the cost of purchasing locally. Therefore, the overall purpose is not to prevent any imports being brought into the region from the external suppliers but to reduce the dependency on imports and the leakage of wealth. A gap analysis can be conducted for regional clusters to determine where additional industries need to be added.

This section aims to identify the missing cluster components from the Tuscaloosa Marine Shale study region. Economic developers can target the missing sectors in order to complete the supply chain and strengthen the support industries in the region. In this section, the gap analysis for polymers/chemicals and Tuscaloosa Marine Shale will be evaluated in two steps.

Step 1: Use input/output tables to determine what sector associations and linkages would make up a complete cluster

Step 2: Compare to cluster map of developed clusters populated with EMSI employment data

Step 1: Use Input / Output Tables to Identify Missing Sectors for Complete Cluster

Input/output tables capture the inter-industry purchasing relationships and commodity flows from producers to final users. In this step, IMPLAN industry balance sheets were used to identify overall supply-demand gaps and disconnects for a complete cluster in the study region. IMPLAN Sector 20, oil and natural gas extractions, are used as the output commodity for oil and gas cluster gap analysis. IMPLAN Sector 126, other basic organic chemical manufacturing, was used as the output commodity for polymers/chemicals cluster gap analysis.

Oil and Gas Cluster

Southwest Mississippi

Based on the IMPLAN industry balance sheet, the supplier chain for oil and natural gas industries had high regional input satisfaction, with regional purchase coefficient (RPC) more than 90 percent (see Table 5). The supplier chain consisted of companies particularly in air transportation services, pipeline transportation services, monetary authorities, depository credit services, and security services. This indicates that there is adequate supply of these industries within the study region.

Table 5. Percent of Input Requirements for Oil and Natural Gas with High Regional Input Satisfaction – Southwest Mississippi

Commodity Code	Description	Gross Inputs	RPC
3332	Air transportation services	$59,193.73	92.84%
3337	Pipeline transportation services	$43,693.17	90.53%
3354	Monetary authorities and depository credit intermediation services	$29,186.26	95.42%
3387	Investigation and security services	$3,125.79	92.16%

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2008).

There were forty-seven kinds of commodities and services mostly imported from external regions. The level of input requirements for these services and commodities were satisfied less than five percent within the region (see Table 6). Most of them concentrated on equipment, machinery, and devices supply some on retail services; and other business and operation support services. These are suppliers to the oil and gas industry that are mostly coming from outside the region and therefore could be target industries for attraction or development into the region.

Table 6. Percent of Input Requirements for Oil and Natural Gas with Low Regional Input Satisfaction – Southwest Mississippi

Commodity Code	Description	Gross Inputs	RPC
3032	Natural gas, and distribution services	$2,769,762.75	0.01%
3113	Printed materials	$1,463,684.80	0.59%
3115	Refined petroleum products	$1,336,519.12	0.02%
3141	All other chemical products and preparations	$779,031.75	0.68%
3149	Other plastics products	$745,504.50	0.01%
3160	Cement	$627,656.34	0.28%
3170	Iron and steel and ferroalloy products	$519,901.51	0.00%
3185	Handtools	$436,582.83	0.13%
3193	Hardware	$398,392.05	0.01%
3197	Coated, engraved, heat treated products	$331,691.50	0.00%
3200	Balls and roller bearings	$306,089.82	0.16%
3202	Other fabricated metals	$302,231.70	0.00%
3206	Mining and oil and gas field machinery	$294,732.09	0.09%
3213	Other commercial and service industry machinery	$252,870.47	4.38%
3216	Air conditioning, refrigeration, and warm air heating equipment	$247,499.15	0.01%
3220	Cutting tools and machine tool accessories	$229,070.38	0.00%
3226	Pumps and pumping equipment	$186,381.34	0.50%
3229	Power-driven handtools	$179,698.29	0.01%
3273	Wiring devices	$123,435.39	0.46%
3315	Gaskets, packing and sealing devices	$105,749.28	0.77%
3320	Retail Services - Motor vehicle and parts OR BEA ALL RETAIL	$100,000.97	0.22%
3321	Retail Services - Furniture and home furnishings	$94,666.94	0.18%
3322	Retail Services - Electronics and appliances	$87,358.37	2.25%
3323	Retail Services - Building material and garden supply	$86,885.55	2.04%
3325	Retail Services - Health and personal care	$80,185.85	0.05%
3328	Retail Services - Sporting goods, hobby, book and music	$66,026.71	0.15%
3329	Retail Services - General merchandise	$64,741.66	0.02%
3336	Transit and ground passenger transportation services	$45,170.07	0.06%
3351	Telecommunications	$34,703.07	0.06%
3352	Data processing- hosting- ISP- web search portals	$31,863.86	0.10%
3360	Real estate buying and selling, leasing, managing, and related services	$20,984.69	4.31%
3368	Accounting, tax preparation, bookkeeping, and payroll services	$15,104.00	0.00%
3370	Specialized design services	$14,071.17	0.00%
3374	Management, scientific, and technical consulting services	$10,399.47	0.00%
3376	Scientific research and development services	$7,857.33	1.52%
3377	Advertising and related services	$7,296.45	0.20%
3380	All other miscellaneous professional, scientific, and technical services	$7,293.24	0.06%
3384	Office administrative services	$4,031.31	4.65%
3385	Facilities support services	$3,504.12	0.03%
3386	Business support services	$3,149.19	0.61%
3390	Waste management and remediation services	$2,301.50	0.00%
3392	Education from private junior colleges, colleges, universities, and professional schools	$1,982.63	0.02%
3403	Spectator sports	$1,866.99	0.00%
3411	Hotels and motel services, including casino hotels	$644.60	0.06%
3414	Automotive repair and maintenance services, except car washes	$465.34	0.12%
3421	Dry-cleaning and laundry services	$149.02	0.12%
3433	Used and secondhand goods	$122.99	2.15%

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2008).

Rank-Score Analysis

The four variables included in the rank-score analysis are: Gross Inputs (Total Regional Demand); RPC (% of Total Demand Satisfied from Outside the Region); Commodity Exports; and Commodity Exports as a Percentage of Total Commodity Production. The variables are ranked on the scale of the 'higher the better'. The rank score is used to determine which industry sectors are strongest in the region. For example, gross inputs for oil and natural gas is the highest, hence it receives a score of '1'. The commodity exports amount of oil and natural gas is the second largest among the top ten, thus it receives a score of '2'. The score of all four variables are added to get a total score to rank. The total score is ranked in ascending order. The commodity/service gets the lowest total score ranks '1' as shown in Table 7.

Table 7: Rank-score Analysis

Commodity Code	Description	Gross Inputs (Total Regional Demand)	RPC (% of Total Demand Satisfied in the Region)	Commodity Exports	Commodity Exports as % of Total Commodity Production	Rank (export variables) [sum of E,F]	Total Rank [sum of C,D,G]	Rank Order
3029	Support services for oil and gas operations	3	1	3	7	10	14	1
3020	Oil and natural gas	1	8	2	5	7	16	2
3031	Electricity, and distribution services	4	6	1	6	7	17	3
3106	Paperboard from pulp	7	2	8	2	10	19	4
3107	Paperboard containers	8	5	4	4	8	21	5
3108	Coated and laminated paper, packaging paper and plastics film	9	3	9	3	12	24	6
3039	Maintained and repaired nonresidential structures	6	4	6	9	15	25	7
3113	Printed materials	10	9	7	1	8	27	8
3032	Natural gas, and distribution services	5	10	5	8	13	28	9
3021	Coal	2	7	10	10	20	29	10

For the top ten suppliers providing the most input into the region (See Table 8), these suppliers are located outside of the region. There is, therefore a relative low trend of regional inputs satisfaction for most of the services and products in the top ten. The region satisfied most

of the inputs requirements of support services for oil and gas operations and paperboard from pulp.

Table 8. Top Input Requirements and Percent of Inputs Satisfied within the Region and Rank Score – Southwest Mississippi

Commodity Code	Description	Gross Inputs	RPC	Commodity Exports	Commodity Exports as % of Total Commodity Production	Rank Order
3020	Oil and natural gas	$15,596,134.19	7.25%	$155,342,211.09	89.99%	2
3021	Coal	$11,109,796.52	15.41%	$0.00	0.00%	10
3029	Support services for oil and gas operations	$7,581,288.34	74.97%	$74,840,510.67	64.71%	1
3031	Electricity, and distribution services	$5,370,501.52	22.37%	$409,831,680.23	76.61%	3
3032	Natural gas, and distribution services	$2,769,762.75	0.01%	$33,678,168.17	48.91%	9
3039	Maintained and repaired nonresidential structures	$2,551,154.85	36.26%	$16,031,739.59	24.75%	7
3106	Paperboard from pulp	$2,128,536.94	70.92%	$3,686,032.75	99.45%	4
3107	Paperboard containers	$1,842,048.29	27.89%	$38,236,056.71	98.71%	5
3108	Coated and laminated paper, packaging paper and plastics film	$1,506,441.24	49.12%	$323,492.07	98.82%	6
3113	Printed materials	$1,463,684.80	0.59%	$5,260,993.02	99.55%	8

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2008); authors' own calculation.

Oil/natural gas, natural gas distribution services, and printed materials are the three commodities with the lowest level of regional input satisfaction. Many reasons may explain the gap between production and consumption of these commodities. One of the reasons may be because the regional extraction companies exported oil/natural gas to trading companies in external regions. Then the trading companies resold the end-user products back to the region. Further research may need to be conducted to identify the extent of this supplier chain relationship.

In addition, there is a big regional input requirement gap for electricity and electrical distribution services indicating that most of the electrical requirements for the region have to be

purchased from other regions. To address this gap, local economic developers could work with electric companies to better utilize supply and distribution efficiency within the region.

Support services for oil/gas operations, oil/natural gas, and electrical distribution services are the top three ranked commodities. These three industries are all export-oriented industries. About ninety percent of regionally produced oil and natural gas was exported to other regions indicating that it is the leading export industry in the study region. It must be noted that the electricity and electrical distribution, such as Entergy Mississippi, is not a locally based industry and, therefore, it isn't considered an exporter. The high export rate may be because of the general operations of headquarter. Therefore, support services for oil/gas operations and oil/natural gas industries have potential to be the candidate industries for the region to develop for oil and gas cluster. Further market analysis may be needed to determine the feasibility of industry expansion and recruitment.

Oil and Gas Cluster

Louisiana

Data from IMPLAN was not available for the Louisiana portion of the study region so IMPLAN for the entire state of Louisiana was used for this section. Based on the industry balance sheet for oil and natural gas in Louisiana, most support service sectors--retail services, catering services, machinery/equipment rental and maintenance services, and support activities for transportation--had high regional input satisfaction, with regional purchase coefficient (RPC) greater than 90 percent (see Table 9). This indicates that these service sectors are self-sufficient in meeting the demand for goods and services within the state of Louisiana.

Table 9. Percent of Input Requirements of Oil and Natural Gas with High Regional Input Satisfaction – Louisiana

Commodity Code	Description	Gross Inputs	RPC
3029	Support services for oil and gas operations	$389,747,558.59	96.48%
3039	Maintained and repaired nonresidential structures	$351,486,541.75	99.75%
3365	Commercial and industrial machinery and equipment rental and leasing services	$40,064,064.03	98.82%
3367	Legal services	$26,148,096.08	90.56%
3121	Industrial gas	$20,902,223.59	90.89%
3118	Petroleum lubricating oils and greases	$9,019,554.14	93.68%
3320	Retail Services - Motor vehicle and parts OR BEA ALL RETAIL	$1,935,628.53	98.63%
3390	Waste management and remediation services	$1,215,733.41	99.68%
3323	Retail Services - Building material and garden supply	$1,095,214.25	99.72%
3329	Retail Services - General merchandise	$1,079,816.10	98.88%
3325	Retail Services - Health and personal care	$579,585.19	99.30%
3326	Retail Services - Gasoline stations	$494,576.60	98.70%
3330	Retail Services - Miscellaneous	$452,752.38	98.15%
3334	Water transportation services	$428,952.28	91.90%
3321	Retail Services - Furniture and home furnishings	$239,369.35	95.71%
3389	Other support services	$228,854.49	97.60%
3413	Restaurant, bar, and drinking place services	$193,870.63	97.39%
3338	Scenic and sightseeing transportation services and support activities for transportation	$156,964.45	98.63%
3417	Commercial and industrial machinery and equipment repairs and maintenance	$57,233.57	98.78%
3421	Dry-cleaning and laundry services	$33,187.90	98.41%
3403	Spectator sports	$8,766.97	90.50%

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2010).

In Table 10, some kinds of tools and hardware and related accessories, equipment and machineries, plastics products, and motor vehicle parts were imported from external regions. The level of input requirements for these services and products were satisfied less than five percent within the region (see Table 10).

Table 10. Percent of Input Requirements for Twenty Extractions of Oil and Natural Gas with Low Regional Input Satisfaction – Louisiana

Commodity Code	Description	Gross Inputs	RPC
3283	Motor vehicle parts	$30,502,355.58	0.98%
3149	Other plastics products	$20,685,483.93	4.59%
3436	Noncomparable foreign imports	$13,166,692.73	0.00%
3200	Balls and roller bearings	$10,465,924.26	0.23%
3230	Other general purpose machinery	$8,773,479.46	0.29%
3216	Air conditioning, refrigeration, and warm air heating equipment	$5,601,753.23	4.97%
3228	Material handling equipment	$5,223,414.90	3.84%
3196	Turned products and screws, nuts, and bolts	$1,924,415.83	2.06%
3225	Other engine equipment	$1,173,178.20	1.98%
3229	Power-driven handtools	$521,863.82	1.72%
3150	Tires	$370,228.86	3.35%
3220	Cutting tools and machine tool accessories	$309,044.33	0.29%
3273	Wiring devices	$211,102.87	0.98%
3185	Handtools	$199,360.58	0.91%
3267	Motor and generators	$105,511.18	2.80%
3411	Hotels and motel services, including casino hotels	$104,175.22	2.51%
3260	Lighting fixtures	$69,370.92	1.64%
3193	Hardware	$55,198.07	1.10%
3252	Totalizing fluid meters and counting devices	$14,789.12	1.85%

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2010).

For the top ten commodities/services with the most input requirements of twenty extractions of oil and natural gas of Louisiana (See Table 11), there is a high trend of regional input satisfaction for most of the services and products in the top ten.

Table 11. Top Input Requirements for Twenty Extractions of oil and natural gas and Percent of Inputs Satisfied within the Region and Rank Score – Louisiana

Commodity Code	Description	Gross Inputs	RPC	Commodity Exports	Commodity Exports as % of Total Commodity Production	Rank Order
3366	Leasing of nonfinancial intangible assets	$553,752,807.62	55.69%	$871,602,763.49	39.29%	3*
3029	Support services for oil and gas operations	$389,747,558.59	96.48%	$1,063,996,982.57	16.60%	2
3039	Maintained and repaired nonresidential structures	$351,486,541.75	99.75%	$1,378,717,918.09	31.53%	1
3381	Management of companies and enterprises	$145,351,699.83	60.94%	$650,086,264.09	17.87%	5
3020	Oil and natural gas	$144,564,224.24	13.72%	$797,604,328.31	10.26%	7
3371	Custom computer programming services	$82,421,150.21	75.86%	$21,570,027.82	2.30%	9
3120	Petrochemicals	$60,944,534.30	76.97%	$5,351,985,083.62	37.12%	3*
3031	Electricity, and distribution services	$51,935,863.49	69.83%	$39,238,576.88	1.09%	10
3369	Architectural, engineering, and related services	$44,697,116.85	84.05%	$599,901,983.58	13.96%	6
3198	Valves and fittings other than plumbing	$41,724,662.78	6.69%	$299,169,102.25	88.61%	8

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2010); authors' own calculation.
* Have the same score in the scorecard

The region satisfied most of the input requirements of support services for oil and gas operations, maintained and repaired nonresidential structures, custom computer programming services, petrochemicals, and architectural, engineering, and related services. The high regional input satisfaction of petrochemical products, with RPC of 76.97 percent, shows that oil and natural gas extraction industry had good industry linkages with regional chemical manufacturing companies in Louisiana. The same as southwest Mississippi, oil and natural gas has a low level of regional input satisfaction in Louisiana. Relative researches should be conducted to explore the reasons.

Maintained and repaired nonresidential structures, support services for oil and gas operations, nonfinancial intangible assets leasing services, and petrochemicals are the top three

ranked commodities/services (nonfinancial intangible assets leasing services and petrochemicals have the same rank score). Among these four kinds of commodity/service, industries that provide support services for oil and gas operations and maintained and repaired nonresidential structures are capable of supplying more than 95 percent of the regional demand and exporting more than one billion dollars commodity/service to external regions. The industry that provides nonfinancial intangible assets leasing services has the highest rate of commodity export of 39.29 percent. In addition, the industry that produces petrochemicals had the largest amount of export in the study region, exporting more than $5 billion in 2010. And this industry has potential to increase its input supply for Tuscaloosa Marine Shale with RPC of 76.97 percent. Therefore, these four kinds of industries have potential to be the candidate industries for the region to develop Tuscaloosa Marine Shale into an oil and gas cluster. Again, further market analysis may be needed to determine the feasibility of industry expansion.

Based on the input/output tables of southwest Mississippi and Louisiana, the industry that provides support services for oil and gas operations (3029) is the common candidate industry for both states and had the largest export amount, $74.8 million in southwest Mississippi (2008) and $1 billion in Louisiana (2010). Industry that provides iron, steel, and ferroalloy products (3170) is the top one industry for Tuscaloosa Marine Shale to attract, with inputs requirement of $520 thousand (SWMS, 2008). For the other candidate industries, appropriate economic development measures can be conducted basing on the situation of each state. Still, further research should be conducted to determine the feasibility of industry expansion and recruitment.

Polymers/Chemicals Cluster

Southwest Mississippi

According to the input/output balance sheet of one hundred twenty six other basic organic chemical manufacturing, input requirements of machinery and equipment maintenance and repairs services, utility services, some kinds of retail services, products and services of state and local government enterprises, and services of general and consumer goods rental had high regional input satisfaction rate, with RPC more than 90 percent (see Table 12).

Table 12. Percent of Input Requirements for 126 Other Basic Organic Chemical Manufacturing with High Regional Input Satisfaction – Southwest Mississippi

Commodity Code	Description	Gross Inputs	RPC
3417	Commercial and industrial machinery and equipment repairs and maintenance	$192,793.59	92.16%
3033	Water, sewage treatment, and other utility services	$112,694.81	96.53%
3329	Retail Services - General merchandise	$55,935.73	92.84%
3432	Products & services of State & Local Govt enterprises (except electric utilities)	$48,748.19	93.16%
3323	Retail Services - Building material and garden supply	$41,288.31	90.53%
3326	Retail Services - Gasoline stations	$27,579.86	95.42%
3363	General and consumer goods rental services except video tapes and discs	$8,850.86	90.34%

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2008).

There are seventy-eight kinds of commodities and services with a high level of import from suppliers from external regions (see Table 13). Most of them concentrate on equipment, machinery, devices, plastics products, and some kinds of organic and inorganic chemicals.

Table 13. Percent of Input Requirements for 126 Other Basic Organic Chemical Manufacturing with Low Regional Input Satisfaction – Southwest Mississippi

Commodity Code	Description	Gross Inputs	RPC
3120	Petrochemicals	$17,598,716.74	0.01%
3115	Refined petroleum products	$8,988,142.97	0.59%
3126	Other basic organic chemicals	$7,212,903.50	0.09%
3125	All other basic inorganic chemicals	$626,894.00	0.10%
3121	Industrial gas	$614,938.02	0.01%
3123	Alkalies and chlorine	$610,356.51	0.20%
3130	Fertilizer	$571,007.25	0.36%
3144	Plastics pipes and pipe fittings	$536,322.30	3.15%
3141	All other chemical products and preparations	$349,332.72	0.22%
3207	Other industrial machinery	$346,177.04	0.81%
3127	Plastics materials and resins	$343,717.22	0.01%
3119	All other petroleum and coal products	$260,559.50	0.00%
3243	Semiconductor and related devices	$254,292.55	0.00%
3315	Gaskets, packing and sealing devices	$244,222.60	0.05%
3246	Printed circuit assemblies (electronic assemblies)	$228,656.78	0.00%
3149	Other plastics products	$208,588.38	0.28%
3252	Totalizing fluid meters and counting devices	$164,431.07	0.06%
3198	Valves and fittings other than plumbing	$162,815.15	0.02%
3214	Air purification and ventilation equipment	$151,708.38	0.00%
3197	Coated, engraved, heat treated products	$144,689.47	0.00%
3107	Paperboard containers	$128,925.04	2.25%
3195	Machined products	$118,401.09	0.13%
3433	Used and secondhand goods	$112,111.71	0.50%
3137	Adhesives	$111,578.77	0.00%
3001	Oilseeds	$103,082.10	1.45%
3332	Air transportation services	$102,741.85	4.31%
3138	Soaps and cleaning compounds	$96,613.88	0.13%
3122	Synthetic dyes and pigments	$87,151.13	0.05%
3142	Plastics packaging materials and unlaminated films and sheets	$82,391.83	1.18%
3148	Plastics bottles	$79,168.83	0.00%
3283	Motor vehicle parts	$64,231.31	0.68%
3006	Greenhouse, nursery, and floriculture products	$58,872.80	0.47%
3411	Hotels and motel services, including casino hotels	$51,865.28	0.03%
3274	Carbon and graphite products	$49,681.31	0.00%
3024	Gold, silver, and other metal ore	$48,608.07	0.18%
3157	Other pressed and blown glass and glassware	$45,728.21	0.00%
3244	Electronic capacitors, resistors, coils, transformers, and other inductors	$45,669.97	0.01%
3021	Coal	$38,884.03	0.00%
3136	Paints and coatings	$38,597.33	0.00%
3269	Relay and industrial controls	$38,394.12	0.12%
3170	Iron and steel and ferroalloy products	$27,818.60	0.00%
3242	Bare printed circuit boards	$27,769.82	0.00%
3251	Industrial process variable instruments	$25,886.89	0.01%
3106	Paperboard from pulp	$25,070.21	0.18%
3189	Metal tanks (heavy gauge)	$19,184.51	0.06%
3196	Turned products and screws, nuts, and bolts	$18,437.09	0.02%
3143	Unlaminated plastics profile shapes	$17,156.84	0.01%
3247	Other electronic components	$15,770.47	0.00%
3129	Artificial and synthetic fibers and filaments	$14,234.33	0.00%
3202	Other fabricated metals	$12,573.45	0.46%
3188	Power boilers and heat exchangers	$12,256.97	0.00%

(Table continues)

3220	Cutting tools and machine tool accessories	$11,932.07	0.00%
3027	Other nonmetallic minerals	$11,522.39	0.00%
3118	Petroleum lubricating oils and greases	$7,066.50	0.16%
3108	Coated and laminated paper, packaging paper and plastics film	$6,441.58	0.06%
3216	Air conditioning, refrigeration, and warm air heating equipment	$5,731.26	0.01%
3113	Printed materials	$4,393.50	0.12%
3105	Paper from pulp	$3,505.88	4.19%
3128	Synthetic rubber	$3,274.73	0.01%
3146	Polystyrene foam products	$2,256.17	0.01%
3165	Abrasive products	$2,030.29	0.00%
3185	Handtools	$1,593.43	0.06%
3023	Copper, nickel, lead, and zinc	$1,495.07	0.00%
3110	Paper and paperboard stationary products	$1,392.83	0.00%
3353	Other information services	$1,153.38	4.65%
3228	Material handling equipment	$1,113.21	0.77%
3150	Tires	$1,034.90	0.00%
3313	Office supplies (except paper)	$959.85	0.00%
3109	All other paper bag and coated and treated paper	$824.62	0.08%
3227	Air and gas compressors	$757.15	0.01%
3124	Carbon black	$621.18	0.00%
3230	Other general purpose machinery	$606.95	0.01%
3266	Power, distribution, and specialty transformers	$547.19	0.02%
3402	Performing arts	$457.38	4.95%
3259	Electric lamp bulbs and parts	$390.67	0.00%
3099	Wood windows and doors and millwork	$376.27	3.12%
3213	Other commercial and service industry machinery	$341.08	0.12%
3171	Steel products from purchased steel	$145.99	0.02%

Unit: U.S. Dollar
Ranked by the amount of gross input
Source: Data are from the Minnesota IMPLAN Group Inc. (2008).

For the top ten commodities/services with the most input requirements from the regions 126 other basic organic chemicals manufacturers (see Table 14), the region satisfied most of the industry demands on electricity and distribution services and wholesale trade distribution services, with RPC more than 60 percent.

Table 14. Top Input Requirements for 126 Other Basic Organic Chemical Manufacturing and Percent of Inputs Satisfied within the Region and Rank Score – Southwest Mississippi

Commodity Code	Description	Gross Inputs	RPC	Commodity Exports	Commodity Exports as % of Total Commodity Production	Rank Order
3120	Petrochemicals	$17,598,716.74	0.01%	$699,628.46	99.75%	7
3115	Refined petroleum products	$8,988,142.97	0.59%	$22,843,210.14	92.47%	4*
3126	Other basic organic chemicals	$7,212,903.50	0.09%	$53,300,457.29	99.93%	1
3319	Wholesale trade distribution services	$2,209,955.93	62.12%	$44,813,026.60	14.36%	4*
3032	Natural gas, and distribution services	$1,893,260.60	39.80%	$33,678,168.17	48.91%	6
3020	Oil and natural gas	$1,513,654.59	15.41%	$155,342,211.09	89.99%	3
3381	Management of companies and enterprises	$1,355,262.76	22.37%	$5,282,903.47	14.78%	8
3376	Scientific research and development services	$839,709.16	8.16%	$141,025.44	5.02%	10
3031	Electricity, and distribution services	$786,368.91	70.92%	$409,831,680.23	76.61%	2
3125	All other basic inorganic chemicals	$626,894.00	0.10%	$4,010,145.14	99.51%	9

Unit: U.S. Dollar
Ranked by the amount of gross input
Source: Data are from the Minnesota IMPLAN Group Inc. (2008); authors' own calculation.
* Have the same score in the scorecard

The table shows that the chemical manufacturing industry at southwest Mississippi needs more local supplies of petrochemicals and refined petroleum products, other basic organic and inorganic chemicals, scientific research and development services, oil and natural gas, and scientific research and development services. For the input gap of scientific research and services, there are a lot of good academic institutions and industry associations in and around the region that can help with the polymer and chemical technologies and products research and development. Local economic development organizations can help the companies get linked with these academic institutions and industry associations to satisfy their need to enhance technological advance locally.

Among the top ten commodities/services with the highest industry demands by chemical/polymer industry, other basic organic chemicals, electricity and distribution services, and oil and natural gas ranked at the first three positions. Inter-industry networking can be

conducted to enhance inter-industry connections to increase the regional commodity supply rate. The industry of oil and natural gas had the second largest amount of commodity export with more than $155 million exports. It has a very high potential of bringing money into the region. It provides more evidence that Tuscaloosa Marine Shale has the potential to become a promising cluster. The same as mentioned before, electricity and distribution services is not a good candidate industry because of the headquarter interference. Therefore, other basic organic chemicals industry and oil and natural gas industry should be the candidate industries for the region to develop. Again, further market analysis may be needed to determine the feasibility of industry recruitment and expansion.

Polymers/Chemicals Cluster

Louisiana

According to the input/output balance sheet of one hundred twenty six other basic organic chemical manufacturing in Louisiana, most input requirements of utility and environment management services, retail services, transportation services, and equipment maintenance and leasing services had high regional input satisfaction rate, with RPC more than 90 percent (see Table 15).

Table 15. Percent of Input Requirements for 126 Other Basic Organic Chemicals Manufacturing with High Regional Input Satisfaction – Louisiana

Commodity Code	Description	Gross Inputs	RPC
3121	Industrial gas	$24,204,328.54	90.89%
3039	Maintained and repaired nonresidential structures	$16,634,569.17	99.75%
3390	Waste management and remediation services	$7,795,779.23	99.68%
3417	Commercial and industrial machinery and equipment repairs and maintenance	$4,955,683.23	98.78%
3367	Legal services	$4,615,847.11	90.56%
3033	Water, sewage treatment, and other utility services	$3,544,845.10	96.01%
3413	Restaurant, bar, and drinking place services	$3,200,217.72	97.39%
3320	Retail Services - Motor vehicle and parts OR BEA ALL RETAIL	$2,567,764.04	98.63%
3365	Commercial and industrial machinery and equipment rental and leasing services	$2,308,969.26	98.82%
3323	Retail Services - Building material and garden supply	$1,452,888.25	99.72%
3329	Retail Services - General merchandise	$1,432,461.26	98.88%
3432	Products & services of State & Local Govt enterprises (except electric utilities)	$1,265,703.92	93.82%
3334	Water transportation services	$1,004,641.18	91.90%
3325	Retail Services - Health and personal care	$768,865.47	99.30%
3326	Retail Services - Gasoline stations	$656,094.85	98.70%
3330	Retail Services - Miscellaneous	$600,611.75	98.15%
3389	Other support services	$516,734.42	97.60%
3321	Retail Services - Furniture and home furnishings	$317,542.34	95.71%
3118	Petroleum lubricating oils and greases	$292,321.00	93.68%
3403	Spectator sports	$169,019.52	90.50%
3363	General and consumer goods rental services except video tapes and discs	$154,748.87	99.68%
3421	Dry-cleaning and laundry services	$23,327.29	98.41%
3338	Scenic and sightseeing transportation services and support activities for transportation	$15,761.14	98.63%

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2010).

Electronic devices, components, and accessories, some kinds of equipment and machinery, and plastics and carbon products had low level of regional inputs satisfaction (see Table 16).

Table 16. Percent of Input Requirements for 126 Other Basic Organic Chemicals Manufacturing with Low Regional Input Satisfaction– Louisiana

Commodity Code	Description	Gross Inputs	RPC
3243	Semiconductor and related devices	$13,281,806.95	0.03%
3207	Other industrial machinery	$11,311,548.23	3.48%
3436	Noncomparable foreign imports	$11,118,462.56	0.00%
3149	Other plastics products	$9,650,577.55	4.59%
3246	Printed circuit assemblies (electronic assemblies)	$8,236,415.86	0.12%
3252	Totalizing fluid meters and counting devices	$5,296,133.04	1.85%
3214	Air purification and ventilation equipment	$5,277,270.32	0.70%
3283	Motor vehicle parts	$3,530,567.41	0.98%
3411	Hotels and motel services, including casino hotels	$2,164,618.02	2.51%
3274	Carbon and graphite products	$1,924,901.84	0.00%
3244	Electronic capacitors, resistors, coils, transformers, and other inductors	$1,589,827.54	1.09%
3242	Bare printed circuit boards	$1,129,707.34	1.87%
3196	Turned products and screws, nuts, and bolts	$769,355.18	2.06%
3247	Other electronic components	$760,779.98	0.04%
3143	Unlaminated plastics profile shapes	$691,814.84	1.93%
3129	Artificial and synthetic fibers and filaments	$553,025.36	1.09%
3220	Cutting tools and machine tool accessories	$342,739.43	0.29%
3216	Air conditioning, refrigeration, and warm air heating equipment	$250,812.65	4.97%
3228	Material handling equipment	$77,192.34	3.84%
3185	Handtools	$61,146.59	0.91%
3150	Tires	$51,722.42	3.35%
3230	Other general purpose machinery	$30,204.48	0.29%
3266	Power, distribution, and specialty transformers	$22,883.09	2.70%
3313	Office supplies (except paper)	$10,320.66	0.23%
3259	Electric lamp bulbs and parts	$8,418.93	0.47%

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2010).

For the top ten commodities/services with the most input requirements by one hundred twenty six other basic organic chemicals manufacturing in Louisiana (see Table 17), the region had a high trend of input requirements among the top ten.

Table 17. Top Input Requirements for 126 Other Basic Organic Chemical Manufacturing and Percent of Inputs Satisfied within the Region and Rank Score – Louisiana

Commodity Code	Description	Gross Inputs	RPC	Commodity Exports	Commodity Exports as % of Total Commodity	Rank Order
3120	Petrochemicals	$543,616,577.15	76.97%	$5,351,985,083.62	37.12%	2
3126	Other basic organic chemicals	$227,872,192.38	31.10%	$1,676,295,472.41	47.99%	3
3115	Refined petroleum products	$183,386,688.23	84.89%	$46,405,116,770.82	69.45%	1
3032	Natural gas, and distribution services	$65,298,156.74	36.47%	$201,538,814.20	11.44%	7
3319	Wholesale trade distribution services	$62,216,205.60	74.04%	$1,913,478,630.94	17.31%	4
3381	Management of companies and enterprises	$51,493,003.85	60.94%	$650,086,264.09	17.87%	5
3376	Scientific research and development services	$34,496,086.12	10.72%	$3,131,681.49	1.09%	10
3020	Oil and natural gas	$27,650,373.46	13.72%	$797,604,328.31	10.26%	8*
3031	Electricity, and distribution services	$26,935,932.16	69.83%	$39,238,576.88	1.09%	8*
3366	Leasing of nonfinancial intangible assets	$25,007,423.40	55.69%	$871,602,763.49	39.29%	6

Unit: U.S. Dollar
Ranked by the amount of gross inputs
Source: Data are from the Minnesota IMPLAN Group Inc. (2010); authors' own calculation.

Most of the petrochemicals, refined petroleum products, and wholesale trade distribution services have high level of inputs satisfaction, RPC more than 70 percent. It shows that the polymers/chemicals cluster is using the advantages of having Tuscaloosa Marine Shale in the region.

The table shows that the chemical manufacturing industry needs more local supplies on other basic organic chemicals, natural gas and distribution services, oil and natural gas, and scientific research and development services. For the input gap of scientific research and services, the same as southwest Mississippi, local economic development organizations can help the companies get linked with those academic institutions and industry associations in and around the region to satisfy their needs of enhancing the advance of technology locally.

Among the top ten commodities/services with highest industry demands by chemical/polymer industry, refined petroleum products, petrochemicals, and other basic organic chemicals are ranked as the first three. The industries that produce refined petroleum products

had the largest amount of commodity exports with more than $46 billion exports. It has the highest potential of bringing money into the region. It shows more evidence that Tuscaloosa Marine Shale should be a development target for the region. Also, industry that produces petrochemicals ranked the second for most of the variables, except gross input as the largest and export rate as the fourth, also shows the potential of being a candidate industry for the region to develop. Similar to the situation at southwest Mississippi for chemical manufacturing industry, the industry of other basic organic chemicals had a high rate of export but low rate of regional inputs satisfaction. This industry is a good candidate for region to develop but inter-industry networking is needed to enhance RPC. Still, further market analysis may be needed to determine the feasibility of industry recruitment and expansion.

According to the input/output tables of southwest Mississippi and Louisiana, the industry that provides other basic organic chemicals (3126) is the common candidate industry for both states. Inter-industry connection measure is recommended to enhance RPC. Industry that provides refined petroleum products (3115) is the top one industry for polymer/chemicals cluster to expand, with export amount of $22 million in southwest Mississippi (2008) and $46 billion in Louisiana (2010). Industry that provides carbon and graphite products (3274) is the top one industry for the polymer/chemicals cluster to attract, with inputs requirement of $1.9 million (LA, 2010). For other candidate industries, appropriate economic development measures can be determined based on the situation of each state. Further researches should be conducted to determine the feasibility of industry expansion and recruitment.

Step 2: Identify Missing Cluster Component by Comparing Cluster Map of Developed Clusters with EMSI Employment Data in the Study Region

The cluster maps of developed clusters describe the components that compose a complete supply chain, from core industry to each support and supply industry. It is a visual portrait of the sectors, associations, and linkages that make up the existing cluster. This tier compares all the sectors in the cluster maps that developed in section four with the industry employment data of study region in order to find the missing components in the target clusters in the study region.

Oil and Gas Cluster. Based on the well developed cluster maps portrait on the former section, a complete oil and gas cluster is composed by the upstream oil and natural gas exploration and development, which is the 'driver' industry for the cluster; downstream oil and natural gas transportation and distribution, oil refining, and support activities for oil and natural gas operations which include oil and gas trading, processing, gathering, and marketing; oilfield services/engineering and contracting firms, which include equipment suppliers, specialized technology services, subcontractors, and business services; and specialized institutions like academic institution, training centers, and industry associations.

For the Tuscaloosa Marine Shale in the study region, the core industry, oil and natural gas extraction and development, is a rapidly growing industry. Connecting the cluster components with regional EMSI employment data, none of the components is missing. The Tuscaloosa Marine Shale in the study region has a well-developed supply chain with highly developed 'driver' industry and complete support and supply industries. The scale of Tuscaloosa Marine Shale in the study region is not as large as the developed Eagle Ford Shale and Haynesville Oil Shale, but it has a balanced distribution of employment on each support and supply industry (see Table 18).

Table 18. EMSI Industry Employment in the Study Region (Source EMSI 2011)

NAICS Code	Description	2011 Jobs
21	Mining, Quarrying, and Oil and Gas Extraction	3012
2111	Crude Petroleum and Natural Gas Extraction	367
213111	Drilling Oil and Gas Wells	1159
213112	Support Activities for Oil and Gas Operations	1020
2212	Natural Gas Distribution	274
23712	Oil and Gas Pipeline and Related Structures Construction	6063
23891	Site Preparation Contractors	1581
23899	All Other Specialty Trade Contractors	3063
32411	Petroleum Refineries	2306
333132	Oil and Gas Field Machinery and Equipment Manufacturing	301
4861	Pipeline Transportation of Crude Oil	105
4862	Pipeline Transportation of Natural Gas	337
54133	Engineering Services	5873
54136	Geophysical Surveying and Mapping Services	167
54138	Testing Laboratories	747
54161	Management Consulting Services	1450
54162	Environmental Consulting Services	837
54169	Other Scientific and Technical Consulting Services	462
5614	Business Support Services	1902
8112	Electronic and Precision Equipment Repair and Maintenance	432
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	1856

Hydraulic Fracturing
Josiah Ball

This section examines the role of the hydraulic fracturing industry in the oil and gas sector and how the economic development of that industry can contribute to the formation of an oil and gas cluster in the study region.

Key Points of this Section:

- Hydraulic Fracturing (NAICS code 213111) is a method of oil and natural gas extraction originated from two combined methods to address inaccessible areas of shale formation. The boom in Liquid Natural Gas extraction is solely credited to the practice of fracking. In 2000, shale gas was one percent of America's gas supplies; today it is twenty-five percent. United States gas reserves were declining prior to the fracking breakthrough, and prices were exceeding fifteen dollars per million British thermal units. Today units are four dollars.
- Fracking revitalized states and regions that were suffering economically. The fracking industry was credited with adding 72,000 direct and indirect jobs to the state of West Virginia within in a period of two years. Fracking is responsible for North Dakota having one of the nation's lowest unemployment rates of 3.2% unemployment.
- In the study region the fracking industry is responsible for the second highest number of jobs added within a ten-year term. It is topped only by crude and petroleum extraction, and fracking represents 31.5% of all jobs created in the region.
- Smaller companies with lower overhead will succeed the larger companies once they have extracted what they can remove profitably.
- A shift share analysis revealed that the fracking industry in the study region is growing

slightly faster than expected, and the growth rate for the region (0.12) is higher than the national growth rate (0.04). However, these findings do not guarantee that the industry will have sustained growth in the region and certainly does not rule out the possibility of clear-cut avoidance of challenges associated with the fracking industry. The oil and gas sector for the southwest study region has an overall shift share of -6.56 verses a fracking industry shift share of 139.14, indicating that the fracking industry possesses a strong competitive advantage and sustained growth throughout the region.

- According to cluster mapping and a gap analysis, the study region is not missing any key components for creating an oil and gas cluster, and the fracking industry could serve as a "driver" industry when traditional extraction becomes obsolete.
- Economic developers can focus on forming partnerships with universities and colleges to create specialized regional workforce development programs. They can also focus on assisting the fracking industry with research and development to ensure that the existing fracking companies in the region are provided with the most innovative, productive and efficient tools and practices for cost effective extraction of oil and natural gas. In addition the economic developers could strive for policy reform or implementation that encourages companies to be compliant with environmentally safe practices.
- Economic developers and decision makers should consider attracting service companies, including drilling, mud logging, and trucking.

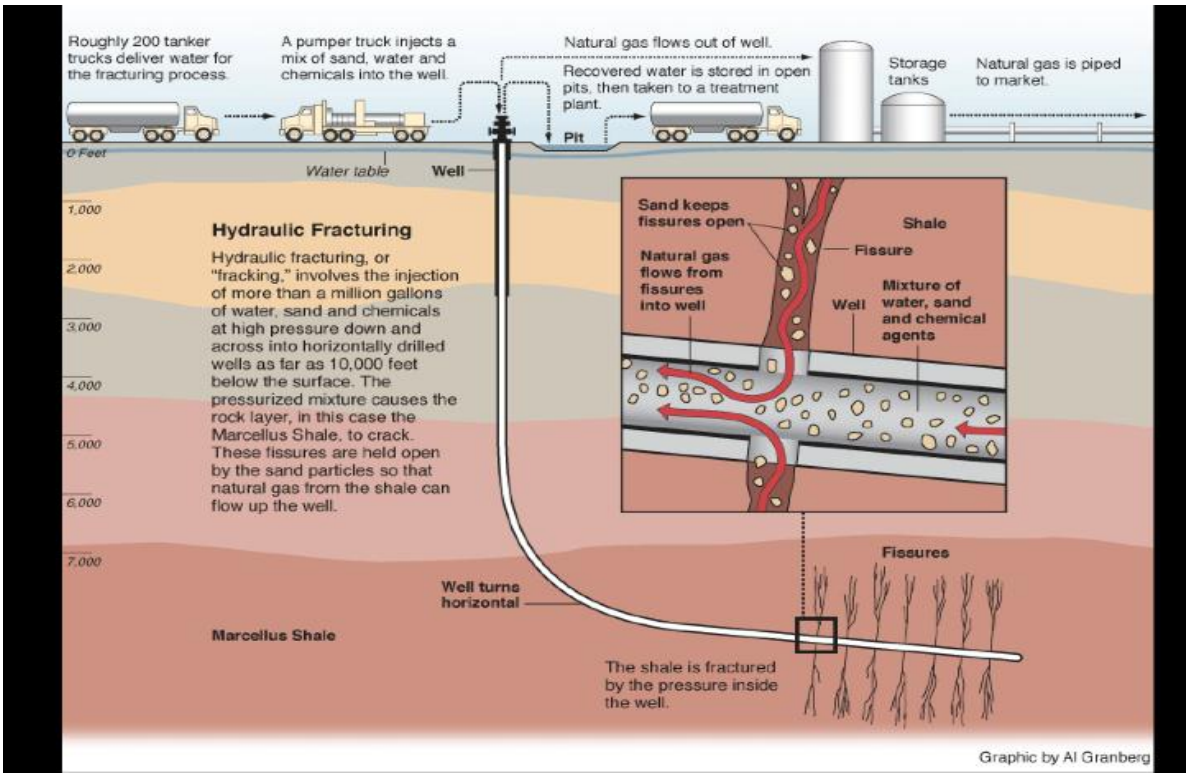
This section focuses on the history and trends of the fracking industry. Its sudden impact originated from a combination of two widely used oil and natural gas extraction methods to extract deposits that were once perceived as inaccessible. Similar regions have experienced

economic development benefits and challenges resulting from a sudden fracking boom. States, municipalities and other entities have addressed these challenges. In those cases, policy reform and progressive policy innovation were required and will need to be taken into consideration for the southwest Mississippi, eastern Louisiana region.

Finally, this section presents the findings of a shift share analysis and the possibility that the southwest region possesses a competitive advantage based on the analysis of three distinct components: proportional shift, industrial shift, and economic growth. This shift share is used to recognize the potential for oil and gas cluster development in the region.

Fracking is the process of accessing oil and gas deposits that were thought to be inaccessible until Texas oil engineers combined two technologies to release natural gas trapped in shale formations (see Figure 9).

Figure 9. Hydraulic Fracturing Process Illustrated



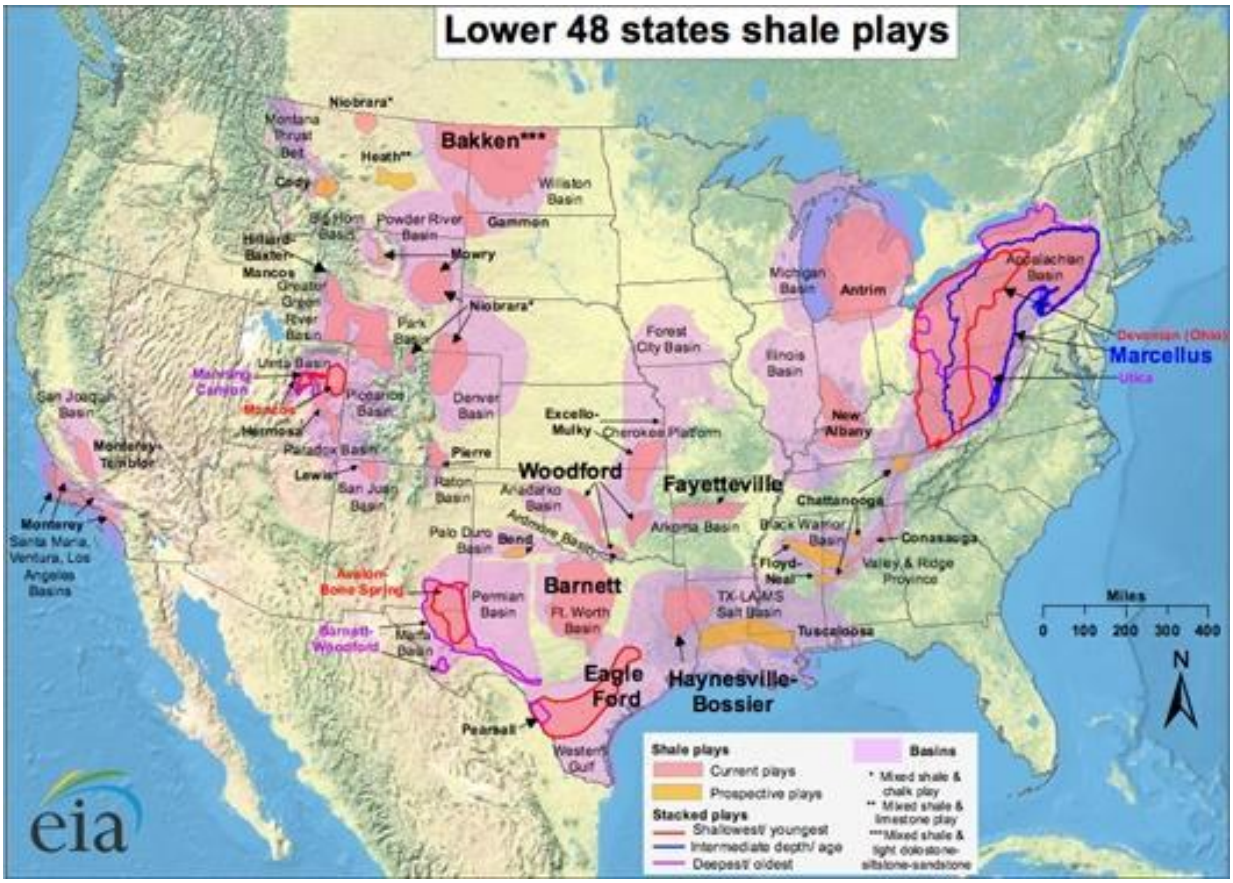
Source: Hage, 2012

This innovative technology consists of a combination of horizontal drilling and hydraulic fracturing with the purpose of separating the natural gas and oil from the shale ("The Facts About Fracking," 2011). Horizontal drilling is a process traditionally used by oil engineers to reach wells that turned sideways after reaching a certain depth. Hydraulic fracturing is a process in which water; sand and chemicals are injected into the well at high pressure.

Impact on the United States

This revolutionary method resulted in a new and unexplored process of domestic oil and natural gas extraction of deposits that were formerly inaccessible. Figure 10 exhibits the shale plays in the United States that are accessible for fracking.

Figure 8. U.S. Oil Shale Plays



Source: Hage 2012

The boom in Liquid Natural Gas (LNG) extraction is solely credited to the practice of fracking. According to the Wall Street Journal, in 2000 shale gas was one percent of America's gas supplies, and today it is twenty-five percent ("The Facts About Fracking," 2011). United States gas reserves were declining and prices were exceeding fifteen dollars per million British thermal units prior to the fracking breakthrough. Ports were being built for LNG imports. Today, unit prices are four dollars, and ports are being retrofitted for LNG exports.

The Impact of Fracking on Economic Development in Other Regions

During the fracking boom many cities, counties and states experience unprecedented economic development to that region. The boom is credited with reviving parts of the country

suffering economically. It also encourages reshoring of many U.S. oil and gas manufacturers while offering a persuasive incentive for existing manufacturers to remain in the country ("The Facts About Fracking," 2011).

The fracking industry has been credited as the economic savior of states such as North Dakota and Pennsylvania. The Marcellus shale, which extends from upstate New York to West Virginia, is responsible for 72,000 jobs in Pennsylvania during a period of two years ("The Facts About Fracking," 2011). The emergence of the fracking industry justifies North Dakota's claim to the nation's lowest unemployment rate. Horizontal drilling in the once thought inaccessible Bakken formation along the Montana-North Dakota border contributed to a 3.2 percent unemployment rate in 2011 ("The Facts About Fracking," 2011).

In recent years fracking has been the target of much scrutiny, regardless of the amount of job creation it created. Critics of the oil and natural gas extraction claim that fracking is detrimental to the environment. According to the Wall Street Journal prominent environmentalists are targeting the fracking industry by making accusations and publishing studies that argue fracking contaminates drinking water and causes cancer, earthquakes, and pollution ("The Facts About Fracking," 2011). These claims have been successfully refuted or immediately addressed.

The argument that fracking causes contamination of drinking water has been refuted because drinking wells are located hundreds of feet below the surface whereas shale formations are located thousands of feet below the surface ("The Facts About Fracking," 2011). Environmental Protection Agency (EPA) administrator, Lisa Jackson, stated in a briefing to the U.S. Congress that there is no plausible evidence that "the fracking process itself" is responsible for drinking water contamination U.S. ("The Facts About Fracking," 2011). In addition,

according to Chesapeake Energy, shale plays are located too deep to corrupt the drinking wells, at least "7,700 the equivalent of more than six Empire State Buildings stacked end to end, one and a half times deeper than the deepest part of the Grand Canyon and more than twenty-five football fields laid out goal line to goal line" (Chesapeake Energy, 2012, p.3). There are state mandates in place ensuring that fracking companies protect freshwater sources. "Current well construction requirements consist of installing multiple layers of protective steel casing surrounded by cement that is specifically designed and installed to protect freshwater aquifers" (Chesapeake Energy, 2012, p.3).

Another common challenge presented by fracking is the sudden influx of materials and products transported by commercial vehicles, which cause irreversible damage to roads and highways. According to Carter (2013), Amite County officials are familiar with the damage the truck traffic can cause during a "shale boom." Currently, Amite County officials are predicting damage to roads based upon their experience with damage resulting from recent drilling. Amite County Chancery Clerk Ronny Taylor holds, "What we've experienced in the last year and a half is a hundred percent failure of our county roads. When I tell you one hundred percent failure, we have blacktopped roads that have gone back to gravel" (Carter, 2013).

Economic development leaders aiming to recruit more fracking industries to the area should focus on the best possible infrastructure to ensure the greatest pull factor. "States with the infrastructure in place, and especially those that lead in natural gas consumption for electricity generation, will likely be big winners" (Batson, 2009, para. 8). Agencies in the study region should first consider the cost of preparing infrastructure in advance of a company's arrival to prevent unbearably expensive maintenance and upkeep, which can hinder their cause.

State and local governments in Wyoming and Pennsylvania addressed claims that fracking releases toxic or radioactive chemicals, ranging form citric acid (found in soda) to benzene, by adapting policy to fracking industry practices ("The Facts About Fracking," 2011). Wyoming and Pennsylvania requires companies to publicly disclose the chemicals present when drillers dispose of fracking fluids containing chemicals ("The Facts About Fracking," 2011). Careful public policy planning is needed to be proactive in order to prevent unexpected environmental protests.

Fracking on Economic Development in the Study Region

The primary shale encompassing the Tuscaloosa formation extends from Alabama to Texas and includes other notable formations where drilling is currently underway. The fracking industry does not have a strong presence in the Tuscaloosa formation. Although there are current plays such as Haynesville-Bossier and Eagle Ford, the formation as a whole is virtually untapped due to inaccessibility

Preliminary Data Analysis of Hydraulic Fracturing Industry

Hydraulic Fracturing identified by the NAICS Code as 213111—Drilling Oil and Gas Wells—is responsible for 31.5 percent (749) of the total number (2,376) jobs created in the oil and gas industry between a ten-year period of time from 2001 to 2011 (see Table 19).

Table 19. Hydraulic Fracturing Industry Job Creation in Study Region 2001-2011

Total Jobs (OIL & GAS SECTOR**) 2001**	**Total Jobs (**OIL & GAS SECTOR**) 2011**	**Total Jobs (**Fracking**) 2001**	**Total Jobs (**Fracking**) 2011**	**Job Creation (**O&G Sector**) 01-11**	**Job Creation (**Fracking**) 01-11**	**Fracking Contribution to job Creation in SW O&G Sector**
85,054	**87,430**	**410**	**1,159**	**2,376**	**749**	**31.5%**

The fracking industry is responsible for the second largest job creation in the oil and gas sector for the study region (see Table 20). Also, the industry growth rate of 0.12 percent is significantly higher than the national industry growth rate of 0.04 percent.

Table 20. Leading Regional Job Growth Sectors

Rank	Industry/Description	Jobs Created 2001-2011	Percentage of Total Region O&G Sector
First	211111/Crude Petroleum and Natural Gas Extraction	2,104	88.5%
Second	213111/Drilling Oil and Gas Wells (Fracking)	749	31.5%
Third	325312/Phosphatic Fertilizer Manufacturing	251	10.5%

The data suggests that the fracking industry is a leading industry in overall growth nationally and regionally. However only a shift share analysis can accurately determine if an industry will have a competitive advantage in a localized region.

Shift Share Analysis of the Fracking Industry

A shift share analysis disaggregates the growth of an industry into its three contributing parts: economic growth, proportional shift/industrial shift, and differential shift (Blakely, 2010). Overall industry growth/decline has had an effect on the study region. In the ten-year period over fifty percent of the overall oil and gas industry has experienced a net job loss. However, within the oil and gas industry, fracking technology has contributed significant growth over the same period of time.

The oil and gas sector for the study region has an overall shift share of -6.56 as compared to a fracking industry shift share of 139.14 indicating that this region has a competitive advantage. Typically, similar industries follow the general economic growth trend of its respective industry sector because the industries share one or more similar driving factors. If a particular industry shows a behavior contrary to the trend, it is usually due to the presence of an outside or environmental factor that should be carefully evaluated for cause-and-effect relationships (Blakley, 2011). There are two potential factors of this study which explain the significant positive shift in the fracking industry: 1) advances in technology, 2) aggressive and progressive changes in policy during a relatively short time period.

Advances in technology contribute to sustained industry growth as a whole by providing methods to access previously inaccessible shale formations. The constant evolution of technology has also resulted in more efficient and affordable procedures. Aggressive policy changes discussed later in the report are important in the strong positive shift because they allowing fracking industries to practice with fewer regulatory standards.

The fracking industry has a faster growth rate/differential shift in the study region (0.12) than nationally, and it is growing slightly faster than expected when compared to the national growth rate of 0.04. Furthermore, it is evident that the hydraulic fracturing industry in the southwest study region has a competitive advantage or at the very least potential for a competitive advantage.

Polymer/Chemical Clusters and Economic Development
Molly Egloff

This section examines the polymer/chemical industry in the study region. Most of the sector is located in Louisiana, but there are pockets in the southwest Mississippi region. The polymer/chemical industry is connected to the oil and gas cluster as a recipient of the raw materials extracted through fracking technology.

Key Points of this Section:

- Polymer and chemical industry in the U.S. is on the rise due to shale gas development. Already, the nation's natural gas prices have significantly dropped between $12.50/MTBU in 2008 to $3.00/MTBU in 2012 – and they are continuing to decrease, ("Shale gas: reshaping the U.S. chemicals industry, 2012).
- Currently, the study region is experiencing some growth in jobs for six-digit NAICS industries considered sub-industries under the three-digit codes, 325, Chemical Manufacturing and 326, Rubber and Plastics Polymers Manufacturing.
- The top five include 1) phosphatic fertilizer manufacturing, 2) polish and other sanitation good manufacturing, 3) all other miscellaneous chemical product and preparation manufacturing, 4) plastics bottle manufacturing, 5) and all other rubber product manufacturing.
- To secure a stronger cluster, it would be wise for the region to recruit and develop basic chemical manufacturing firms to support these intermediate to finished chemical product manufacturing firms. Not only would all of the industries find the easy and low-cost energy supplies in the area to be attractive, but the close proximity to suppliers would minimize costs as well.

- Policymakers and economic developers should consider consulting with environmental experts when developing partnerships with chemical/polymer industries to ensure environmental sustainability for both the individuals living in the study region and for the future use of these non-renewable fuel sources.

Polymer and chemical firms, especially those that exist or that may be recruited to this study region in support of oil and gas cluster, are classified under the NAICS Manufacturing Sector. This portion of the study will specifically focus on, but is not limited to, codes 325 and 326, and the relationship with the oil and gas industries. Their definitions, according to the 2012 NAICS, are as follows:

> 325 Chemical Manufacturing: This subsector is based on the transformation of organic and inorganic raw materials by a chemical process and the formulation of products. There are two types of chemical firms that are distinguished under this code; firms that produce basic chemicals and firms that produce intermediate and final products from the basic chemicals. An example of a basic chemical production firm would be the $4.1 billion ethylene cracker and derivatives complex that is being constructed by the Sasol plant in Calcasieu Parish in Louisiana. Georgia Pacific's facilities in Louisiana manufacture intermediate and finished chemically based products, including tissue products, printing paper, and corrugated containers.
>
> 326 Plastics and Rubber Products Manufacturing: Industries in this sector process plastics materials and raw rubber, selling to other companies to create a finished product. They are a distinguished subsector because they mainly focus on plastics or rubber product production. An example of one of these firms would be Acadiana Plastics Molding, Inc. in New Iberia, Louisiana.

In order to provide the most practical information possible, this portion of the study will also present the most competitive industries classified by the six-digit NAICS codes that begin with 325 and 326. This will provide a more specific description of the types of firms that could be the strongest supporting industries to retain, expand, or recruit for an oil and gas cluster.

Industry Trends

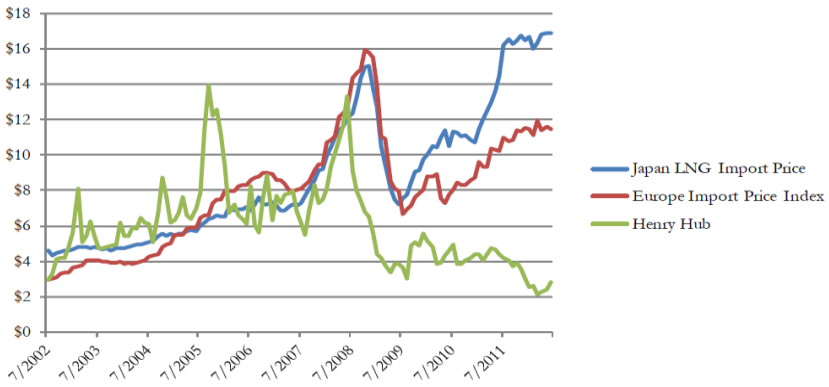
According to the Texas Chemical Council and Association of Chemical Industry, chemical firms directly touch more than ninety-six percent of all manufactured goods (Rivero, n.d.). This overwhelming percentage shows that recruitment of chemical and polymer companies would be a sustainable and smart choice for economic development efforts in an area that would be conducive to such industries.

What does an ideal location look like for a chemical and polymer cluster to exist? Experts agree that internal factors, such as educational and research institutions, government support through policymaking, and a skilled workforce are necessary. An area that is poised to host a successful and sustainable polymer and chemical cluster would require fracking technology capable of extracting raw materials from shale gas basins (PwC, 2012).

Polymer and chemical industry clusters in the U.S. are on the rise (Scott, 2012). Certain regions in the U.S. have a competitive advantage to grow and sustain strong polymer and chemical clusters because of an abundance of shale natural gas reserves. Chemical industries in the U.S use natural gas to produce ethylene--the key ingredient used for many forms of chemical or polymer products. Europe's chemical cluster, one of the major export competitors for American polymer and chemical industries, relies on imported oil to produce ethylene. As of December 5, 2012, oil exceeded the price of natural gas at a ratio of 25:1 (Scott, 2012). The cost difference of a foundational chemical input for production as seen in Figure 11 creates a

significant competitive advantage for states like Texas, New Jersey, California, and Louisiana (Scott, 2012).

Figure 11. Natural Gas Prices by Region ($/mmBtu) (Source Scott, 2012)



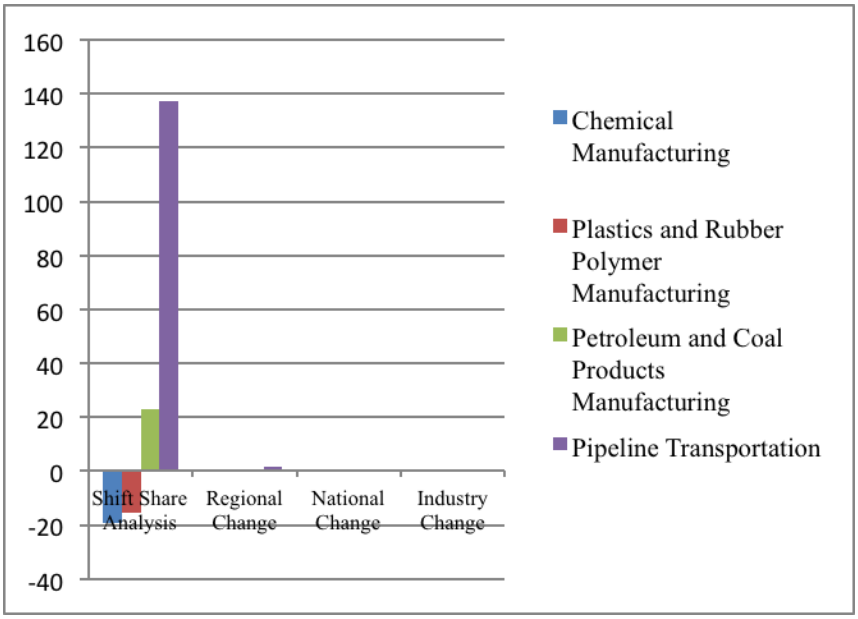
As illustrated in Figure 11, the comparison between the prices for fuels for Japan, Europe, and the U.S. are telling. Japan's Liquid Natural Gas (LNG) import price and Europe's oil import price index are approximately five to eight times higher than the cost of Henry Hub, Louisiana's natural gas pipeline subsidiary of Chevron Corporation. Currently, the chemical industry on the national level is known for its innovation, productivity, growth, and global competitiveness. Technologically advanced industries rely on government policies that encourage innovation, and the chemical industry ranked number seven for the amount of patents produced in the U.S. in 2007, accounting for five percent of the nation's total patents (Ketels, 2007, p. 25).

Regional Trends

The data for the region's chemical and polymer industries according to NAICS three-digit codes 325 and 326 looks bleak compared to the oil and gas industries (See Figure 12). The shift-share in Figure 13 indicates that the study region has extremely low job growth for

chemical and polymer manufacturing firms, while it indicates high job growth for industries that are a part of an oil and gas cluster.

Figure 12. Job Growth Comparison for Chemical/Polymer Manufacturing and Petroleum Coal Products Manufacturing for the Study Region



One glance at the extremely low job growth for chemical and polymer manufacturing in the study region may deter an economic developer from speculating any cluster potential. Not only does Figure 12 show a negative share of jobs for chemical and polymer industries, but it also depicts little to no growth on the national level as well. A more in-depth analysis is needed to accurately depict the industries that locals would know exist and thrive within Mississippi and Louisiana.

Based on the six-digit NAICS codes, the shift-share analysis of the industries within Louisiana and Mississippi has indicated some specific local polymer and chemical firms that are growing (see Figure 13). Imminent access to the supplies of natural gas from the Tuscaloosa Marine Shale could create the opportunity to recruit chemical and polymer industries already

growing in the area. As noted in the previous Quantitative Analysis Section, the top five most viable industries within the study region are competitively sharing the nation's jobs in the chemical, rubber, and plastics polymer manufacturing sectors. These include phosphate fertilizer manufacturing, polish and other sanitation goods manufacturing, miscellaneous chemical products and preparation manufacturing, plastics bottle manufacturing, and all other rubber product manufacturing. The growth rate of these industries in comparison to the total national economy indicates that these five industries have been growing within the study region but are not performing as well elsewhere. The industrial mix helps to determine the extent to which local industries factor into the growth or decline of a cluster as indicated by a shift-share analysis. One will notice that each of these industries has grown to provide a significant portion of jobs to individuals living within the study region. Recruitment, retention, and expansion efforts could increase those numbers.

Figure 13. Southwest Mississippi and Louisiana's Chemical and Polymer Industries with a Regionally Competitive Shift-Share

NAICS Code	Industry	Region Jobs 2001	Region Jobs 2011	Nat'l Jobs 2001	Nat'l Jobs 2011	Total Nat'l Employment 2001	Total Nat'l Employment 2011	Nat'l Growt	Industrial Mix	Shift-S	Total Economic Change
325312	Phosphatic Fertilizer Manufacturing	15	266	8064	6906	165430818	176290933	0.98	0.21	253.15	253.93
325612	Polish & Other Sanitation Good Manufacturing	1	25	30788	25429	165430818	176290933	0.07	0.24	24.17	24.00
325998	All Other Misc Chem Product & Prep Manufacturing	47	153	39419	37392	165430818	176290933	3.09	0.12	108.42	111.39
326160	Plastics Bottle Manufacturing	19	257	36768	31113	165430818	176290933	1.25	0.22	240.92	241.95
326299	All Other Rubber Product Manufacturing	5	77	41875	25219	165430818	176290933	0.33	0.46	73.99	73.85

(Source: Data from the Mississippi Department of Employment Security, 2012)

The Texas Chemical Council is clearly pro-shale natural gas development, as President and CEO Rivero (n.d.) stated, "Access to shale gas has the potential to dramatically boost Texas' and America's competitiveness and help meet our nation's goals for increased job growth and

global exports" (para. 13). According to the Wall Street Journal, there have been sixteen proposed facilities that will serve as Liquefied Natural Gas (LNG) export terminals, but currently the U.S. is not exporting any LNG, (cited in Perry, 2013*)*. This is a sign of major economic growth occurring within this study region.

Mississippi Governor Phil Bryant's temporary severance tax cut for firms that are horizontally drilling oil and natural gas wells in Mississippi could create an oil rush for incoming and growing firms that are looking to capitalize on this incentive package. This increase in oil and gas development may boost job growth for the already growing polymer and chemical industries in Figure 14 because of overlapping industry needs and resources, thus allowing the establishment of a supporting cluster.

Figure 14. Density of 325 and 326 NAICS Industries within Southwest Mississippi

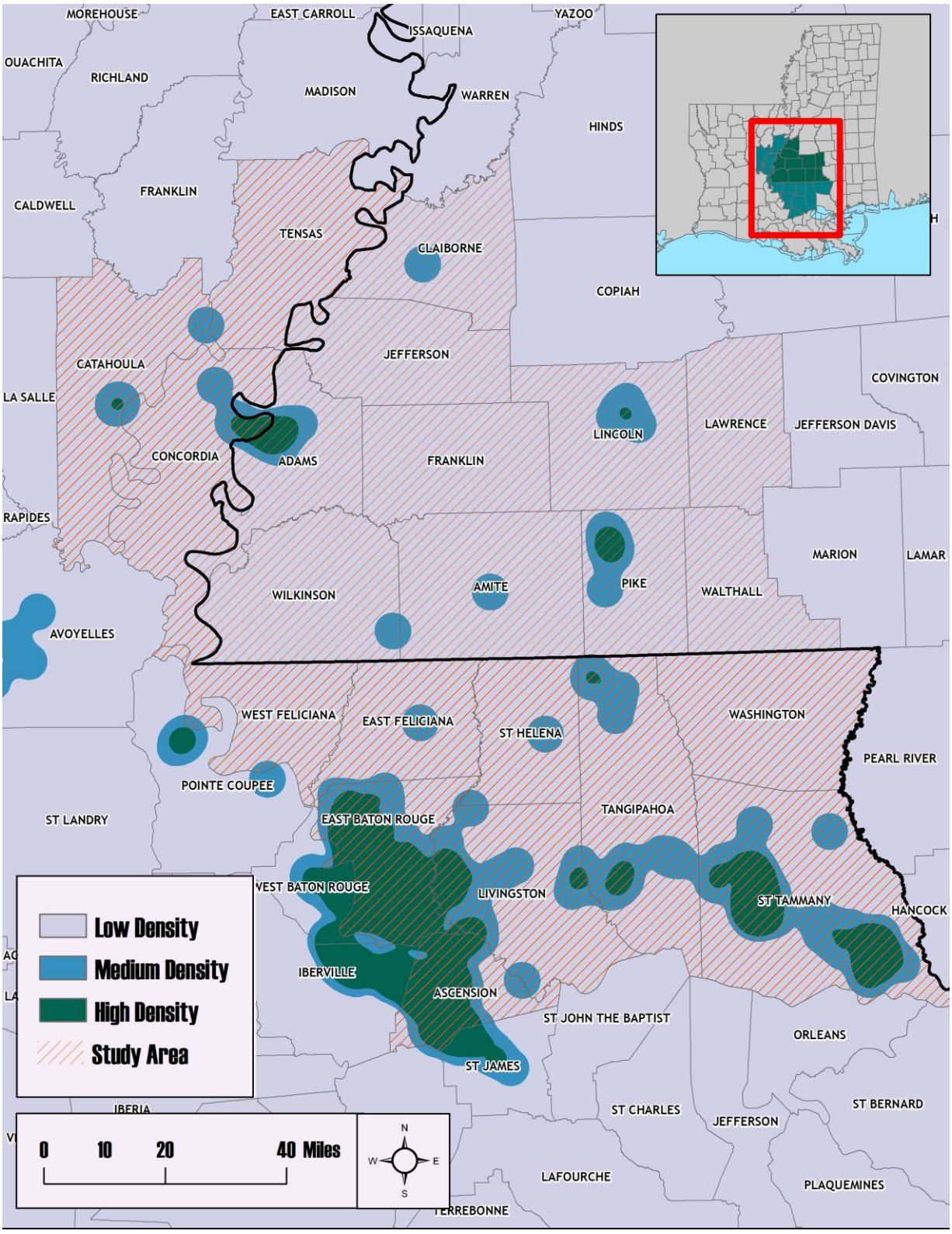


Figure 14 illustrates the current presence of the chemical and polymer manufacturing industries in the NAICS three-digit codes 325 and 326, especially along the Mississippi River. Although Figure 12 indicates there has been a significant amount of job loss for Chemical Manufacturing, 325, and Plastics and Rubber Polymer Manufacturing, 326, within the study region, the six-digit code shows that there actually has been significant growth within the region. Data collection and detailed research has evidenced the development of an oil and gas cluster, and a polymer and chemical cluster could complement it. Economic developers in the study region could take advantage of the abundance of natural gas in combination with the established research institutions and workforce training to create thousands of new jobs for the study region (Ketels, 2007).

Research has shown that the location of strong clusters "appears naturally," and there are many factors necessary for fostering an excellent cluster, (Ketels, 2007, pp. 8-10). The top five industries in Figure 13 are all considered to be manufacturers of intermediate to finished consumer-ready products. The gap analysis indicated that the recruitment and development of basic organic and inorganic chemical manufacturing facilities to both Louisiana and southwest Mississippi would be necessary for an excellent polymer and chemical cluster. Basic chemicals make up close to nineteen percent of all U.S. employment and offer wages that are ten percent higher than the average for the country's chemical industries as a whole. Semi-consumer-ready to consumer-ready chemical manufacturing, such as the polish and sanitation manufacturing industries that have seen job growth in the study region, have less than average wages and make up sixteen percent of the country's employment (Ketels, 2007, p. 25).

Recruiting basic chemical manufacturing industries to an area with existing, growing similar companies would only boost economic growth. A combination of factors can be cited to

reinforce this claim: the access to significant amounts of natural gas; close proximity to companies that need basic chemicals, such as alkaline and chlorine for production purposes; higher education institutions with established programs and research that will encourage innovation; and community and junior colleges able to provide workforce training programs with state incentives that cut costs.

Environmental Factors

A combination of both quantitative research and qualitative research should guide the construction of any policies or incentives related to encouraging a polymer and chemical industry cluster. The quantitative analysis provides insight into the initial perspectives of economic trends that may be occurring within the region. Qualitative data provides an "account of real economic relations" when merged with quantitative data to get an accurate picture of the existence of a cluster. Although some established research argues in favor of a polymer and chemical industry cluster in an area like southwest Mississippi, decision makers must address the controversy over the environmental effects from these industries in states with established clusters. Proper government oversight and enforcement, along with environmental stewardship, is necessary. "The process of extracting natural gas from shale deposits includes fracking where fluids and solids and pumped into the well," making environmental regulations and enforcement crucial according to Rivero (2013, para. 10). While there are expected to be hundreds of years of energy resources lying within the Tuscaloosa Marine Shale, these are limited natural resources. In order to protect nonrenewable fossil fuels, Mississippi and Louisiana must balance preserving the environment while capitalizing on the availability of domestic natural gas.

If a polymer/chemical cluster is developed in this region, policies should be carefully considered to protect the environment and the people living around the industrial sites. Chemical

industries in the past have argued that strict pollution controls and regulations will result in fewer jobs (Allen, 2003). Based on the EPA's Toxic Release Inventory (TRI) and the Census Bureau's employment data, Dr. Paul Templet developed an emission-to-job (E/J) ratio and refuted the claim of fewer jobs (Allen, 2003). "The E/J ratio is derived by dividing the toxic emissions for a sector of the economy by the jobs provided by the same sector" (Allen, 2003, pp. 59-60). On a national level, Dr. Templet found that chemical industries produce the most toxic emissions at 1,859 pounds per job. On a state-by-state basis, the states with low pollution controls and relaxed regulating agencies have higher E/J ratios than those states that do have strong anti-pollution polices. Further, those states like Texas and New Jersey that take an active role in partnering with chemical and polymer companies to protect the environment are also coincidentally considered the number one and number two states for chemical manufacturing (Allen, 2003).

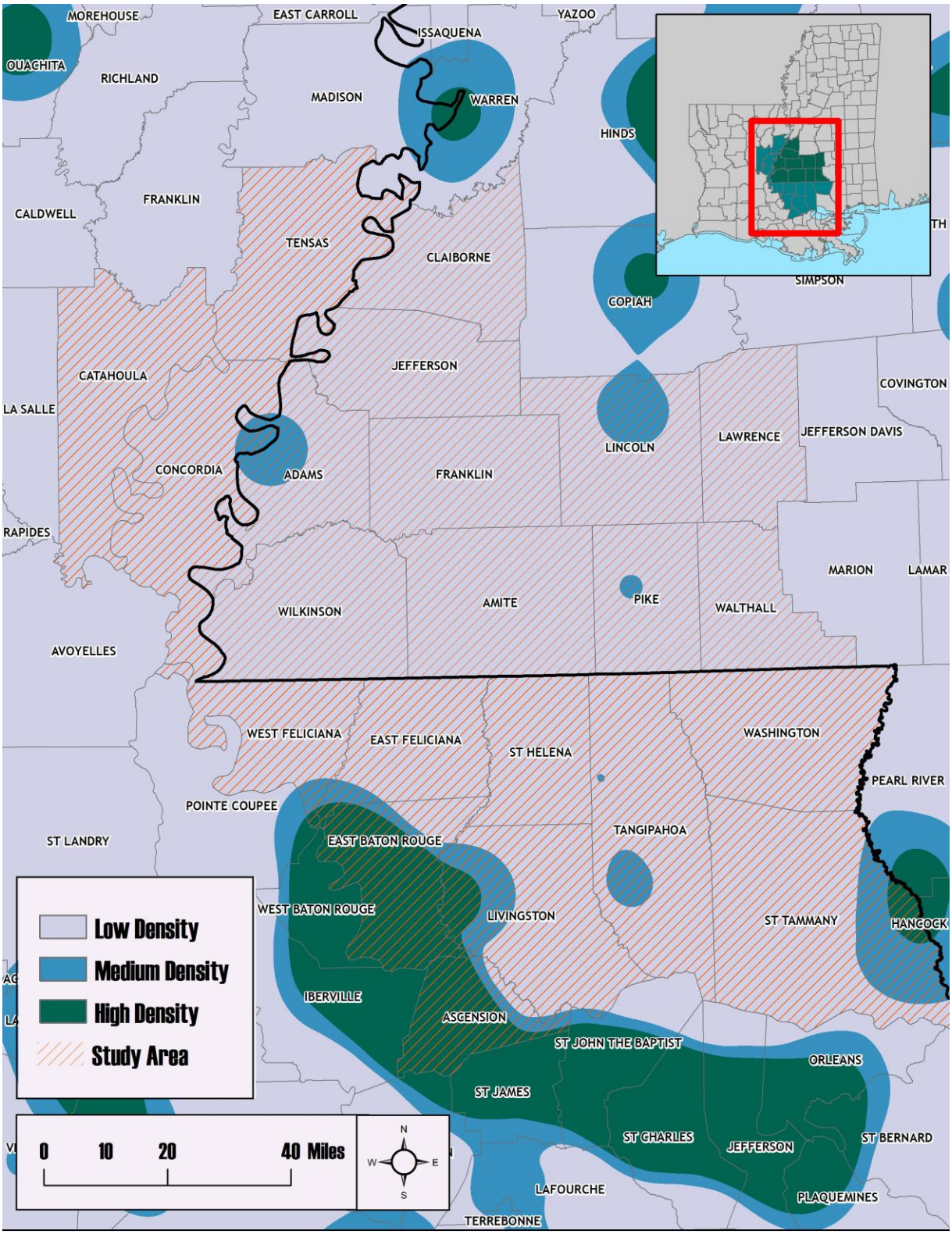
Texas produces 15.3% of the chemicals by value and has about 8,997 pounds of toxic waste per job. Following close behind, New Jersey has about 8.4% of the chemical production, and only 1,084 pounds of toxic waste. Louisiana follows New Jersey in third place for the top chemical-manufacturing states in the nation. It only produces 6.7% of the national chemical production, less than half of Texan chemical production, and produces 16,280 pounds of pollution associated with each job (Allen, 2003, pp. 59-60).

According to Allen (2003), the lower E/J ratio in Texas and New Jersey shows that these states have thoroughly distributed environmental harms throughout the public sector; therefore they absorb less pollution per job. Also, New Jersey has a low E/J rate because they recruit both intermediate to finished-product chemical manufacturing firms as well as basic chemical manufacturing firms. If this theory holds true, it only provides more incentive for southwest Mississippi and eastern Louisiana to recruit, develop, and expand more basic chemical firms in

addition to supporting the growth of intermediate to finished-product chemical manufacturing firms.

The pollution produced by the chemical companies in Louisiana has been condensed within nine adjacent parishes along the Mississippi river, known as the Chemical Corridor, making the impacts very visible and potentially harmful for the residents living nearby (see Figure 15). Allen (2003) cited that there have been multiple cases of children diagnosed with a rare, highly malignant, soft tissue tumor called rhabdomyosarcoma within this region. In fact, in the early 1990s, three children living in Ascension parish were diagnosed with this disease within a fourteen-month span. A disease so rare, that it only affects 1 in every 250,000 children a year in the United States. At another time, four children from Zachary, Louisiana fell victim to the same aggressive tumor within a short period of time. Although the oncologist working with the children requested a study, they died and no research was ever completed (Allen, 2003, pp. 144-145). Policymakers should solicit the help of environmental professionals in aiding with future economic development decisions to create the most beneficial chemical and polymer cluster for the study region.

Figure 15. Environmental Contamination



It is estimated that by 2025, shale gas development could add more than one million workers to the U.S. manufacturing industry. If this comes to fruition, chemical and polymer firms among other manufacturing firms could see raw material and energy costs lower to over $11 billion (PwC, 2012). As these firms have already witnessed a significant drop in the price of U.S. natural gas, the main energy feedstock used for production, from $12.50/MBTU in 2008 to around $3.00/MBTU in 2012, it is no surprise that a chemical/polymer cluster development in an area like southwest Mississippi would be discussed (PwC, 2012). Recent government policies regarding horizontal drilling and fracking, the abundance of shale oil and natural gas, the availability of higher education institutions, and the established chemical/polymer firms that have already experienced job growth combine to create an ideal location for an excellent chemical/polymer cluster.

Marketing and Business Development Policies and Actions
Alex Pickle

This section focuses on resources available to the Southwest Mississippi Partnership. In terms of attraction and cluster development, the region and the State of Mississippi are focusing on the energy sector, which means a particular emphasis on the oil and gas industry. The state has several incentives for extraction companies and supporting industries. The region's community colleges and universities offer a variety of programs applicable to the oil and gas industry as well as chemical manufacturing and polymer science. Industry trade shows are abundant in the region and internationally providing a valuable avenue for marketing and networking. In short, resources for the oil and gas, chemical manufacturing, and polymer industries are abundant in Mississippi.

Key Points of this Section:

- The area's community colleges and universities offer numerous programs relevant to the oil and gas industries, from petroleum engineering and well construction to polymer engineering and logistics, trade, and transportation.
- To develop the oil and gas extraction industry, especially using Enhanced Oil Recovery and carbon dioxide, specific severance and sales tax incentives have been made available through the state.
- A number of organizations, including the Mississippi Development Authority, the Mississippi Polymer Institute, the U.S. Oil and Gas Association Mississippi/Alabama Division, and the Southwest Mississippi Partnership are working to promote oil and gas and/or offer services relevant to the industry.

- Enhancing export efforts with the assistance of MPI and the Mississippi World Trade Center is a key aspect of cluster development.
- A comprehensive marketing strategy, including creating a united brand for the region, establishing a presence at international industry trade shows, and gaining exposure in industry publications, is needed to guide development efforts.

Skilled Workforce

The workforce in the area is uniquely qualified for jobs in these fields. The Mississippi Department Employment Services (MDES) helps match job seekers with companies and with industry-specific training. Serving as a bridge between employees and educational opportunities, MDES and the statewide network of WIN Job Centers provide pre-employment and post-employment services to individuals and companies (MDES, n.d.).

The area's community colleges offer numerous programs relevant to the oil and gas industries and manufacturing industries. Southwest Mississippi Community College, for example, offers degrees in well construction and process operations that are specific to the oil and gas industry (SMCC, n.d.). They also offer a welding and cutting degree and an occupational safety and health degree. Other community colleges in the state, including Mississippi Gulf Coast Community College, Pearl River Community College, and Jones Junior College, also offer relevant programs.

In addition to the community college programs, the University of Southern Mississippi offers highly skilled graduates from one of the most highly recognized polymer science programs in the country. The University is a valuable source of research and development, whether through the Mississippi Polymer Institute or academic departments. Southern Miss's Center for Logistics, Trade, and Transportation is also an asset to industries in the state, acting as

a driver of "practical, cutting-edge, interdisciplinary knowledge and technologies to advance logistics, trade, and transportation" in the gulf region (CLTT, n.d., "Mission of the CLTT"). As logistics and supply chains are key factors for many companies, this center could provide valuable information and graduates prepared for jobs in this important sector.

Louisiana State University in nearby Baton Rouge, Louisiana has much to offer the oil and gas industry. The Center for Energy Studies holds a wealth of information on energy and natural resources although the organization mainly works in state. What may be more beneficial to the region is the university's engineering department. The department offers degrees in chemical, environmental, and petroleum engineering, among many others, all of which could be beneficial to developing the skilled workforce in southwest Mississippi (LSU College of Engineering, n.d.).

Severance Tax Reduction and Sales Tax Reduction

Mississippi Governor Bryant's administration has developed "Energy Works-Mississippi's Energy Roadmap," which outlines the state's specific goals for developing Mississippi's energy industry. Among these goals is the development of the oil and gas extraction industry, especially using Enhanced Oil Recovery (EOR) and carbon dioxide (MDA, 2013). These technologies are especially pertinent to companies in the southwest Mississippi region, as they allow economical access to gas that was previously not feasible to extract. Specific incentives in new legislation include a severance tax reduction for horizontally drilled wells and a sales tax reduction on electricity for Enhanced Oil Recovery (from 7% to 1.5%). These tax incentives not only help boost the bottom line of existing companies, but they can additionally help attract new companies to the state. Cutting taxes on these companies will also

help attract investment into the region, as lower taxes helps to maximize investors return on investment (MDA, 2013).

Business Support Services

A number of business support resources are available to companies in the region. The Mississippi Development Authority (MDA), the Mississippi Polymer Institute (MPI), the U.S. Oil and Gas Association Mississippi/Alabama Division, and the Southwest Mississippi Partnership are all organizations that are working, at least in part, for the benefit of these industries in the state. Each of these organizations independently markets Mississippi to companies looking to expand or relocate. In addition, they are tremendous assets to existing businesses in the region. Each organization offers a unique benefit to Mississippi companies. As these industries begin to gain even more traction in southwest Mississippi, even more efforts to aggressively market the area's resources will be useful to continue growth.

Some of these, like the MPI, focus more on technical services. MPI offers contract research and development work for companies needing assistance with materials. They can perform physical testing and do rapid prototyping with 3D printing. Outside of the labs, MPI can provide Six Sigma Black Belt and Lean Manufacturing certification programs (MPI, n.d.).

Others, like U.S. Oil & Gas Association: Mississippi/Alabama Division, are more active on public policy issues. They provide a united voice for companies in the industry to ensure that their interests are communicated to policy makers. They host conferences and publish periodicals to keep all members informed on current events in the industry. The organization acts as a forum for member discussion and industry analysis creating a great environment for collaboration (U.S. Oil & Gas Association: Mississippi/Alabama Division, n.d.).

Some focus more on economic development in general. The Southwest Mississippi Partnership and the MDA each offer general services to Mississippi businesses. Whether the company has issues with site selection for relocation, expansion, or having trouble finding a quality workforce, these two organizations can assist with these and many other problems. Bridging the gap between the public and private sector, these economic development associations can assist in expediting zoning and regulation procedures, as well as matching companies with public incentive programs (Southwest Mississippi Partnership, n.d.; MDA, n.d.).

Growing export activity among companies in the region has been identified as an important focus for cluster development. In terms of export promotion, the Mississippi World Trade Center (MSWTC) offers valuable services for making connections and conducting business abroad. These services include "educational seminars, conferences, workshops and briefings on opportunities and how to do business with other countries; assistance with international business plan development; customized market research; consulting and matchmaking; trade leads and partner referrals" (MSWTC, n.d. para. 1). While these services may not be industry specific, the organization's expertise in export promotion can certainly benefit any industry. In addition to the MSWTC, the MPI can also offer valuable international opportunities with its connection to the European Commission's Worldwide Intercluster Initiative for New Materials and Processes Focused on Clean Technology (WIINTECH). One of only two places in the United States connected to this European group; MPI gives Mississippi companies' connections with over 2,500 European companies in the advanced materials and energy sectors (Arnold, 2013).

Comprehensive Marketing Campaign

Mississippi's commitment to oil, gas, chemicals, and polymer manufacturing, and the resources that are available in the southwest region of the state are immense assets to the industries in the area. These assets must be properly represented to industry leaders outside of the region to generate outside investment. Mobile's Offshore Alabama (www.offshorealabama.com), an initiative run by the Mobile Area Chamber of Commerce, markets the offshore drilling industry in Baldwin County, Alabama. The principal idea of marketing a cluster can be applied to Southwest Mississippi Oil and Gas as well. If the region develops a united brand, it can more easily market itself and its companies.

Industry trade shows and industry publications provide excellent opportunities to market the region. Southwest Mississippi is well positioned geographically to take advantage of these events, as many are located in Houston and New Orleans. The Society of Petroleum Engineers' Annual Technical Conference and Exhibition (ATCE) is held in New Orleans, Louisiana annually (ATCE, n.d.). Houston, Texas is home to numerous conferences each year, including Water Management in Oil and Gas, Oil and Gas Procurement, and Cyber Security for Oil and Gas, which will all take place in 2013 (Oil & Gas IQ, n.d.).

While the relatively local trade shows offer convenience and networking close to home, to effectively promote the region, drive growth, and stimulate exports Southwest Mississippi Partnership must also look to market itself at international trade shows. With numerous trade shows on every inhabited continent, it is unlikely that Southwest Mississippi Partnership can feasibly reach each of these each year. However, it is important that the region establishes a presence at some of these events. In addition to trade shows, industry publications can be a valuable method of gaining international exposure. Placing ads in printed periodicals such as the

Oil and Gas Journal (www.ogj.com) or industry websites like Rigzone.com could be valuable parts of an overall advertising and marketing strategy. Using these resources to market the region itself, as well as assisting area companies in taking advantage of these opportunities individually, will be very beneficial in building the brand of southwest Mississippi oil and gas industry.

The Importance of Collaboration

Though all of these resources make the region primed for industry growth, and the marketing opportunities are numerous, building the cluster will take a united effort from the regional industry stakeholders. Company executives, employees, institutions, environmental specialists and economic developers must all be committed to the collaborative success of the industry in the region. If these parties are unwilling to join together for marketing and political efforts, the success of these initiatives will be much harder to achieve.

Oil and Gas Transportation Infrastructure
Faisal Mallum

This section of the report discusses the specialized transportation infrastructure needs of the emerging oil and gas development cluster in southwest Mississippi. It examines all the modes including trucking, rail, water, and pipelines.

Key Points of this section:

- The impact on roads from fracking will be significant so there is need for long-range planning, especially with a reduced severance tax.
- Local landholders in southwest Mississippi have had negative experiences in the past from small drilling companies not living up to their commitments for road maintenance, cleanup, etc.
- Despite the recent explosion in oil and gas production in the country, a number of oil companies have expressed concerns about profitability due to lack of efficiency in the transport system. Baker Hughes, an industry leader, reported a drop of 6 percent in their profit for the fourth quarter of 2011, citing shortages of materials and difficulty in getting equipment and materials to job sites.
- Production is originating in regions that have never generated this scale of output and must be transported to markets never before served.
- Pipeline is by far the lowest cost transportation method for oil, gas-refined products, chemicals, etc. Although the state of Mississippi has extensive oil and gas pipeline connectivity, additional pipelines may be required to accommodate increased industry activity.

- Flexible pipeline is more economical than truck and more flexible than pipelines because of its capacity to serve a dual purpose.
- Most of the fracking locations are rural areas with a low capacity transportation infrastructure incapable of supporting current truck traffic. Amite County, Mississippi has traditionally maintained roads, which were mostly used for the transportation of farm produce. This has radically changed due to the massive truck traffic and excessive truck weight that is beyond the county road capacity. The roads have been reduced from blacktop to gravel. The oil companies, principally Encana Oil and Gas and Goldrich Petroleum, have committed to help replace the damaged roads.
- The decision of the legislators to cut the oil and gas severance tax from 6 percent to 1.3 percent will further affect the maintenance of road facilities with the anticipation of more investments in the region.
- According to reports, upgrading the highway into a four- lane highway from McComb to Woodville will cost approximately $700 million. This is an amount that the state does not have at its disposal for undertaking such a project. According to reports from the Mississippi Department of Transportation (MDOT) Commissioner representing the region, if money is not allocated for the project, MDOT will first focus on building the section of the Highway 24 from McComb to East Fork to position McComb as the hub of the Tuscaloosa Marine Shale play. However, a bypass around the Amite county seat would not be constructed until after the highway extension is complete.
- Experts have forecasted that the county might see as much as 2,500 18-wheeler loads per well. This is a significantly increased number compared to the type of road facilities now available. In the future, trucks may be replaced by more economically viable modes of

transportation. However, many decisions depend on the quantity of shale gas available for exploration and the amount companies are willing to invest in infrastructure.

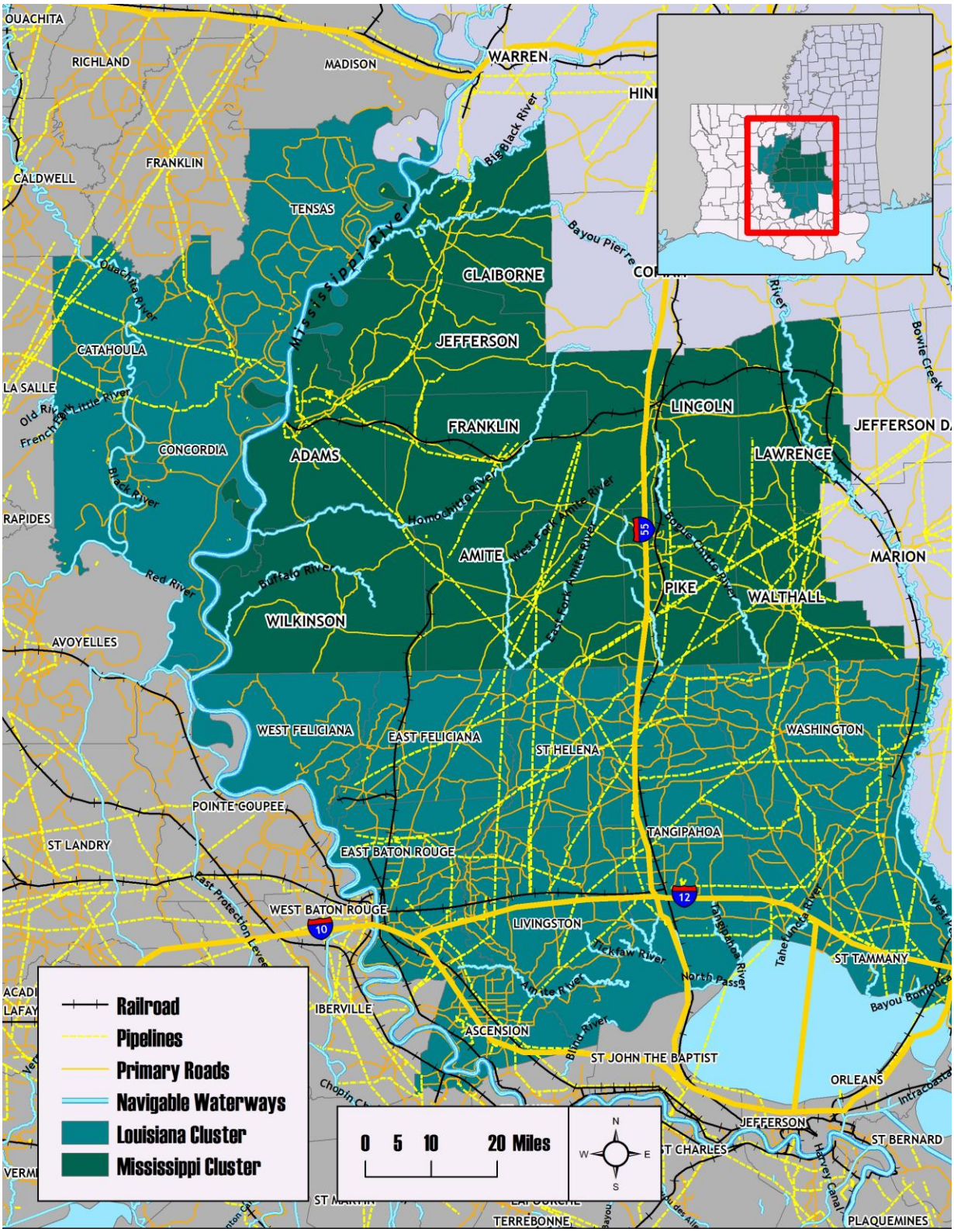
- Water for fracking is usually transported from fresh water sources or ground water sources to the fracking sites. Wastewater produced at sites has to be transported by trucks to disposal sites or recycling plants for processing. The cost of disposing of such wastewater ranges from a low of $0.002 per gallon to a high of $0.30 a gallon.
- Federal agencies including the U.S. Coast Guard, EPA, and Department of Transportation are currently reviewing the feasibility of transporting fracking wastewater by barge.
- Fracking methods in oil and gas extraction are a transport intensive venture, which leads to challenges such as an adequate workforce of truck drivers within the study area. Policy makers and stakeholders, therefore, may need to develop solutions for filling gaps in the transportation workforce.

Transportation is the key mechanism in promoting, developing and shaping every economy. Transportation infrastructures serve as the arteries through which goods and services are distributed; from the stocking of inventories by the producer to the supply of finished products to the final consumer. Transport policies arise because of the extreme importance in virtually every aspect of economic, social, and political activities of nation states (Slack and Notteboom, 2013). Transportation development in the United States has always been a collaboration of the private and public sector with the public sector spearheading investments. Governments seek to promote transportation infrastructure and services where capital investment or services may not be forthcoming. Shortage of funds for such infrastructural investments has always been the bane of transport development in the United States and other economies.

Logistics and transportation costs play a critical role in the economics of oil and gas development. Oil and gas must be transported from production locations to downstream processing facilities and from there to the markets and end users. Despite the recent rapid growth in oil and gas production in the country, a number of oil companies have expressed concerns about profitability due to lack of efficiency in the transport system. Baker Hughes, an industry leader, reported a drop of six percent in their profit for the fourth quarter of 2011, citing shortages of materials and difficulty in getting equipment and materials to job sites (Batson, 2012).

Hydraulic fracturing, a recently introduced gas exploration method, is a transport intensive venture that requires an extensive transportation infrastructure and network in the regions in which it is held. It is arguable that production is originating in regions that have never generated this scale of production and must be transported to the areas that have never before been served (Batson, 2012). Batson (2012) contended that while pipeline is by far the lowest-cost transportation method for oil, gas-refined products, and chemicals, the construction of pipelines cannot keep up with production due to the long lead times. In many cases, pipelines are not practical solutions because the life of individual oil wells may not justify the investment nor support the long-term production volume commitments. Although the state of Mississippi has extensive oil and gas pipeline connectivity, additional pipelines may be required to accommodate increased industry activity (See Figure 16).

Figure 16. TMS Transportation Infrastructure Map



‘’Flexible pipeline’’ has increasingly been the mode of choice for shale oil and gas operations, especially for remote locations (Batson, 2012). Flexible pipeline is more economical than truck and more flexible than pipelines because of its capacity to serve a dual purpose. Both inbound and outbound freight such as sand, chemicals, and equipment are transported to drilling sites. The resulting oil, natural gas liquids, and natural gas (LNG) production is transported from the wells to processing facilities and markets. Experts also contend that the flexible pipelines allow the oil producers the flexibility to quickly respond to regional crude oil price variations and seek out the best-price market or refineries.

Fracking is also a resource–intensive operation. It requires a significant amount of materials and supplies from large volumes of sand to heavy equipment for drilling activities. According to experts, estimates of the frac-sand market in 2011 were as high as 21.7 million tons and were forecasted to increase by at least thirty percent in 2012. However, not all sand is ideal for the process of fracking according to experts. The best quality frac-sand is quarried in Wisconsin, Arkansas, Minnesota, Iowa, Louisiana, Illinois, and Missouri. The transportation of this material will require an efficient mode like rail. Trucking may be too expensive depending on the location of the wells and the availability of transport facilities. In addition, rail is also used to transport outbound products produced from drilling sites to refineries, transportation nodes or end users.

Major drill sites located around southwest Mississippi have witnessed massive truck traffic. Most of the locations are rural areas with a low capacity transportation infrastructure incapable of supporting truck traffic. Amite County, Mississippi, a rural county with a population of only 13,400 people, is seated on a vast gas reserve. In previous years, county-maintained roads were mostly used for the transportation of farm produce to the market. This has radically

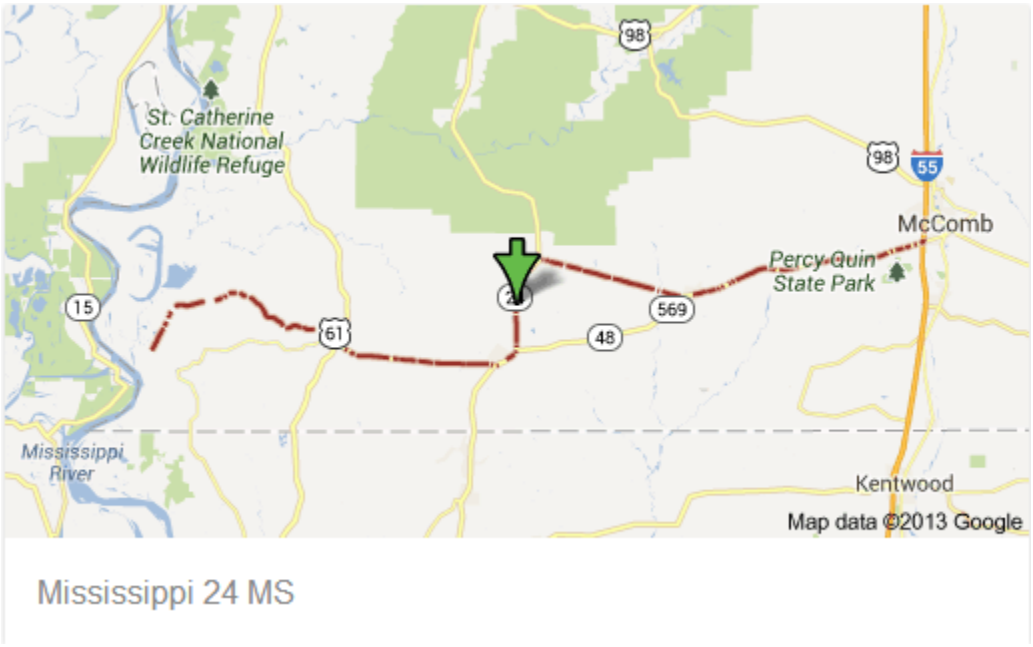
changed due to the truck weight and massive traffic the county is witnessing. County roads where not built to carry weight and traffic at the current capacity. According to Carter (2013), in the last year, citizens of the county are experiencing failure of the county roads. The roads have been reduced from blacktop to gravel. Carter further stated that oil companies, principally Encana and Goldrich Petroleum, have committed to help replace the damaged roads.

One significant concern is the decision of the legislators to cut the oil and gas severance tax from six percent to 1.3 percent further affecting much needed funding to support the maintenance of road facilities in the county. Amite County is not the only county affected; this legislation will also affect Wilkinson and Pike counties.

Mississippi Highway 24 and Oil and Gas Industry Development

Highway 24 is one of the major road networks connecting southwest Mississippi to other major road networks, and it is the major highway that is predicted to witness massive truck traffic due to increasing oil production in the region. Highway 24 runs seventy-six miles from Fort Adams to an interchange with Interstate 55 (I-55) and U.S Highway 98 in McComb. It passes through Wilkinson, Amite and Pike counties, serving the communities of Woodville, Centreville, Gloster and Liberty. The road was designed in 1932 to run from Fort Adams eastbound to Leakesville ensuing gravel roads across the southern part of the state. Throughout the 1930s and 1940s, much of the road was paved and realigned. U.S 98 replaced the MS 24 designation from McComb to east of McLain splitting the highway into two segments. The eastern segment was renamed MS 594. The eastern terminus was moved to its current location in 1967 with U.S. 98 replacing the part leading into McComb (see Figure 17).

Figure 17. Mississippi Highway 24



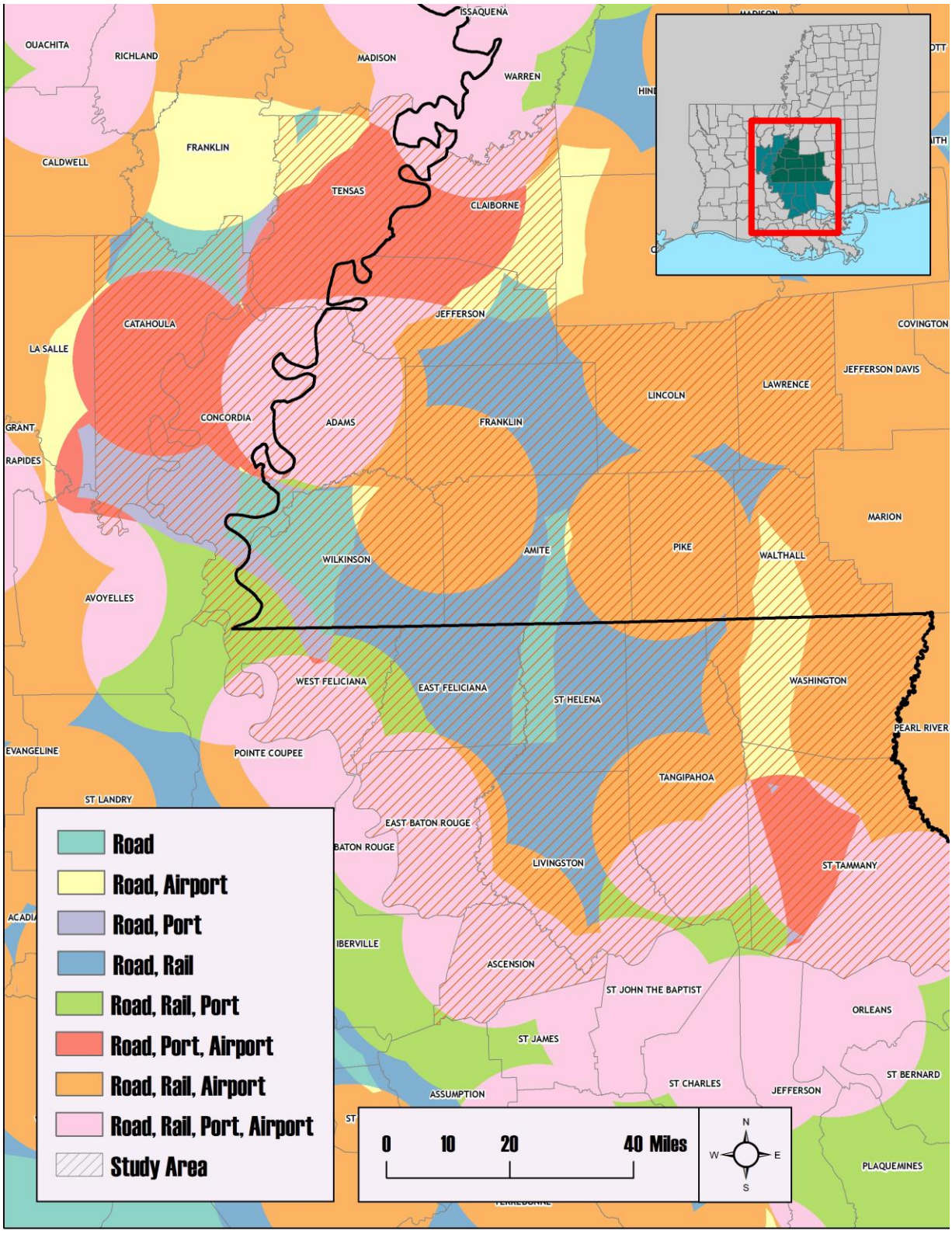
The need for expanding and reinforcing the road has been a hot topic of the people and Mississippi Department of Transportation (MDOT). According to reports, to upgrade the highway to four lanes from McComb to Woodville will cost approximately $700 million. This is an amount that the state does not have at its disposal for undertaking such a project. The MDOT Commissioner representing the region has reported if money is not allocated for the project, MDOT will first focus on building the section of the Highway 24 from McComb to East Fork, ensuring the importance of McComb as the hub of the Tuscaloosa Marine Shale play (Carter, 2013). However, a bypass around the Amite County seat would not be constructed until after the highway extension is completed, according to the MDOT central district commissioner (Carter, 2013).

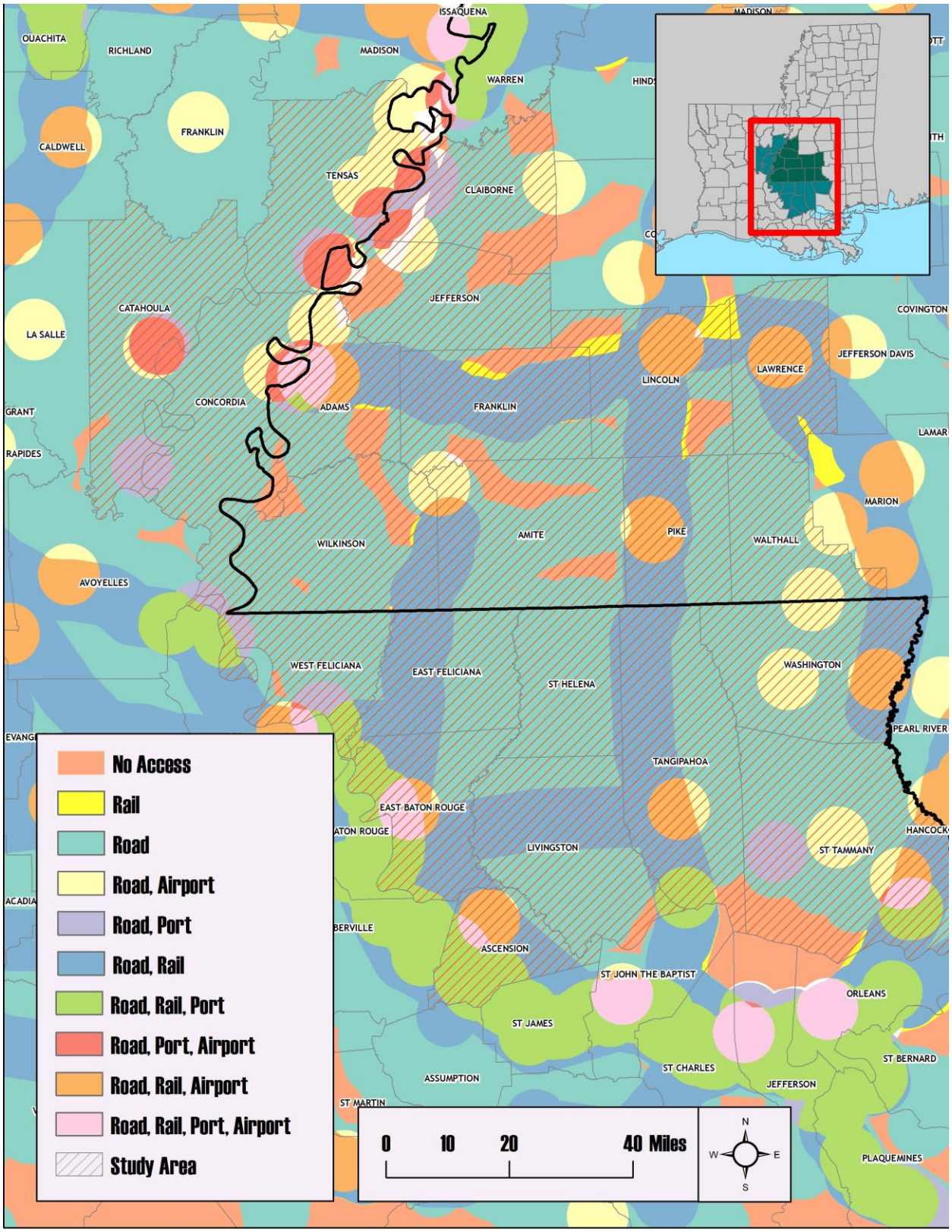
Transportation Concerns of the Oil and Gas Manufacturing Region

Mississippi is endowed with very good transportation network connectivity, such as highway systems, railroad networks, a major waterway transport artery, and strategically located

seaports. The state as a whole is poised to efficiently handle increased traffic of road, rail, water and pipeline transportation. The boom in shale-extracted gas in recent years has raised many capacity-related questions of transportation infrastructures. While the state in general has a well-built transportation infrastructure, the region around the boom is lagging behind. Figure 18 has the proximity to transportation modal connections.

Figure 18. Transportation Feature Access Based on 15-mile and 5-mile Proximity




ISSAQUENA
OUACHITA
RICHLAND
MADISON
WARREN
FRANKLIN
CALDWELL
TENSAS
CLAIBORNE
JEFFERSON
CATAHOULA
LA SALLE
CONCORDIA
ADAMS
FRANKLIN
LINCOLN
LAWRENCE
JEFFERSON DAVIS
GRANT
RAPIDES
WILKINSON
AMITE
PIKE
WALTHALL
MARION
AVOYELLES
WEST FELICIANA
EAST FELICIANA
ST HELENA
WASHINGTON
TANGIPAHOA
EAST BATON ROUGE
LIVINGSTON
ST TAMMANY
ASCENSION
ST JOHN THE BAPTIST
ORLEANS
ST JAMES
ST CHARLES
ST BERNARD
ASSUMPTION
JEFFERSON
ST MARTIN
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Highway infrastructure. Rural transportation infrastructure in the study region is not necessarily developed to handle the increased capacity. Southwest Mississippi has witnessed a tremendous influx in truck traffic, which has considerably damaged some major roads in those localities. For instance, the massive truck traffic that has supported the drilling occurring in Amite County has given county officials a glimpse of what is to come when production from the Tuscaloosa Marine Shale begins in earnest (Carter, 2013). Experts have forecasted that the county might see as much as 2,500 18-wheeler loads per well. This is a significantly increased number compared to the type of road facilities now available. Therefore, it is imperative that the question of financial investments in transportation infrastructure be addressed. In the future, trucks may be replaced by more economically viable modes of transportation. However, many decisions depend on the quantity of shale gas available for exploration and the amount companies are willing to invest in infrastructure.

Carbon dioxide emissions. Excessive truck traffic in these regions means higher traffic congestions and higher emissions of carbon dioxide into the atmosphere. Trucks are powered by fossil fuels burnt through internal combustion. Fossil fuel emits noxious gases such as carbon dioxide (CO2), the principal greenhouse gas (GHG). Although the United States Environmental Protection Agency (EPA) has set significant emission reductions measures in recent years, road transport is still the largest contributor to GHG emissions. Recent economic crises have caused some firms to reduce their emphasis on green initiatives due to perceived cost and uncertainty of long-term payoffs (Mollenkopf et al., 2010). An increasing number of organizations have introduced 'greening' requirements to both upstream and downstream supply chain activity, such as collaborative transportation efforts and interaction between transport modes. Private sector and public sector stakeholders should adopt an eco-innovative type of transport system taking

into consideration long-term sustainability and green gas effects. Hazardous materials transportation must be well planned to avoid possible spillages and contamination of the environment. A good collaboration between the oil and gas industry, the economic development agencies, and local universities will go a long way to finding answers to pressing problems faced by the sector.

Water sources and wastewater disposal. Another major concern for the study region is the water source and the disposal sites for wastewater from fracking. The wastewater produced from this process includes a mixture of either liquid or gaseous hydrocarbons, produced water, dissolved or suspended solids, produced solids such as silts, and recently injected fluids. Wastewater has to be transported by trucks to disposal sites or recycling plants for processing. According to Altela, Inc. (n.d.), the cost of disposing of such wastewater ranges from a low of $0.002 per gallon to a high of $0.30 a gallon. By contrast, water for agricultural irrigation can be as low as $0.0001 per gallon, and municipal drinking water costs in the range of $0.001 per gallon (Altela, Inc., n.d.).

Some oil and gas companies store such water in tanks and may reuse them, but in the end, trucking companies visit the site multiple times per week to transport the waste to commercial underground reinjection sites. In general the trucks travel long distances to the reinjection sites. Trucking costs alone can be in excess of $3 per barrel, and a disposal reinjection well can cost upwards of four million dollars to drill (Altela, Inc., 2013). However, federal agencies including the U.S. Coast Guard, EPA, and Department of Transportation are currently reviewing the feasibility of transporting fracking wastewater by barge (Lower, 2013). This will be a very important development for oil and gas production in the state of Mississippi.

Trucking workforce capacities. With the growing oil and gas economy and improved productivity methods, there has been a higher demand for truck drivers in this industry. Fracking and oil and gas extraction is a transport intensive venture. The service of trucking companies is crucial at drilling sites delivering heavy equipment and transporting water, sand, and other required materials. Trucks are the sole method used to transport wastewater from the sites to dumping sites or recycling plants for disposal. The concern is the lack of availability of additional truck drivers needed to meet additional labor force demands. Solutions to the shortage of manpower may have to be developed or outsourced.

Current Economic Development Incentives and Taxing Policy for Oil, Gas and Chemicals
Bryan Parker

This section discusses a number of public policy issues related to the oil and gas extraction industry. Many oil and gas producing states have developed incentives and taxes toward attracting extraction companies to do business in the state.

Key Points of this Section:

- The federal government, particularly the Environmental Protection Agency (EPA), has not acted on an energy policy that includes fracking. Currently, federal regulations associated with fracking are the Safe Drinking Water Act and Clean Water Act.
- States have the latitude of regulating oil and gas extraction methods through a statewide plan. If no state plan exists, then EPA regulates the method.
- Oil and gas rich states are developing incentive programs that are competitive for companies such as; reduction of severance tax, reduction of impact fees, incentives for employment, and incentives related and complementary industries.
- Mississippi legislation reduced the severance tax from six percent to 1.3% for thirty months or until well payout.

These incentives are offered in various forms, but many are in the form of a severance tax. The severance tax is levied on companies that extract nonrenewable minerals from the ground. Severance tax incentives have come in many forms by various mineral-rich states (Pless, 2012). Illinois recently passed legislation that would cut severance taxes in half if more than fifty percent of the employees are residents of the state (Wernau, 2013). Other states have capped severance taxes and made it only apply at a certain production rate.

Impact fees are also a common source of both taxing and incentive in oil and gas producing states. Impact fees are set by states and local governments to assess companies for using various infrastructures that exist in the locality. Impact fees can be a source for incentives by waiving or cutting the fees for companies that hire a certain number of employees or make a commitment to stay a certain amount of time (McNulty, 2013).

The Mississippi Oil and Gas Board (MOGB) is the primary entity regulating and permitting oil and gas extraction in the state. The agency regulates chemicals used in the process and assures that machines used in the process are approved for the extraction that takes place. The MOGB also enforces the taxing of companies that do business in the state (Pless, 2012).

The Mississippi severance tax is the major income producer for the state in the way of oil and natural gas extraction. The severance tax is as follows:

- Six percent of the value at point-of-gas production
- Three percent of gross value of occluded natural gas from coal seams at point of production for the well's first five years
- Maximum 35 mills/bbl. oil or four mills/1,000 cubic feet of gas (Oil and Gas Board maintenance tax)
- Six percent of value at the point-of-oil production
- Three percent of value at production when enhanced oil recovery is used (Pless, 2012)

Mississippi Governor Phil Bryant recently signed legislation that reduces the severance tax from six percent to 1.3% on companies that come to the state. The legislation allows the reduction for thirty months or the payout of the well and will be in place for the next five years. The severance tax is important to the state because it replaces nonrenewable natural resources with a

stream of revenue. The severance tax could also be used as a means to entice companies to locate in the state and create jobs (State of Mississippi, 2013).

Though the state of Mississippi does have the severance tax and localities can institute impact fees, the state legislature has not taken up any legislation concerning the fracking process. No incentives have been established outside of those used to lure other businesses to the state. The state should decide if they want the process to move forward in Mississippi, and if so, lay out a plan for companies that would fit into the process they are looking for and incentivize them to make the move to Mississippi.

On the federal level, many of the regulatory and taxing policies associated with the industry come from the Environmental Protection Agency (EPA) and fall under two acts - the Safe Drinking Water Act (SDWA) and Clean Water Act (CWA). These acts were established to prevent groundwater contamination and pollutants. The EPA allows latitude for state agencies to control this process if they have established a plan for Underground Injection Controls (UIC). If states have not established these controls, then the EPA would step in to control this process (Interstate Oil & Gas Compact Commission, n.d.).

Congress is considering legislation concerning the fracking process but has yet to produce a bill. House Republicans are said to be considering a bill that could be brought up to address energy policy needs. This bill would most likely include some consideration to this industry, but the only specifics that have been brought forward concern the Keystone Pipeline. A new energy policy could include guidelines and incentives for oil and gas extraction using fracking technology. The Southwest Mississippi Partnership should pay close attention to rules and regulations coming out of the U.S. Congress because they could open new possibilities for the state.

Recommendations for Economic Development Incentives and Taxing Policy

Because the federal government has not taken a lead role in an energy policy containing shale oil, the states have had to establish their own taxing and regulations of the industry. The federal government's taxing and regulatory process, at this point, lies in the Environmental Protection Agency. When congress establishes a way forward regarding energy policy, other agencies could have a say in how the process works. Congress could reduce barriers that would make the process easier and more streamlined or they could make regulation, taxes and fees that would make it more difficult for these companies to do business.

The federal government should work to establish an energy policy that includes all forms, both renewable and nonrenewable. These industries should be regulated, especially when extracting oil and gas from the ground, but the process should be streamlined and less bureaucratic. The plan should also include incentives for companies that are safe and establish jobs in the United States. If a national policy were in place, this would give the industry a clear picture of how to proceed and establish their individual companies over the next decade.

If a national policy is established, then states should decide how they want to be included and establish taxes and incentives based on their interest. The State of Mississippi currently has a policy based around the severance tax. Incentives for the fracking process have not been passed, but companies could qualify under current incentive programs. Counties with high unemployment could also qualify under the Growth and Prosperity Program (GAP).

Several states, in the last few years, have established incentives and tax structures based on the possibility of the companies coming to their states to do fracking. The Illinois legislature passed a 2013 bill reducing the state's severance tax by fifty percent if over half the workforce were a citizen of the state. The bill also requires companies to disclose all chemicals and fluids

used in the process (Wernau, 2013). Governor John Kasich, of Ohio, has proposed a plan to supplement a reduction in personal income taxes with increased taxes on shale drilling. The plan would tax the company at 1.5% in the beginning and could reach around 4% as the company recovers capital cost (Kasich, 2013). The Governor of Pennsylvania recently proposed millions of dollars in incentives for a petrochemical plant to be located in the state. He says it will bring thousands of jobs to the state (Schwartzel, 2013).

The State of Mississippi should consider some of the legislation proposed in other states over the last few years and determine how the process is working. A Mississippi taxing and incentive process could include components from the Illinois bill such as a high amount of disclosure and a severance tax reduction for companies hiring in-state workers. The plan could also include incentives for chemical-related companies assisting in producing more jobs. Also, a state impact fee could be assessed at a gradual rate and capped. In closing, as Mississippi's oil and gas industries move forward, private and public sector stakeholders should align their efforts to address these key issues in order to maximize the state's natural energy resources.

Limitations

This research project has been highly limited to only data sources obtainable through secondary means. To date, there has been zero response to interviews and surveys, which were planned to be the primary means of data collection.

It is pertinent to seek other means of primary data collection, which would validate if an actual oil and gas cluster exists in the study region. The economic development agencies, government agencies, and major stakeholders in the oil and gas sector should be involved in the research project to enable a higher response rate. The service of an engineering consultant may be employed to find out the precise infrastructure type and quality that the study area may need.

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Sources of GIS Data

Data Sets for Mapping	Sources	Scale of Analysis
Airports	MARIS & Louisiana Department of Transportation and Development	State
Education	U.S. Census Bureau & American Community Survey	Census Tract
Louisiana State Highways	Louisiana Oil Spill Coordinator's Office	State
Oil and Gas Wells	Louisiana Department of Natural Resources & MARIS	State
Pipelines	USGS	State
Ports	MARIS	State
Primary Roads	MARIS	State
Railroads	MARIS	State
Toxic Release Inventory	MARIS	State
Unemployment	U.S. Bureau of Labor Statistics	County
Waterways	MARIS & Louisiana Oil Spill Coordinator's Office	State

Services Offered by The University of Southern Mississippi
Economic Development Outreach

In addition to providing graduate education in economic development through the Master of Science in Economic Development program (MSED) and the Graduate Certificate in Economic Development, the Department of Economic Development provides assistance to economic developers through four main approaches:

1. Graduate students can work on class projects involving research for a community (e.g., retail pull factor analysis).
2. Each student is required to do a thesis or capstone project. The capstone project involves completing an actual economic development research study (e.g., feasibility study).
3. Each student is required to do an internship in an economic development organization.
4. Communities can do sponsored research projects and tap into the faculty expertise and university data sources (e.g., EMSI and REMI).

Examples of class projects involving research for communities:

- Retail Analysis for the City of Greenwood
- Feasibility of a Livability Court for the City of Hattiesburg
- Economic Impacts of a Native American Casino in Jones County, Mississippi
- Ecotourism Development in Noxubee County
- Strategic Plans for Stone County, Sunflower County, Bolivar County and Historic Downtown Development Association
- Community Study for the Hattiesburg Mid-Town District
- Entrepreneurial Development Plan for the Area Development Partnership

The University of Southern Mississippi offers economic development training through the following programs:

- True South Economic Development Course—This introductory course is accredited by the International Economic Development Council. It fulfills one of the prerequisites for those who wish to take the examinations for the Certified Economic Developer (CEcD) designation.

- Basic Community Economic Development: Practical Tools for Elected Officials—This course covers key components for attracting new business and industry into a community. It is important for economic developers and elected officials to understand their roles of building a successful economic development team.