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Economic and Employment Impact of the Decline in Oil Prices

Texas Tech University

Center for Public Service

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Thanks to the steering committee and all who attended meetings and gave feedback and direction to the study.

Over 20 people were interviewed for the study. We wish to thank them for their time, candor and insights.

The analysis, report and recommendations are the sole responsibility of the Center for Public Service.

EXECUTIVE SUMMARY

This report is on the economic and employment impact on selected counties in the Permian Basin and the South Plains from the decline in oil prices. The study area is the 15 counties served by the South Plains Association of Governments and the 17 counties served by the Permian Basin Regional Planning Commission. Two additional counties were added because they are oil producing counties. The research and analysis were conducted for the South Plains Association of Governments by the Center for Public Service at Texas Tech University.

The purpose of the research was to assess the economic and employment impact on the West Texas region from the decline of oil prices and make recommendations to mitigate the impact of future oil price fluctuations. Data were gathered for the study through surveys, interviews, census data, websites of governments, nonprofit and private organizations, published and unpublished reports from organizations and associations, seminars and conferences, and analyses by oil and gas industry specialists. The study used a mixed methods approach, combining the gathering of quantitative and qualitative information to analyze the issues and make recommendations. The specific methodology utilized is called grounded theory, which consists in developing theory as data are systematically gathered and analyzed.

The research analyzed national energy policy and national and global supply and demand and the impact on West Texas. An in-depth longitudinal analysis was made of the economic and employment impact of the oil industry in West Texas. Specifically, employment by county relative to oil price fluctuations was analyzed. The oil industry in West Texas laid off many workers because of the downturn. The impact on employment, while substantial, was not as devastating as the rapid decline in the 1980s. The oil industry was technologically more sophisticated in the recent 2011-2013 boom, requiring fewer workers per barrel of oil produced.

We conducted a survey of 1074 laid-off oil workers from the West Texas oil fields. Over half of the laid-off workers were white, the largest age category was over 50, and most of them were residents of West Texas, mostly in the Permian Basin. We asked questions about education. Two-thirds of the workers had less than a college degree. However, most of the workers had training or certification. Less than 10 percent of the respondents were enrolled in any type of education program. We analyzed Workforce Solutions' involvement in supporting retraining and found that it has limited funds to support training and education of the laid-off workforce.

We noted that there are several skilled trade labor occupations that are in short supply due to a large demand and supply gap and a lack of flexibility. There is a general stigma to a technical trade. There is a strong focus in the United States for young people to obtain a 4-year college education.

We discussed the oil price recovery and the prognosis for its future price point and the impact and possible benefit to the West Texas economy for renewable energy.

We investigated ways that the economy could be diversified. We performed a location quotient analysis and a shift-share analysis to determine compatible businesses that would benefit from location and growth in the region. Despite the seemingly divergent economic drivers, both areas have advantages that can complement each other. We conducted a SWOT analysis to assess the area's strengths, weaknesses, opportunities, and threats for development. We concluded from the SWOT analysis and the other research that there is substantial economic development potential for the West Texas area, but there should be more of a regional perspective and collaborative partnerships between the business, government and education sectors to fully realize the development potential.

We made recommendations for education and training, marketing and economic development, and business involvement. Community colleges are a key provider of technical training and educational programs that are important for the continuing development and viability of the West Texas economy. Although technology programs are expensive to provide, community colleges must find ways to provide them. One major way is collaborative partnerships that include working together to avoid duplication of expensive programs and working with private sector partners to provide for their specific training needs. Existing collaborative partnerships between industry and community colleges should be increased and significantly expanded. The industry should work closely with community colleges on training programs to supply their needs for a technically trained workforce.

Community colleges must increase funding and effectively market the technical training programs that are available on their campuses. They should undertake a marketing campaign to reduce the stigma of a technical education and market the advantages of technical and certificate programs.

The education and industry leaders should collaborate on the establishment of a centralized education and training center for the oil and gas industry for in-service and pre-service workers to meet industry specific needs. The center should bring community colleges together with industry to provide technical training and certificate programs. Universities should also be involved in providing research support and articulation agreements for those wanting to earn a bachelor's degree. It should be marketed across the

country as the place for the industry to bring its employees for additional training and for students seeking a career in the energy field.

The government, economic development agencies, and business leaders should collaborate and work together on regional economic development. Recommendations include:

- **A region-wide economic development corporation to combine resources:** The entire region benefits from development in any one part. Combining resources avoid competitive duplication, frees funds for a larger impact and provide a united front to prospects.
- **Large oil and construction company involvement:** These companies must put in substantial resources and be leaders in development. Collaboration and public/private partnerships will provide synergies that individual entities working alone will not be able to achieve.
- **Improve the north-south transportation system:** This includes not only highway but rail. This is an area where working together will move the effort along much faster than working alone. Ports-to-Plains would be a good partner to work with in this endeavor.
- **Brand the area and work to change the culture:** The region should be branded as the Energy Corridor from Lubbock to Midland/Odessa. The region should embrace all aspects of energy from renewables to battery power; not just focused on oil and gas extraction. Education should be part of the brand. The educational institutions from the community colleges to the universities should be on the cutting edge of energy research and development and prepare technically trained people to work in the energy field and in the new and developing industries.
- **Provide appropriate incentives to attract business:** The area should use Chapter 380/381 Economic Development Agreements and other incentives to attract business to the region and help businesses to grow in the region.
- **State and federal grants:** The region should utilize state and federal grants to the extent possible to develop the area. A West Texas Caucus, combining state and federal elected officials along with local government, private and civic leaders, would substantially enhance the ability to lobby and gain favorable treatment and legislation for West Texas.
- **Improve Quality of Life:** The region has its own unique beauty and obstacles. Every effort should be made to improve the quality of life of all those who reside in the area. Sufficient parks and recreational opportunities as well as concerts, and festivals should be encouraged and supported. The region has advantages that should be marketed including small town atmosphere, friendly people, easy commuting, moderate cost of living, and warm climate among other amenities.

As indicated in the other recommendations, the business community must be an integral part of any collaborative program. Business leaders must be committed and provide time and resources in regional and community development partnerships. The region benefits from the resources, clout and leadership of the private sector in any economic development endeavor. Oil and gas companies should be an integral part of marketing and development of the region.

The business community must be willing to work closely with community colleges giving time and resources to support community college technical training programs. Industry must be an integral partner in the development of a center for technical training and education in the energy sector. There should be industry resources and commitment to utilize the training center for its prospective and current workers for the center to be successful. Energy companies should give generously not only to the development but also to the operation of the center.

Private companies should establish a civic agency dedicated solely to the economic development of the region. The civic agency should have the involvement of business leaders on its board and a staff that can work collaboratively with government, education, and other civic associations on community and economic development plans and programs. Collaboration and public/private partnerships will provide synergies that individual entities working alone will not be able to achieve.

INTRODUCTION

The Texas Tech Center for Public Service (CPS) presents this report to the South Plains Association of Governments (SPAG) in fulfillment of its obligation under a grant that SPAG received from the U. S. Economic Development Administration. An oversight committee was established to monitor the study as it proceeded. The oversight committee was expanded as additional members were added as the grant continued. Members of the oversight committee and those who attended meeting are listed in Appendix 1. Regular reports were made to this committee, and feedback and direction were received. The major part of the data upon which this report is based was gathered between November 2015 and July 2016.

The Center for Public Service would like to thank all those who gave of their time to attend meetings, be interviewed and otherwise gave input into the study. The analysis of the data obtained in the study, the resulting report and recommendations are the sole responsibility of the Center for Public Service.

The initial work plan is in Appendix 2. The study, for the most part, followed the original work plan. Adjustments were made as it became clear that a particular item was not useful, necessary or relevant data for the item could not be gathered. Changes were made following consultations and discussion at committee meetings.

The focus of the grant was to investigate the economic and employment impact on the South Plains (SP) and the Permian Basin (PB) from the rapid decline in oil prices. In addition, the study investigated and made recommendations on training and education programs that to provide those individuals laid off from the oil and gas industry employable skills so that they can return to the workforce. A final component of the study was recommendations on diversification of the economy of the South Plains and Permian Basin to avoid or cushion the boom and bust cycle of the oil and gas industry.

The study area is the 15 counties served by the South Plains Association of Governments and the 17 counties served by the Permian Basin Regional Planning Commission. Two additional counties were to the Permian Basin added because they are oil producing counties.

Data were gathered for the study through surveys, interviews, census data, websites of government, nonprofit and private organizations, published and unpublished reports from organizations and associations, seminars and conferences, and analyses by oil and gas industry specialists. Accumulation of information and analysis was an iterative process. A collection of data from one source often led to other

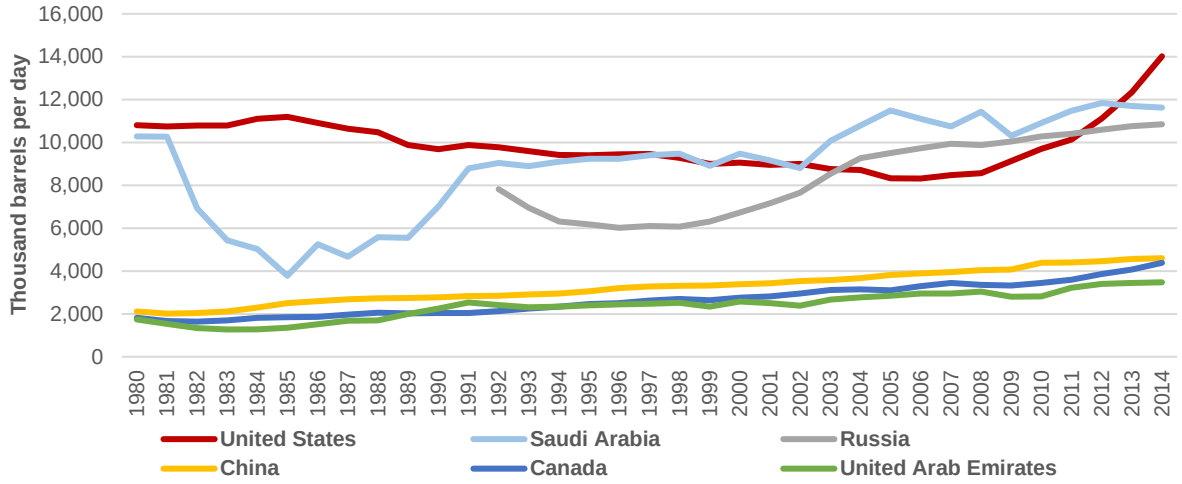
sources from which data were collected, compared to other data, and analyzed. The data sources were occasionally not compatible or covered geographical areas other than our targeted areas. The numbers, therefore, did not always match.

The study used a mixed methods approach, combining the gathering of quantitative and qualitative information to analyze the issues and make recommendations. The specific methodology utilized is called grounded theory, which consists of developing theory as data are systematically gathered and analyzed. In this approach theory is continually elaborated, tested and modified as new data are collected and systematically analyzed. Theory generation thus results from an iterative process of collecting and analyzing various data allowing the combining of both quantitative and qualitative data and giving the researchers freedom to pursue new information as sources are discovered (See Strauss and Corbin, 1998 for a more detailed elaboration of grounded theory).

NATIONAL AND GLOBAL ISSUES AFFECTING WEST TEXAS

According to the U. S. Energy Information Administration (EIA), from 1980 to 1997 the United States was the biggest oil producer in the world (Chart 1). In 1998, this position was occupied by Saudi Arabia, but during 1999 to 2002 both countries had almost the same production. By 2003 Saudi Arabia became the biggest oil producer in the world, and in 2004, Russia occupied the second position, and the U.S. was the third place until 2011. In 2012, the United States recovered the second place and in 2013 became the biggest oil producer in the world again.

Chart 1. The United States and other top 5 oil producers in the world – 1980 – 2014



Source: U.S. Energy Information Administration (2014) retrieved from http://www.eia.gov/beta/international/

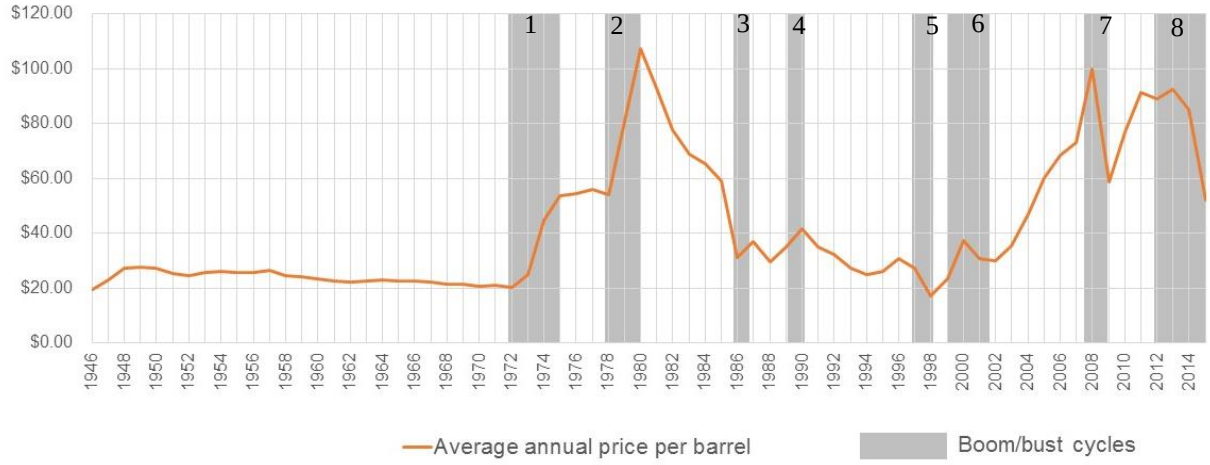
The West Texas economy is substantially impacted by global oil supply and demand. The Permian Basin (PB) part of the study area is much more dependent on global oil supply and demand than the South Plains (SP) because the economy of this second is much more diversified. Therefore, SP is better able to weather the volatility of the price of oil. More than most other regions, the West Texas economy is affected by decisions at the national and state governments. National energy policy is much more political than it once was. Energy bills at the national level are much more partisan. Congress is deadlocked over many policy issues including energy bills. Environmental awareness looms larger than ever, and the environmental lobby is better organized and funded than previously. The push for renewable energy is starting to have an impact on the consumption of oil in the world, and its impact promises to be greater in the years to come. Even in the United States, the last great hold out, renewable energy is becoming more prominent in public policy. The move to alternative energy sources is aided by major oil spills and the visibility from media reports on the environmental concerns of fracking. Obviously, some of the media

reporting is sensationalized. However, there are legitimate environmental concerns that need to be addressed.

With the energy policy gridlock in Washington, D.C., state energy policy is becoming more important. Texas has always had a very inviting energy climate. It is a good place for the oil companies to do business. Even when local communities try to restrict drilling and fracking, the state has forbidden them from taking action that could disrupt this permissive energy climate. The latest example is Denton, which banned fracking within the city in 2015. This ban was negated by law passed by the state that forbids municipalities from passing ordinances on fracking (Baker, 2016).

It is impossible to predict with certainty oil cycles due to price vulnerability to exogenous forces. Chart 2 presents the variation in the price of oil/barrel from 1946 to 2014. According to Rodrigues & Cross (2015), oil prices are dependent on external factors, and they present seven significant oil spike and recession cycles since the 1970s.

Chart 2. Variation in the prices of oil/barrel from 1946-2015



Source: Inflationdata.com retrieved from http://inflationdata.com/inflation/inflation_rate/historical_oil_prices_table.asp. Oil prices for 2015 are from U.S. Energy Information Administration, retrieved from https://www.eia.gov/forecasts/steo/report/prices.cfm

- Number 1 represents an <u>oil spike</u>, due to the Organization of Petroleum Exporting Countries – **OPEC Oil embargo.** Those caused significant increasing in the oil prices in 1973 and 1979.
- Number 2 represent a second <u>oil spike</u>. The oil prices were high due to the OPEC Oil embargo and increased even more from 1978 to 1980 because of **Iranian Revolution and Iran-Iraq War**.
- Number 3 represent a <u>recession cycle</u>. After 1895, the prices of oil decreased rapidly because of the **oversupplied** position of OPEC.

- Number 4 represents a small oil spike. It happened due to the **invasion of Iraq in Kuwait** in 1990.
- Number 5 represents a recession cycle. In 1997 the oil prices started to decline due to the collapse of the Asian financial markets, achieving the lowest prices in 1998.
- Number 6 represents an oil spike and recession cycle. With the recovering of the Asian financial markets, the oil prices started to increasing, achieving the high prices in 2000. However, after the September 11, 2001, attack, prices declined until 2002.
- Number 7 and 8 represent an oil spike and recession cycle. As markets in India and China grew, oil prices started to increase. Also, after the U.S. entered into Iraq war, OPEC began some production cuts to keep oil prices high. The highest price occurred in 2008, which dropped from $100 per barrel in 2008 to $58.75 in 2009 due to the collapse of the financial markets.
- In 2012-2014, the oil prices increased again, but in 2015 dropped due to a slowdown in economic growth in Asia and U.S. production that flooded the market.

The 2015 steep drop in oil prices had a drastic effect worldwide. It is estimated that 500,000 jobs were lost. The US contributed significantly to the drop in oil prices by increasing its oil production significantly, while other countries' output remained the same. The increased supply coupled with a slowdown in demand resulted in an oil glut, which resulted in the collapse of the price of oil.

When the price of oil was high in the 2011-2014 period, there was feverish drilling. Technological advances allowed the implementation of horizontal drilling of wells and the use of fracking to extract oil in quantities that were not possible before. Use of new technology made it possible to bring in additional oil from old wells. America has abundant supplies of shale oil. Other countries do as well, but not in the Middle East. However, with American technology and ingenuity and a way to compensate owners of the land for extracting oil or the ability to buy mineral rights, the U.S. is the only country that is using fracking techniques to bring oil to the market. The US companies also had or could obtain the capital to invest in shale oil production as it takes $6 to 12 million to bring a shale oil well online. The ability to use fracking technology allowed the United States to become the largest oil producer. United States' producers flooded the market.

The impact in Texas from the sudden price drop was devastating. The oil industry contributes 17 percent of the Texas economy. As of March 2016, more than 38,000 jobs in the industry were lost in Texas. It is estimated that 9,300 oil jobs were lost in the Midland-Odessa Metro area. The downturn in the oil and gas industry has a ripple effect on unemployment throughout the economy. It is estimated that the Permian

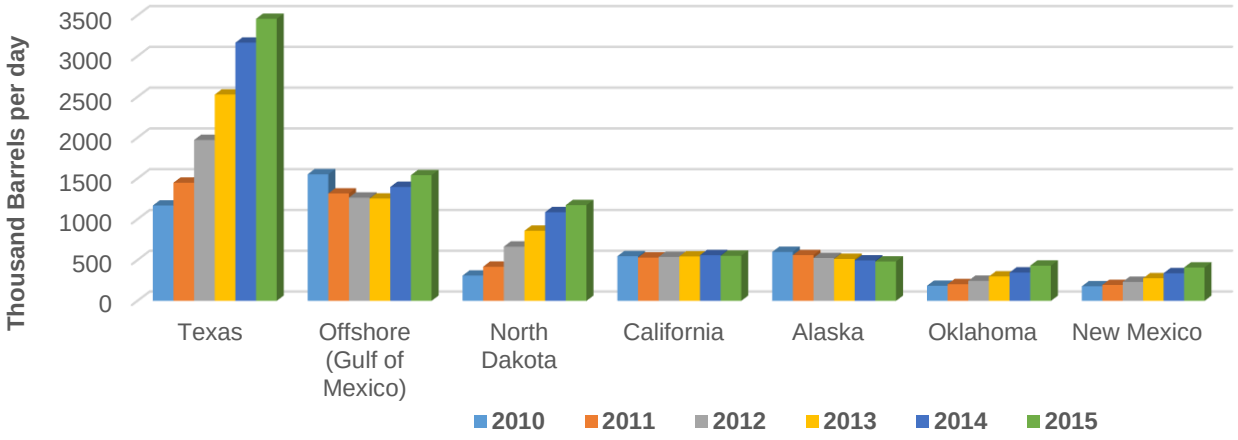
Basin metro areas have lost 15,000 jobs from the decrease in oil prices. Job loss will continue as long as the price of oil remains low (Midland Economy, 2016). On a positive note, as the price of oil dropped, the price of gasoline plummeted resulting in consumers in the U.S. realizing a savings of $20 plus billion. It has also spurred investment by companies outside the oil and gas industry.

Oil industry in West Texas

West Texas has been at the epicenter of oil since the 1920s when the first wells were drilled. Oil has been responsible for many economic booms and downturns since that time. Texas is an inviting place to do business. The oil industry in Texas is less regulated than it is many other states. For example, it is generally less costly to drill for oil in West Texas than it is in New Mexico. The oil infrastructure and skilled workforce in the PB are superior to many other oil sites.

Texas is the biggest oil producer state in the U.S. It was responsible in 2015 by 36% of the country's oil production (EIA, 2016). Behind Texas is the Federal offshore drilling in the Gulf of Mexico. North Dakota was in third place extracting 33% of the Texas production while all the other States presented values less than 15%, as illustrated in Chart 3.

Chart 3. Top 7 oil producers in the United States (States and offshore)

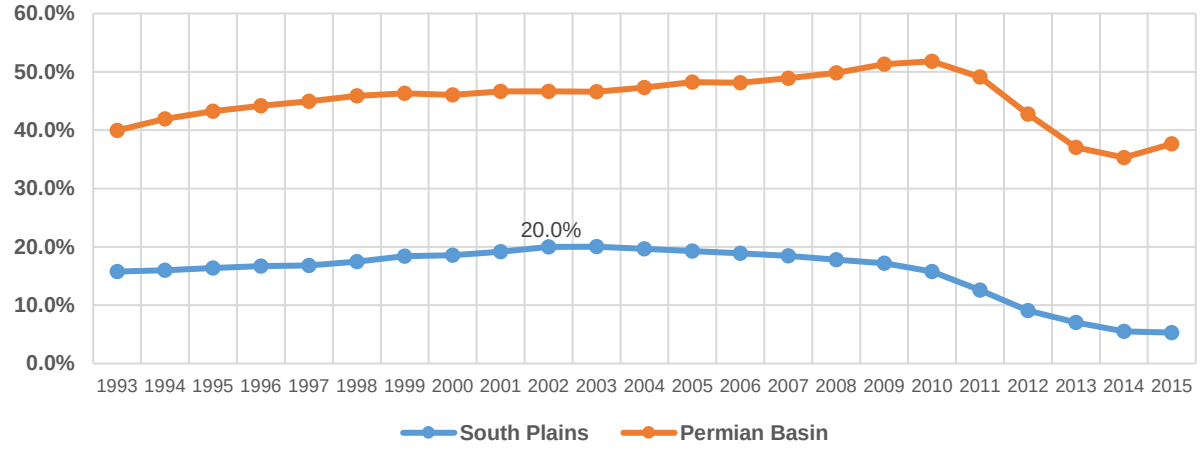


Source: U.S. Energy Information Administration (2016) retrieved from https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbblpd_a.htm

In the West Texas study area, the premier producer is the Permian Basin. In 2015 the South Plains, counties produced only 44,214,230 barrels of oil while the Permian Basin produced 313,301,381 barrels. Those correspond to 5.3% (SP) and 38% (PB) of total oil production in Texas. Oil production in the

South Plains has changed since 1993. In that year, South Plains was responsible for 15.8% of the total oil production in Texas (Chart 4). The highest participation of South Plains was in 2002 and 2003 when it produced 20% of the oil produced in Texas. After that, production decreased rapidly as a percent of Texas' production.

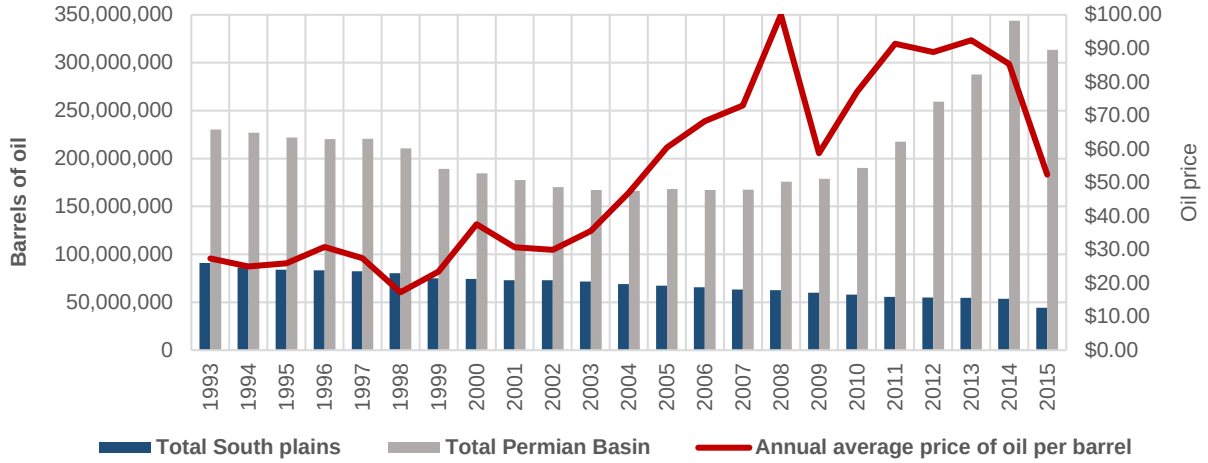
Chart 4. Percentage of oil production in South Plain and Permian Basin per year in comparison to total oil production in Texas



Source: RRC Online System – Oil & Gas Production Data Query. Retrieved from http://webapps.rrc.state.tx.us/PDQ/generalReportAction.do

Production in the Permian Basin has been consistent. In 1993, the region produced 40% of the oil in the state, and 51% at its height in 2009. Chart 5 shows that oil production in West Texas continued on an upward trajectory regardless of the price of oil. It is an indication that oil production in West Texas is less affected by the price of oil than in many other parts of the state and country. With the oil producing infrastructure and positive oil environment in West Texas, it seems that profits were still being made despite the price decline. Once the well is brought online, which requires the most expensive investments, the wells continue producing and even more wells are brought online as Chart 5 shows an upward trajectory in the PB at least from 2007 despite price fluctuations.

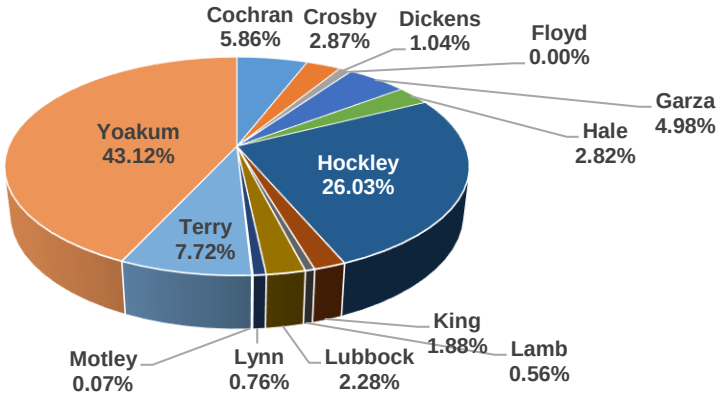
Chart 5. Barrels of oil produced in South Plain and Permian Basin per year in relation to the variation of oil prices per barrel



Source: RRC Online System – Oil & Gas Production Data Query. Retrieved from http://webapps.rrc.state.tx.us/PDQ/generalReportAction.do

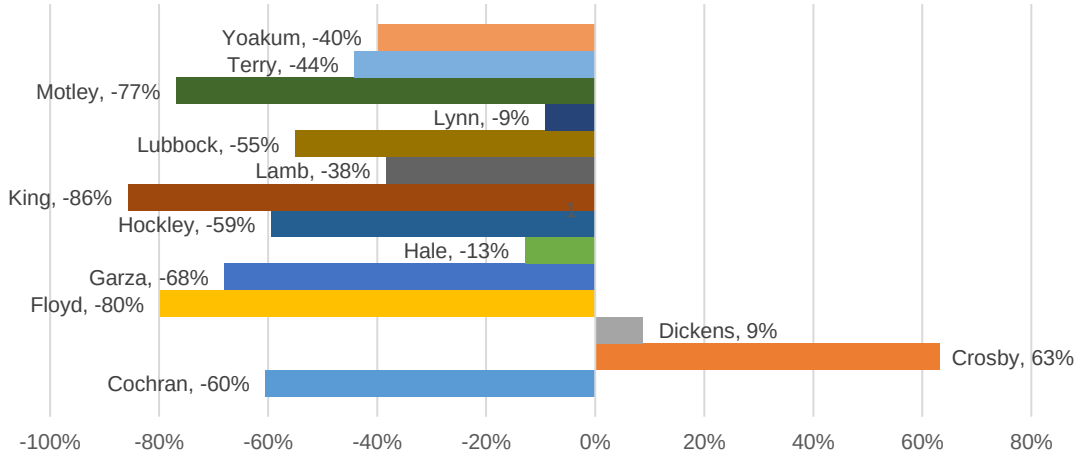
Although not all the counties in South Plains generate jobs related to oil production, all of them, except Bailey, have oil production. Comparing the oil production in the South Plains counties, the biggest oil production in the region occurs in Yoakum (43%) and Hockley (26%). Chart 6 presents the percentage of oil production in South Plains per county in 2015. Except Crosby and Dickens Counties, oil production has decreased since 1993 as can be seen in the Chart 7.

Chart 6. Percentage of oil production in South Plains per county, 2015



Source: RRC Online System – Oil & Gas Production Data Query. Retrieved from http://webapps.rrc.state.tx.us/PDQ/generalReportAction.do

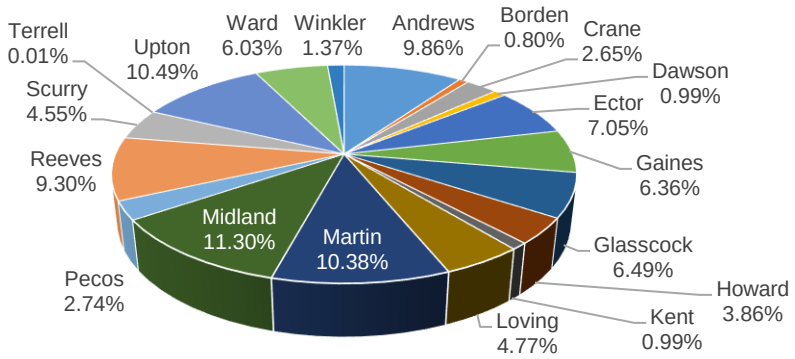
Chart 7. Percentage variation of oil production in South Plains per county, from 1993-2015



Source: RRC Online System – Oil & Gas Production Data Query. Retrieved from http://webapps.rrc.state.tx.us/PDQ/generalReportAction.do

In the Permian Basin, oil production is more evenly distributed among the counties than in the South Plains. The biggest oil producer is Midland followed by Martin, Upton, Andrews, and Reeves, as illustrated in Chart 8.

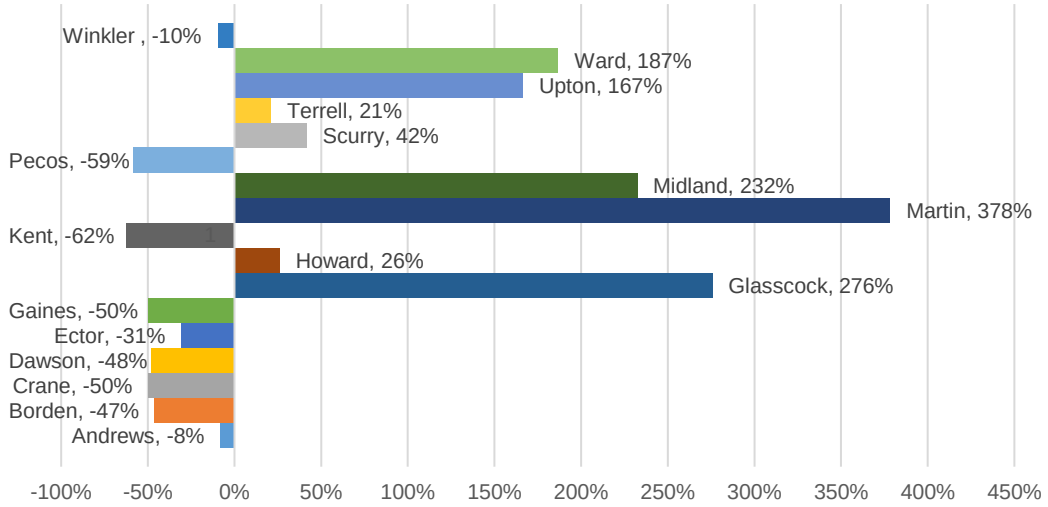
Chart 8. Percentage of oil production in Permian Basin per county, 2015



Source: RRC Online System – Oil & Gas Production Data Query. Retrieved from http://webapps.rrc.state.tx.us/PDQ/generalReportAction.do

Several counties in the Permian Basin have had a substantial percentage increase in oil production between 1993 and 2015. Martin, Midland, and Glasscock have increased oil production over 200 percent while Ward and Upton counties have increased over 100 percent as shown in Chart 9. Loving and Reeves are not included in the chart because they had, respectively, 798% and 2,245% oil production growth between 1993-2015.

Chart 9. Percentage variation of oil production in the Permian Basin per county from 1993-2015



Source: RRC Online System – Oil & Gas Production Data Query. Retrieved from http://webapps.rrc.state.tx.us/PDQ/generalReportAction.do

EMPLOYMENT IN THE OIL FIELDS OF WEST TEXAS

Jobs in the oil industry are related to the price of oil. We have identified boom and bust cycles and have correlated them with work in the oil industry in West Texas. There is available data after 1990 by county to document employment related to the price of oil. Figure 1 shows the boom and bust cycles that we analyzed.

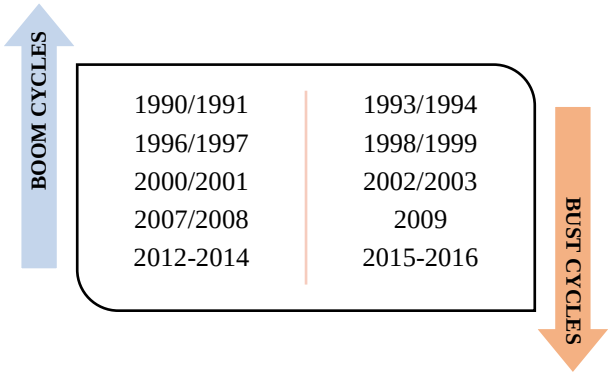


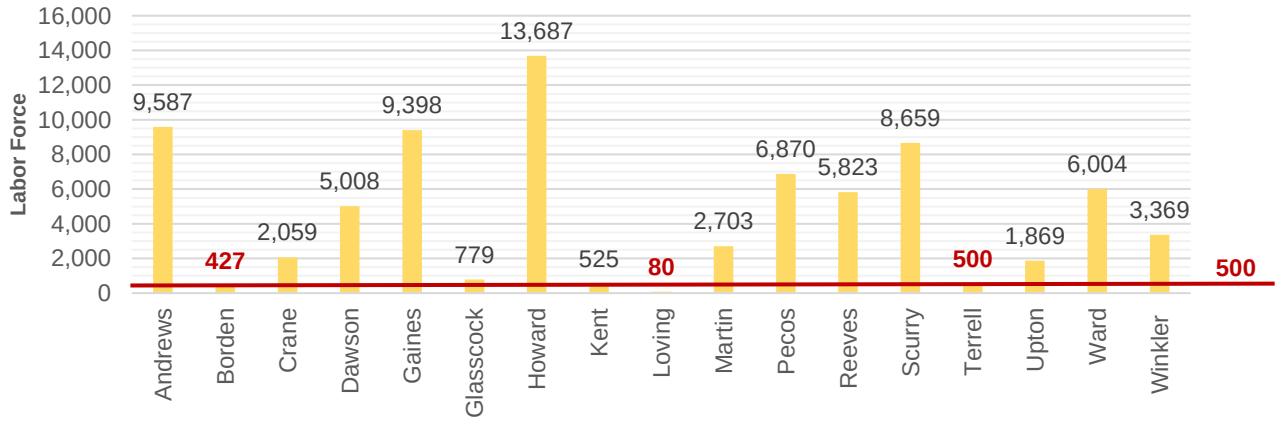
Figure 1. Boom and bust cycles

The analysis of employment and unemployment in oil and gas industry used data from the following sources:

- **Labor force** data came from annual averages from the Bureau of Labor Statistics, available at http://www.bls.gov/lau/#cntyaa. The data are from The Local Area Unemployment Statistics (LAUS) program, which is a Federal-State cooperative effort that provides monthly estimates of total employment and unemployment. The concepts and definitions underlying LAUS data come from the Current Population Survey (CPS), a household survey that is the official measure of the labor force for the nation.
- **The unemployment rate** came from annual averages information according to the Bureau of Labor Statistics, available in http://www.bls.gov/lau/#cntyaa.
- **Jobs related to oil and gas** came from United States Census Bureau County Business Patterns, available in http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl. These match the NAIC code 21, which is oil and gas extraction, drilling oil and gas wells and support activities for oil and gas operations. It is in reference to employment during the week of March 12, 2014. These data were supplemented for some of the analysis by information on oil and gas employment provided on the Texas Workforce Commission Website http://www.tracer2.com/, which had employment information for the last quarter of 2015.

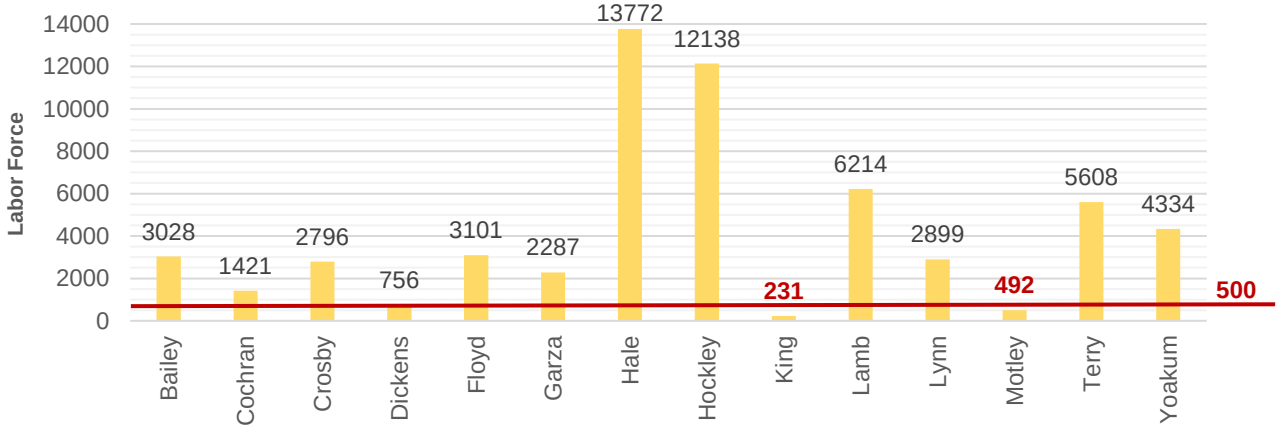
The analysis evaluated counties and the two regions. However, counties with a labor force less than 500 were eliminated due to the difficulty of obtaining specific data. Chart 10 shows the total labor force of the counties in Permian Basin in 2014. Chart 10 shows that Borden, Loving, and Terrell are not further analyzed as their labor force falls below 500. In addition, Ector and Midland are not presented in this chart because they have larger labor forces than could be easily shown on the graph. There were in Ector a labor force of 83,057 people in 2014 and 91.588 in Midland. Chart 11 shows the total labor force of the counties in South Plains. King and Motley are not further analyzed because they have less than 500 people in their labor force. Lubbock is not presented in the chart because it is an outlier with a labor force of 148,679 in 2014.

Chart 10. Labor Force per county in Permian Basin, March 2014



Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables

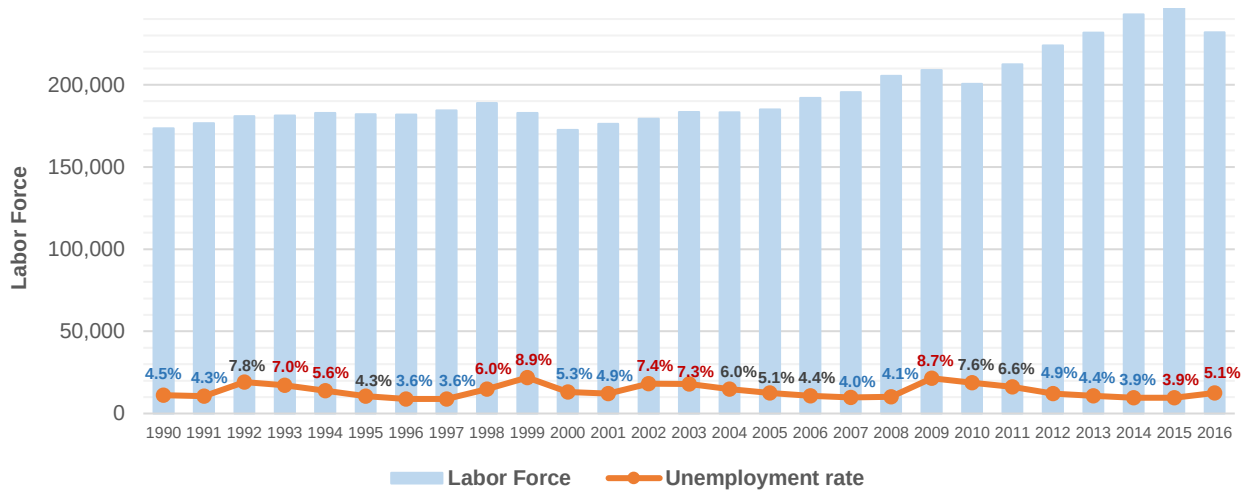
Chart 11. Labor Force per county in South Plains, March 2014



Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables

The charts below present the labor force and unemployment rate in Permian Basin (Chart 12) and South Plains (Chart 13). The unemployment rate marked in blue is related to the boom cycles and in red the bust cycles. Chart 12 shows that in the boom time, the unemployment rate in Permian Basin averaged 4% and in the bust periods was almost double at an average of 7%. It is clear from the data that oil prices affect employment and unemployment in the Permian Basin. It is interesting to see that in the latest downturn in the price of oil the unemployment rate did not change significantly in 2015 and is still a respectable 5.1 percent in 2016. However, the workforce declined in 2016 from its high in 2014 and 2015. It is an indication that oil field migrants left the area or stopped looking for work.

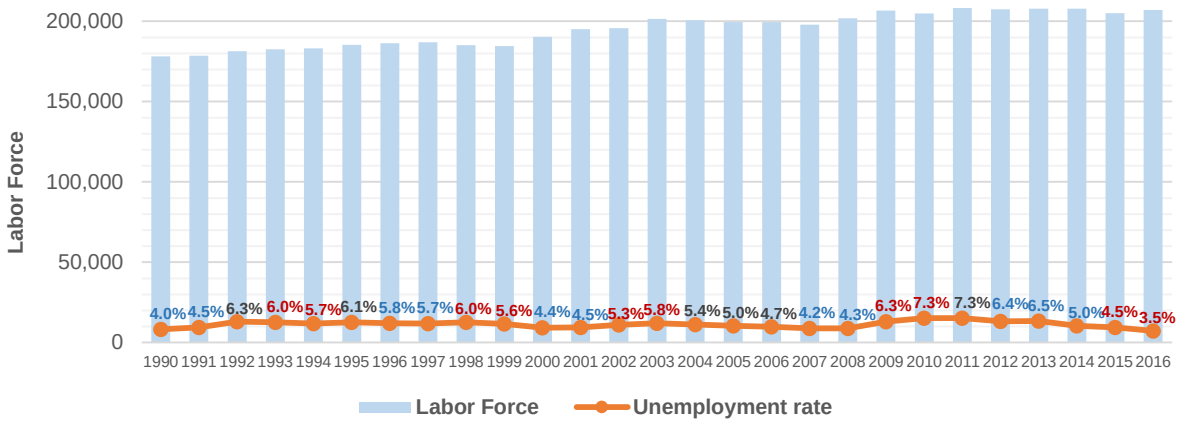
Chart 12. Labor Force and Unemployment rate in Permian Basin, 1990-May 2016



Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables. Data from 2015 is the annual average considering data from Texas Labor Market Information retrieved from http://www.tracer2.com/cgi/dataAnalysis/AreaSelection.asp?tableName=Labforce

Chart 13 provides data on the South Plains. During the boom times, the unemployment rate averaged 5.1% and during oil price downturns, it averaged 5.8%. The average difference is not significant (0.7%), which means that oil prices do not have a significant impact on the employment and unemployment in the South Plains. Indeed, during the current oil price downturn in 2015-16, the unemployment rate is less than during the boom time; however, the labor force has also slightly declined.

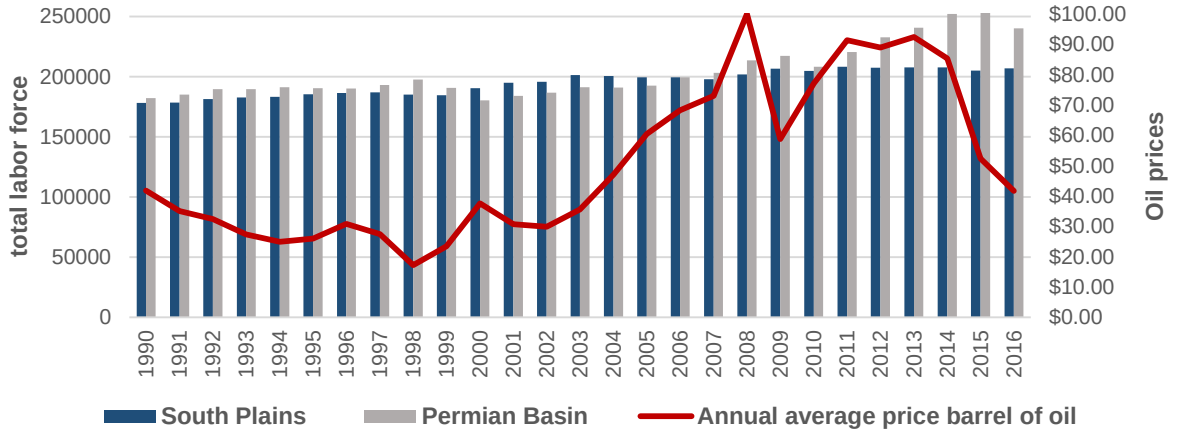
Chart 13. Labor Force and unemployment rate in South Plains, 1990-May 2016



Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables. Data from 2015 is the annual average considering data from Texas Labor Market Information retrieved from http://www.tracer2.com/cgi/dataAnalysis/AreaSelection.asp?tableName=Labforce

In Chart 14 we compare the total labor force to oil prices. The total labor force is affected by the price of oil, but this is largely the case only in the Permian Basin. There is always a lag between the increase in the price of oil and an increase in the labor force. There is also a lag in the decrease in the price of oil and a decrease in the labor force. This can be seen in the labor force increases and decreases relative to the price of oil between 2008 and 2016.

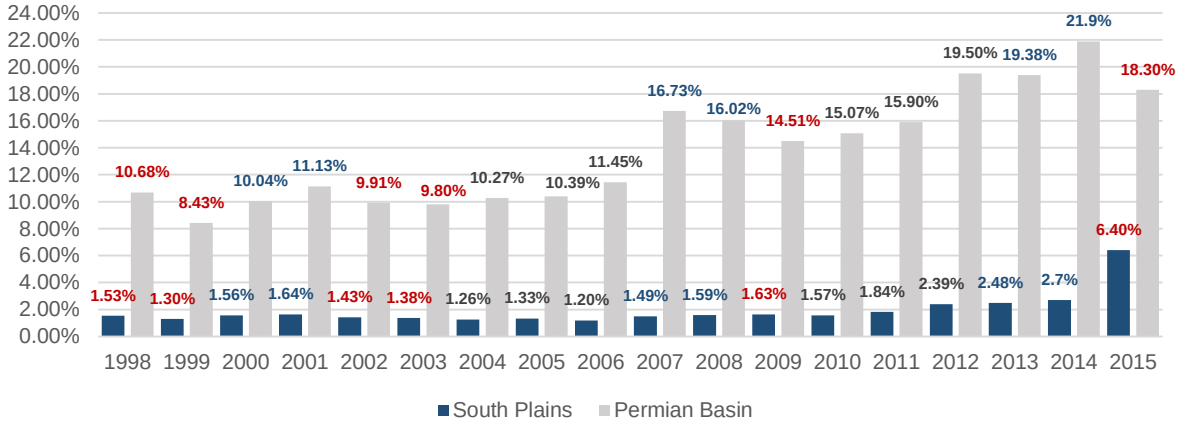
Chart 14. Variation of total labor force in South Plains and Permian Basin and variation of average annual oil prices per barrel, 1998-May 2016



Source labor force: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables. Data from 2015 is the annual average considering data from Texas Labor Market Information retrieved from http://www.tracer2.com/cgi/dataAnalysis/AreaSelection.asp?tableName=Labforce
Source oil prices: Inflationdata.com retrieved from http://inflationdata.com/inflation/inflation_rate/historical_oil_prices_table.asp. Oil prices for 2015 are from U.S. Energy Information administration, retrieved from https://www.eia.gov/forecasts/steo/report/prices.cfm

Chart 15 shows the percentage of employment in oil and gas relative to the total labor force. The red numbers are in the oil price downturn periods while the blue numbers are the labor force during boom periods. Until 2007, the PB labor force in oil and gas extraction has always hovered around 10 percent. However, in 2007 it jumped to over 16 percent around the same year (Mostly Economic, 2015, January 14) that oil shale was being explored. The percentage stayed at that level until the latest boom when it jumped to 19.5 percent in 2012 and reached a high of 21.9 percent in 2014 at the height of the boom. The last available figures at the time of this analysis are from the end of 2015. They show that the percentage of jobs had declined but is still higher than in 2011 when the boom was underway. Undoubtedly, with the layoffs that we know occurred in the early part of 2016, the percentage of jobs has continued to decline relative to the total labor force. The South Plains oil labor force, on the other hand, has been less than 2 percent of the total until the latest boom, when it went to 2 percent in 2012 and reached a high of 2.7 percent in 2014. The numbers for the SP oil and gas labor force actually show an increase in 2015. These numbers were obtained from a different source than the data for the other years, which seem more consistent. We suspect, therefore that these numbers are not correct and that they should be discounted.

Chart 15. Percentage of jobs related to oil and gas extraction* in relation to the total labor force, 1998-2015

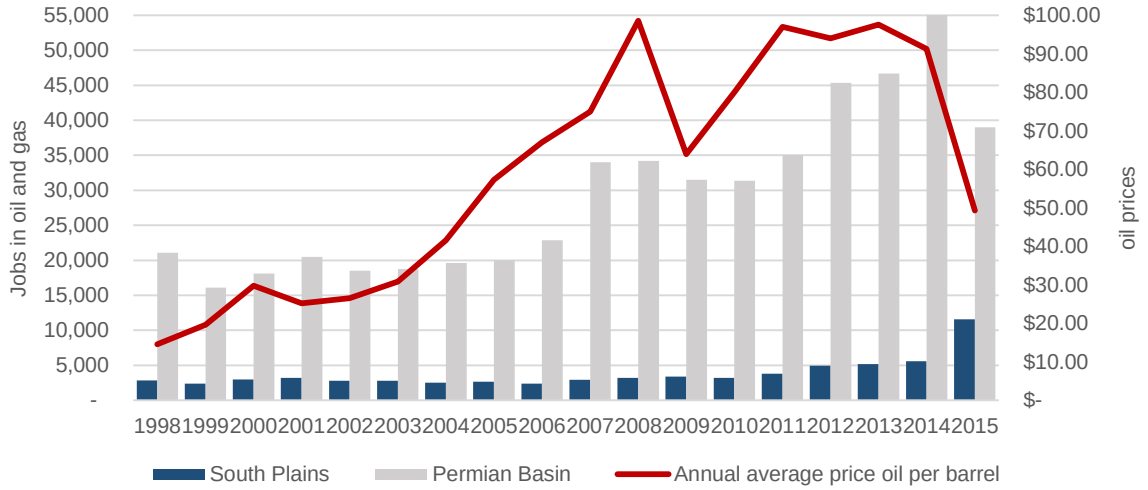


*Jobs related to oil and gas extraction match to NAIC code 21, which is oil and gas extraction, drilling oil and gas wells and support activities for oil and gas operations.
Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables and United States Census Bureau – Business Pattern –retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl. The data from 2015 was obtained from http://www.tracer2.com/admin/uploadedpublications/1758_southplainswda.pdf and http://www.tracer2.com/admin/uploadedpublications/1755_permianbasinwda.pdf

Chart 16 shows jobs in oil and gas extraction in relation to the price of oil. As indicated in previous charts, the major impact is in the PB. It also shows that there is a correlation between oil prices and growth of jobs, but there is a lag between price increases and job growth in the industry. There is also a

lag between a downturn in the price of oil and a reduction in the oil and gas labor force. The large increases in the oil and gas extraction labor force occurred in 2007 and during the latest boom when employment peaked at around 55,000. According to the latest available numbers from the end of 2015, it is now down below 40,000. With the continuing layoffs in 2016, it will fall even more. The numbers for the SP oil and gas labor force actually show an increase in 2015. As stated above, these numbers were obtained from a different source than the data for the other years. We suspect that these numbers are not correct and it should be discounted.

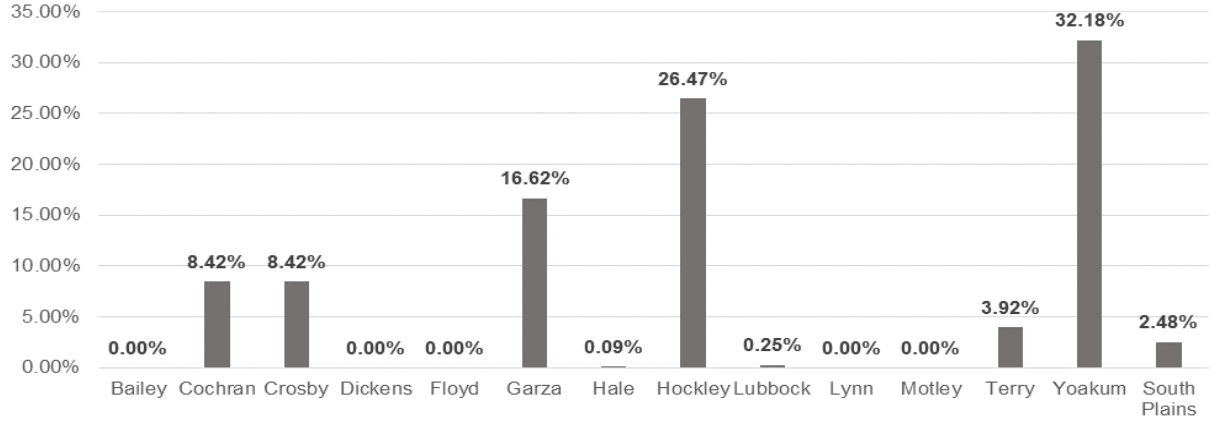
Chart 16. Variation of jobs related to oil and gas extraction* in South Plains and Permian Basin and variation of average annual oil prices per barrel, 1998-2015



*Jobs related to oil and gas extraction match to NAIC code 21, which is oil and gas extraction, drilling oil and gas wells and support activities for oil and gas operations.
Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables and United States Census Bureau – Business Pattern –retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl. The data from 2015 was obtained from http://www.tracer2.com/admin/uploadedpublications/1758_southplainswda.pdf and http://www.tracer2.com/admin/uploadedpublications/1755_permianbasinwda.pdf
Source oil prices: Inflationdata.com retrieved from http://inflationdata.com/inflation/inflation_rate/historical_oil_prices_table.asp. Oil prices for 2015 are from U.S. Energy Information administration, retrieved from https://www.eia.gov/forecasts/steo/report/prices.cfm

The South Plains, in general, has only a small number of jobs in oil and gas extraction. When the evaluation is made by county using the 2013 figures (2.48% of the total workforce), the latest available at the time of this writing, the numbers change. According to the United States Census Bureau, those jobs represented 32.18% of the labor force of Yoakum, 26.47% of Hockley, 16.62% of Garza, 8.42% of Crosby and 8.42% of Cochran, as illustrated in Chart 17. However, the labor force in these counties, as a percentage of the labor force in the SP is small. Lubbock County dominates the labor force, and very few percentage wise in Lubbock County work in the oil field.

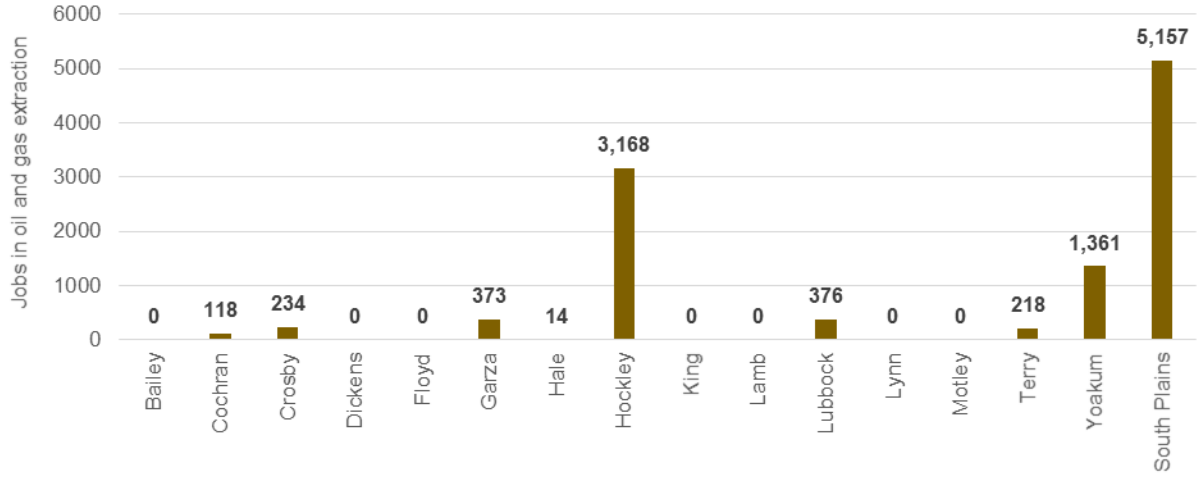
Chart 17. Percentage of jobs related to oil and gas extraction in South Plains, 2013



Source: United States Census Bureau – Business Pattern –retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl

Considering the absolute numbers of jobs related to oil and gas extraction, there was in the South Plains in 2013, 5,157 people working in this field. The concentration of those jobs are in Hockley (54.04%) and Yoakum (23.21%). Chart 18 presents the absolute numbers of jobs related to oil and gas extraction in the South Plains during the oil boom. During the height of the boom in 2013, only Cochran (8%), Crosby (8%), Garza (17%) and Hockley (26%) counties had more than 5 percent of their labor force in oil and gas extraction.

Chart 18. Number of jobs related to oil and gas extraction* in South Plains, 2013

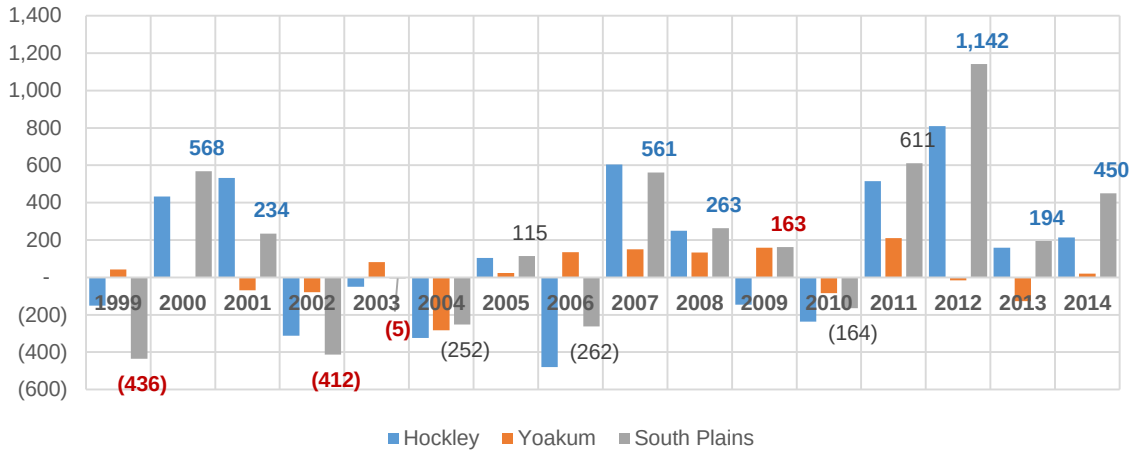


Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables and United States Census Bureau – Business Pattern –retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl

Chart 19, presents the change in jobs in the oil industry from the previous year for Hockley and Yoakum counties and the South Plains as a whole. The numbers in blue are related to boom cycles and in red to the

bust cycles. Although the numbers are small, they represent a large impact on the two counties. The chart shows that Hockley County is more negatively and positively impacted by the oil price fluctuations than Yoakum County. It is also interesting to note from the chart that overall South Plains employment in oil and gas extraction had major increases over the previous year in 2012 although the numbers are not large.

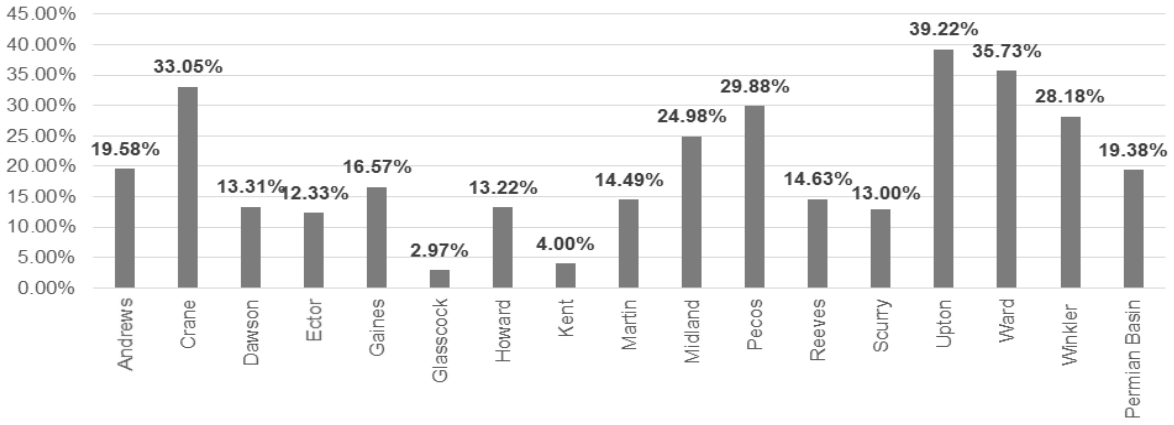
Chart 19. Number of jobs variation in oil and gas industry considering the previous year, 1998-2014



Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables and United States Census Bureau – Business Pattern – retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl

In the Permian Basin, with the exception of Glasscock, other counties have at least 12% of the jobs related to oil and gas extraction. Crane, Upton, and Ward County have more than 30% of their labor force in this field, as illustrated in the Chart 20.

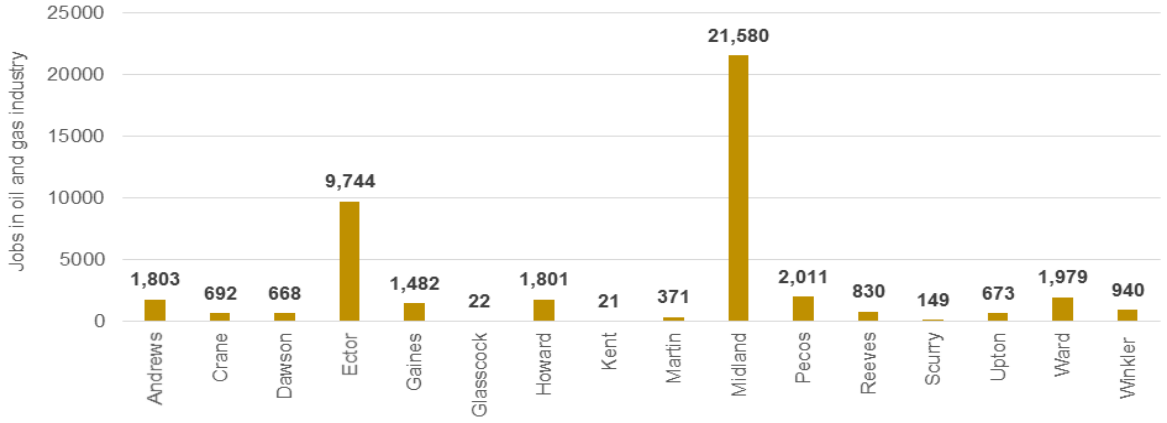
Chart 20. Percentage of jobs related to oil and gas extraction in Permian Basin, 2014



Source: United States Census Bureau – Business Pattern –retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl

Considering the absolute numbers of jobs related to oil and gas extraction, there was in the PB in 2013 46,664 people working in this field. The concentration of those jobs are in Midland (48.20%) and Ector (21.77%). Although the other counties represent less than 5% of the jobs related to oil and gas extraction, in absolute numbers there are more than 1,000 people in that field in the following counties: Andrews, Ector, Gaines, Howard, Midland, Pecos, and Ward, as illustrated in Chart 21.

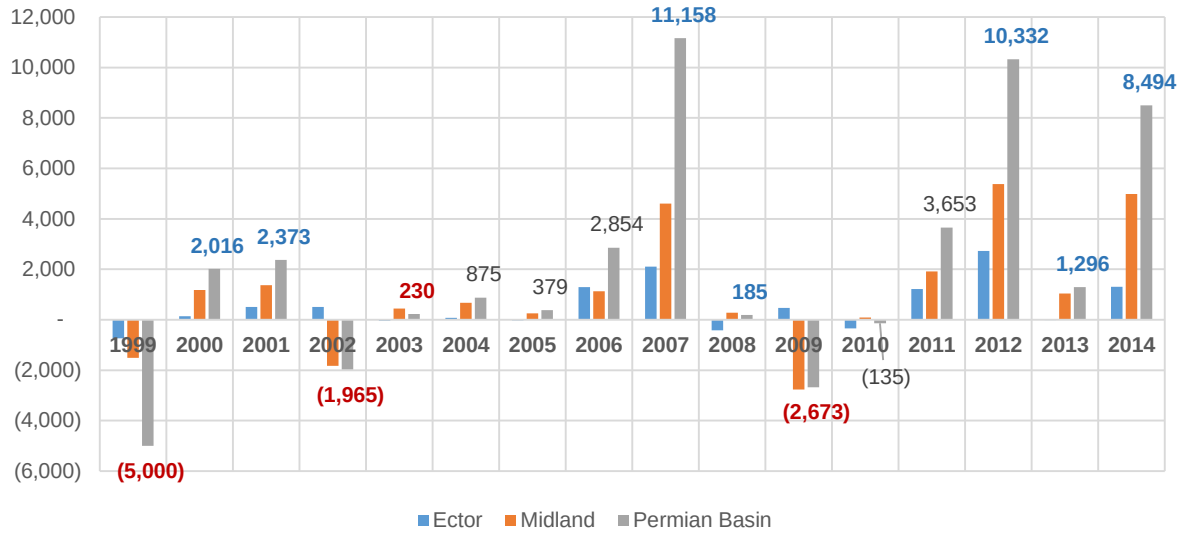
Chart 21. Number of jobs related to oil and gas extraction in Permian Basin, 2013



Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables and United States Census Bureau – Business Pattern –retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl

Chart 22 shows the variation in the numbers of jobs in oil and gas extraction industry from the previous year in the Permian Basin as a whole and in Ector and Midland counties, the major population centers. The numbers in blue represent the boom cycles and in red the bust cycles. The chart shows that in 1999, which was a bust period, more than 4,165 jobs in oil and gas industry were lost in the Permian Basin from the previous year. The other two downturns, where jobs were lost from the previous year, were in 2002 after 9/11 and 2009 during the Great Recession. The major employment counties lost jobs, but only Midland County had substantial job losses during the downturns. During the boom times, the chart shows large increases over the previous year with 2007, just before the Great Recession and the upsurge in fracking in the PB, being the largest increase. However, major increases over the previous year also occurred in 2012 and 2014 during the last boom. A substantial amount of the increases was in Midland County.

Chart 22. Number of jobs variation in oil and gas industry considering the previous year, 1998-2014



Source: United States Census Bureau – Business Pattern –retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl

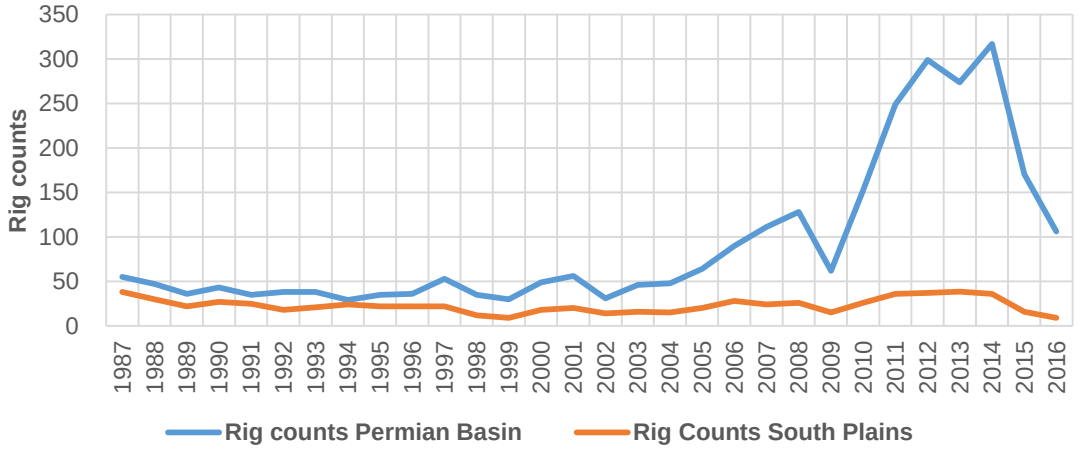
To understand which factors influence oil jobs in the Permian Basin, a regression analysis was made, with oil jobs as the dependent variable, and oil prices, and employment in other sectors of the economy as the independent variables. The regression shows that the dependent variable is statistically associated with all independent variables with a p value of ≤0.01. The adjusted R-square (0.94) shows a strong association because 94% of the independent variables explains the jobs in oil and gas industry. As one would suspect, the price of oil is positively associated with oil jobs, while all the other categories of jobs have a negative association. The regression shows that increases in oil jobs draw workers from other sectors of the economy. In the downturn, workers come back to jobs in the other sectors of the economy. (See Appendix 10 for the statistical data on the regression).

Drilling Permits and Oil Rig Activity

One of the most accurate measures of oil and gas activity are rig counts. Many firms and industry analysts use rig counts as a measure of exploration and drilling in the oil and gas sector. They contend that employment in oil- and gas-producing states are more responsive to changes in rig counts than changes in oil prices. When oil prices decline, firms invariably reduce their expenses, including exploration and drilling. The reduction in exploration and drilling would mean fewer oil and gas workers. Depending on the initial intensity of activity, the size of the development area, and the length of the oil-price drop, employment in other sectors could also decline.

Chart 23 shows the oil rig activity from 1987 to Jun 2016. From 1987 to 2005 the Permian Basin had an average of 42 rigs per year. In 2006 for the first time, rig counts increased to 90 and remained above this number in all years thereafter except in 2009. The rig counts in South Plains never were more than 38, which occurred in 1987 and 2013. From 2009 until the current price drop, the number of rigs in the Permian Basin jumped from around 50 to 300. This was at the time that the drilling of horizontal wells and shale oil was being exploited. The number of rigs dropped drastically with the oil price decrease. (The data in Chart 28 and 29 are only for the counties in the Permian Basin covered by the study area, which is the Permian Basin Workforce Development area or the Permian Basin Regional Planning Commission. The rig counts shown by Baker Hughes for the Permian Basin cover a much larger geographical area. When we use the term "Permian Basin" we are referring to our study area, not the larger geographical area if we are able to obtain data by county. If we do not have the county data, the term will be for the larger geographical area.)

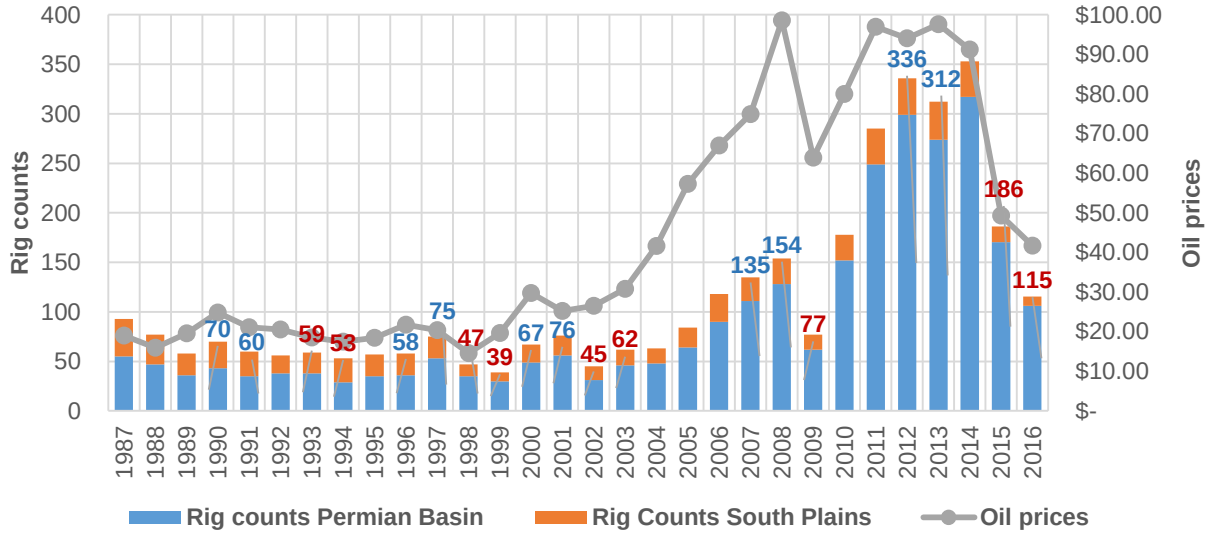
Chart 23. Oil rigs activity from 1987 – Jun 2016 in Permian Basin and South Plains



Source: Baker Hughes - retrieved from http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsother

Chart 24 shows how much oil prices impact rig counts. The number in blue represents the total rig counts in SP and PB in boom times, and the values in red correspond to the total rig counts in SP and PB in the downturn. Rigs follow the oil price movements, and they tend to increase as the oil prices go up and to decrease as oil prices go down.

Chart 24.Comparison between oil rigs activity from 1987 – Jun 2016 in Permian Basin and South Plains and oil prices



Source: Baker Hughes - retrieved from http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsother and Oil prices - retrieved from http://www.investing.com/commodities/crude-oil-historical-data

It is interesting to consider the difference of oil rig activity for the entire Permian Basin, not just the counties in our study area to obtain a larger picture of the extraction activity. Table 1 shows the rig counts, leases and drilling permits for selected years. The point of the table and the charts is that rigs are highly oil price elastic. If the price drops, the number of rigs drops precipitously. However, the rig count does not go to zero. It is also interesting that during the height of the recent boom the number of rigs was much greater than at any other time. The Permian Basin had 30 percent of the total rigs in the US. Moreover, the drop in the rig count reached its lowest point in May 2016 and has started to come back already. This is an indication that companies have confidence that the price of oil will stabilize at least in the $40-50 range and that they can make a profit at that price. During the boom, more rigs were drilling horizontal wells for shale oil. In 2005 12 percent of the rigs were drilling horizontal wells compared to 41 percent in 2013 (Economic Impact: Permian Basin's Oil & Gas Industry 2014).

The indicators for all of the PB show the impact of decline on activity in the oil field. Although the bottom has dropped out of leasing and rig counts, drilling permits are only down 35.4 percent. The major employment activity is connected to the rig counts, which are down 77 percent. Employment changes as rig counts change. It is estimated that employment declined 11.1 percent from May 2015 to May 2016. When the price returns, it will take some time for rig counts and employment to rebound.

Table 1. Rig Counts, Leases and Drilling Permits for selected years in the Total Permian Basin Area

Year	Rig Counts total Permian Basin	Leases (17 Counties in Texas)	Drilling Permits (17 Counties in Texas)	Notes
1982	< 300			
1987	< 100			
2008	382			
2009	64			
2014	583	9036	517 Jan/2015	1931 rigs in U.S.
May 2016	134	1036	334	
July 2016	160			136 drilling horizontal wells
% Change High to Low	-77	-88	-35	

Source: Permian Basin Economic Indicators. http://midlandtxedc.com/permian-basin-economic-indicators. Accessed July 13, 2016; Information compiled by Curtis Helms

THE IMPACT ON OIL AND GAS COMPANIES DOING BUSINESS IN THE PERMIAN BASIN

The oil industry was hit hard by the price decline. We sought to gain a perspective from a sample of the oil companies on the actual impact and their perspectives and plans relative to our study. Most major oil companies doing business in the PB have corporate offices in Houston. We were not interested in the typical press corporate information, but in the perspectives of industry managers working and living in the area. The industry impact is based on reports and interviews with managers of eight major companies. Admittedly, this is not a representative sample. It was difficult to find industry representatives who would divulge propriety information. The information provided in the interviews was general in nature and for the most part reflected the interviewees' opinions and not the official stand of the companies.

Most thought that the price downturn would be short-lived similar to the other *price* fluctuations in the 2000s. Most downturns in the 2000s were around 18 months. The consensus of the oil managers who were interviewed thought that the price would rebind in late 2016 or early 2017. In fact, the price has rebounded from its low of less than $27 per barrel in February 2016 to between $40 and $50. Most of the managers felt that the industry will come back when the price increases to around $70 per barrel and shows some stability.

With the infrastructure in place, accessible topography, available equipment, and a skilled workforce, it is generally less expensive to extract oil in the PB than in most other oil fields. Obviously, the price point at which a well is profitable varies from well to well. One person indicated that many wells in the PB are profitable at $17 per barrel. Another interviewee claimed that a horizontal well was profitable at $50 per barrel. Once the well is drilled and producing, the major costs have been incurred. There is a cost to service wells and royalties, etc. Finally, the consensus was that the oil industry would be strong in the PB for many years as only 22 % of the oil has been extracted.

During the recent boom, there was a lot of overbuilding of drilling and service rigs. The price of oil escalated quickly, and the industry moved to take advantage of it by expanding rapidly. Firms in the PB are a major supplier of oil and gas equipment and expertise to other oil fields in the United States and Canada. Firms with major operations in the PB build facilities in other states using a mix of employees with expertise from the PB and onsite employees. For example, REF-Chem, located in Odessa, is building a chemical plant in Nebraska and a refinery in California using a number of workers from the PB because of their expertise and skills.

There was a lot of overproduction to take advantage of the opportunities. Labor, material, and capital were provided or sought and usually found if the price was right. Resources descended on the area as never before. The economy grew rapidly. Prices for housing escalated, labor costs increased in the service industry as workers were enticed into the oil patch. For example, McDonalds was forced to pay up to $15 per hour to secure workers.

The result of the rapid escalation was an oversupply of everything related to the oil industry. There is now a glut and huge inventory. Some rigs are sold for a fraction of the original cost. For example, a $750,000 service rig was sold at auction for $350,000. Some sectors of the business have been hit harder than others. Manufacturing of rigs has ceased. One company that had 60 employees in manufacturing is now down to 4. One company interviewed cut employees for 265 in 2013 to 140 in April 2016. Another company declined from 350 to 150. Two smaller oil service companies declined from 16 to 9 and 53 to 40. Another company had 65 and now is down to 14. These are examples of how companies were affected by the downturn. However, the service side of rig manufacturing companies is still operating to service and maintain the pumps.

Although companies with substantial resources are still managing to survive and even continue to hire selected positions in the downturn, a number of companies have filed for bankruptcy. According to the Haynes and Boone law firm (2016), companies have filed bankruptcy with 43 or more than half in Texas. Some companies have merged, and a few are closing down in outlying areas and consolidating their operations into Midland and Odessa. One example is Occidental, which moved out of the Bakken field in North Dakota because of the cost of producing oil and has concentrated its major oil production in the PB. The major companies have tightened their budgets and reduced expenses. Some drilling is still going on, but this is mainly in Midland County. The outlying counties have been hardest hit. If the price downturn continues, more bankruptcies will undoubtedly occur.

Companies seem to become more efficient with each boom and bust cycle. For example, one company that manufactures service rigs had 120 employees in 2007 at the height of that boom. In 2013, at the height of the last boom, it had 65 workers and was meeting the demand. Companies are also increasingly more efficient at producing oil. They have reduced the amount of time required to drill a well. Moreover, the PB has been a leader in drilling horizontal wells. It is the largest oil region for these wells.

Some companies planned ahead for this downturn and were better prepared for it than in previous downturns. These companies did not do massive layoffs. Occidental is an example. It is still hiring and

training specialists and technical people. Many companies were like Key Company. One section of Key Company was initially planning to ramp up production in 2015, but towards the end of the year in 2014 decided to maintain the same levels as in 2014. They did not anticipate the sharp decline in oil prices that occurred at the beginning of 2015.

During the boom, companies went to great lengths to hire workers. They raided other companies offering them a higher wage. Some recruited in Mexico. Housing was often provided by renting blocks of motel rooms or the entire motel. Trailers were also brought in to house the workers. However, most of the oil field workers were residents of the PB. They left jobs in other parts of the economy or went back to work to earn more money in the oil patch. Therefore, with the downturn, there was not a major exodus from the area. Many recruited from outside the area have remained, waiting for oil to come back or have been successful at finding jobs in other parts of the economy. There was not a large exodus from the area or a large uptick in the unemployment rate. However, if the downturn continues for any length of time, it will undoubtedly have a greater impact on the economy.

While the economy has been adversely affected by the downturn in oil prices, the two major urban areas, Midland and Odessa, appear so far not to have been seriously affected. There are few empty or shuttered restaurants or shops. Other indicators are that housing prices have not gone down. Jobs are still available, and people are still being recruited from outside the area for specific positions. The cities and population are large enough so that many of the laid-off workforce are able to be absorbed in the economy in full time or part time jobs, undoubtedly with less pay, or they find jobs with other oil companies that are doing the selective hiring. Others are still receiving unemployment compensation.

This is not to say that the price downturn has not had a significant impact. Many employees have been laid off and, for others; hours have been cut. The hourly wage for those still in the workforce has generally remained the same. Salaried employees have had bonuses slashed or eliminated and some have taken hour or salary reductions. One company indicated that wages during the boom for welders and mechanics would be in the $25-30 area. Currently, the company is paying under $20 for experienced welders and mechanics with fewer hours. Another company manager indicated that during the boom it would pay $30 to hire workers, but now would pay $18. Laborers making $18 during the boom now are hired at $9.00.

The Permian Basin is the major branch location for many companies located in Houston. A number of companies are reducing expenses by consolidating facilities and operations into the PB from other areas.

For example, Occidental has consolidated its North American training facility in a new training facility in Midland. It is currently bringing employees into its facility to cross-train and upgrade their skills. Some companies are still hiring, but not on a massive scale. They are also more selective in their hiring.

Employment

As indicated above, there have been a number of boom and bust cycles in the oil industry. Employment in the oil and gas sector responds to the cycles. Steep oil price declines have occurred several times in the last 30 years. In the recent rapid decline, oil prices fell by more than 50 percent between the second half of 2014 and January 2015. Thus far, the impact on the economy and employment in the PB has not been as long or as difficult on the economy as it was in the bust of the 1980s. The economy is larger and more diversified with a larger service sector. The price decline of the 1980s lasted a number of years as opposed to the short-lived downturns in the 2000s. Unemployment was much higher, many businesses closed and many people left the area.

The impact on employment, while substantial, was not as devastating as the rapid decline in the 1980s. The oil industry was technologically more sophisticated in the recent 2011-2013 boom, requiring fewer workers per barrel of oil produced. For example, in 1985 the share of GDP from oil was approximately 17 percent and approximately 8 percent of labor compensation came from the oil and gas industry in Texas. That percent was under 15 percent for GDP and under 6 percent for labor compensation in 2012 during the current boom (Brown, 2015)

Although the Permian Basin is still heavily dependent on oil production, it also was able to absorb the unemployed in the downturn better as it was not as dependent on oil and gas as it was in the 1980s. Even with the layoffs, unemployment has been under any previous downturn since at least 1990. It is currently around 5 percent. (See Chart 12 and Chart 13 for unemployment rates from 1990).

There are a number of models that project employment impact from the oil and gas industry. One of the best predictors of employment is based on drilling rig counts. One model projects that for each additional rig there are an estimated 28 jobs added in the oil and gas sector in the first month, 94 jobs after 6 months with a long-term impact of 171 jobs added in the industry. Jobs include drilling rig operators, excavation crews, truck drivers, heavy equipment operators, fracking equipment operators, rig service employees, and semiskilled general laborers. Once workers finish drilling wells in one area, crews and rigs typically move on to other areas in the same region to drill more wells (Brown, 2015).

This model used national data to project the employment impact based on rig counts. The model uses national data, and some of the data is imprecise, so the model is suspect. In additional the employment impact of rigs in West Texas is different than the national data because drilling activity is more favorable in Texas and in the Permian Basin than in most other parts of the country. The data employed for the national model are not disaggregated for the Permian Basin part of the study area so the model could not be replicated. However, we tested the model based on rig counts in the Permian Basin study area and found that the model was reasonably accurate in predicting the number of jobs during the boom but not accurate in predicting the employment in the downturn. For this reason, even though acknowledging that number of rigs has to have a major impact on employment, we discounted this model to use in predicting employment based on rig counts.

A projection of employment was made by the Texas Workforce Commission at the height of the latest oil boom using 2012 as the base year. It projected that employment in oil and gas extraction would increase by 42.3 percent in the South Plains region and 46.3 percent in the Permian Basin between 2012 and 2022 (Texas industry profiles, n.d). This projection was dependent on a continuing oil boom. This projection is overoptimistic in light of the oil price decline. Nevertheless, it must be considered. The Texas Workforce Commission in this forecast projects that employment in oil and gas extraction will grow from 16.2 percent of the workforce in the PB to 19.1 percent by 2022. The projected impact on the South Plains total workforce is minuscule even though the percent increase is large because of the small base. The projected growth is from 1,079 to 1,680.

Table 2 shows that the top 7 positions growing the fastest in the Permian Basin region are in the oil and gas industry. With the layoffs from the decline in oil prices, the oil industry would need to rebound quickly to reach these projections.

Table 2. Projection of Fastest Growing positions in the Permian Basin Workforce Development Area

PERMIAN BASIN WORKFORCE DEVELOPMENT AREA Fastest Growing Occupations					
Occ Code	Occupational Title	Annual Average Employment 2012	Annual Average Employment 2022	Number Change 2012-2022	Percent Growth 2012-2022
49-9041	Industrial Machinery Mechanics	1,530	2,410	880	**57.5%**
47-5013	Service Unit Operators, Oil, Gas, & Mining	3,940	5,770	1,830	**46.4%**
47-5081	Helpers--Extraction Workers	950	1,370	420	**44.2%**
47-5012	Rotary Drill Operators, Oil & Gas	1,440	2,070	630	**43.8%**
47-5011	Derrick Operators, Oil & Gas	1,420	2,040	620	**43.7%**
47-5071	Roustabouts, Oil & Gas	4,170	5,980	1,810	**43.4%**
51-4041	Machinists	1,180	1,640	460	**39.0%**

Source: Texas Labor Market Information. "Permian Basin Long-term Occupation Projections. <http://www.tracer2.com/publication.asp?PUBLICATIONID=846>. Accessed April 18, 2016

Table 3 shows the mean wages reported by the US Bureau of Labor Statistics for the growth positions in the western region of Texas, an area slightly larger than the study area. This region was used to be sure that all counties in the study area were included. The mean wages for 2015 show that the downturn and layoffs have not yet had an impact on the wage rates. Indeed, they show an increase in mean wages in most of the categories. Pay increased in these positions over the period from a minimum of $1.04 to a maximum of $3.71. The overall average hourly increase for the positions came out to $2.55. The wages are substantial for West Texas compared to other positions with comparable training and experience. The increases over the period in the table were generally over 12 percent.

Table 3. Wage Rates for the Projected Fastest Growing Positions in West Texas

Bureau of Labor Statistics					
Occ Code	Occupational Title	Hourly Wage 2012	Hourly Wage 2013	Hourly Wage 2014	Hourly Wage 2015
49-9041	Industrial Machinery Mechanics	**$ 21.34**	**$ 22.49**	**$ 24.99**	**$ 24.76**
47-5013	Service Unit Operators, Oil, Gas, & Mining	**$ 21.80**	**$ 22.63**	**$ 23.83**	**$ 24.08**
47-5081	Helpers--Extraction Workers	**$ 15.43**	**$ 16.20**	**$ 19.14**	**$ 19.14**
47-5012	Rotary Drill Operators, Oil & Gas	**$ 23.46**	**$ 23.16**	**$ 23.33**	**$ 26.33**
47-5011	Derrick Operators, Oil & Gas	**$ 23.48**	**$ 24.48**	**$ 24.60**	**$ 24.52**
47-5071	Roustabouts, Oil & Gas	**$ 15.88**	**$ 16.59**	**$ 17.24**	**$ 17.86**
51-4041	Machinists	**$ 18.61**	**$ 19.35**	**$ 20.51**	**$ 21.18**

U.S. Bureau of Labor Statistics "May 2012-2015 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates." n.d. Web. 18 Apr. 2016. <http://www.bls.gov/oes/2012/may/oessrcma.htm>.

SURVEY OF LAID OFF WORKERS

We obtained a list of laid-off workers from the oil industry from the Texas Workforce Commission. The list contained 38,297 names of all laid-off workers on unemployment between July 2015 and March 1, 2016. An analysis of the list showed that the majority (89%) of the laid-off workers had Texas addresses. Of the 38,297, 4589 or 12% had addresses in the study area with by far the majority in the Permian Basin counties. We conducted an email survey of all those in these counties with email addresses (2621) and followed up with a phone survey of those with no email addresses (1934). In addition, we surveyed a random sample of 2,117 names of the remaining names in Texas. We selected Arkansas, Arizona, California, Colorado, New Mexico, Nevada, Oklahoma and Utah for the out-of-state survey and sent an email survey to all the names on the list in those states. Table 4 presents the total population, the sample and the number of respondents in the survey.

Table 4. Target population, sample and number of respondents in the survey of Laid-off workers

Survey	Location	Total population*	Sample		Respondents	
			Number	%	Number	%
Web Survey	Arizona	31	31	100%	4	13%
	Arkansas	132	132	100%	16	12%
	California	77	77	100%	6	8%
	Colorado	60	60	100%	10	17%
	New Mexico	111	111	100%	5	5%
	Nevada	19	19	100%	1	5%
	Oklahoma	218	218	100%	25	11%
	Utah	12	12	100%	0	0%
	Others	-	-	-	10	-
	Total out of State	660	660	100%	77	12%
	Permian Basin and South Plains	2,639	2,639	100%	419	16%
	Texas (except PB&SP)	21,256	2117	10%	412	19%
Total web survey		24,555	5,416	22%	908	17%
Telephone Survey	Total out of State	262	262	100%	13	5%
	Permian Basin and South Plains	1934	1934	100%	153	8%
Total telephone survey		2,196	2,196	100%	166	8%
Total web survey + telephone survey		26,751	7,612	28%	1074	14%

*Total population refers to the total population data eligible for unemployment compensation from the Texas Workforce Commission.

To be eligible for the survey, the respondent had to be laid off from the oil and gas workforce. In the web survey 56 respondents (6% of the total web survey) did not meet the criterion, and in the telephone survey

20 respondents (12% of the total telephone survey) did not meet the criterion. In addition, the respondent had to be laid off from the oil and gas industry in the South Plains or Permian Basin. In the web survey 263 respondents (31% of the total web survey), and in the telephone survey 3 respondents (1% of the total telephone survey) did not meet this criterion. Those who completed the survey received a $10 gift card to Walmart for participation.

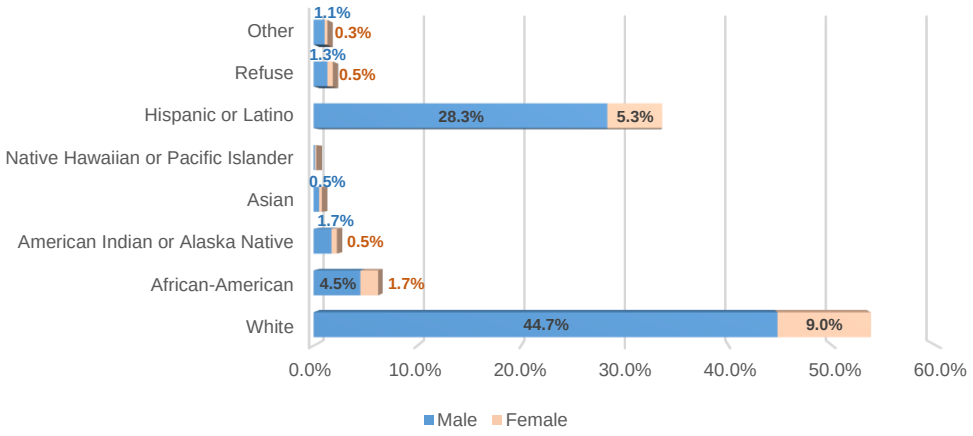
The total sample was 7,612 with 1074 usable responses or 14 percent. The web survey response was much better than the telephone response. The overall response rate was reflective of the target population as 87 percent of the respondents were from Texas compared to 89 percent on the unemployment list. Calculating the confidence interval considering the response rate, the sample used[1], and a confidence interval of 95%, the survey of laid-off workers has a margin of error of 2.77%. The results are representative of the target population

Demographic Data

Of the respondents, 53% live in South Plains or Permian Basin region, 9% are out-of-State, and 38% live in other parts of Texas. Regarding gender (Chart 25), 18% of the respondents were female and 82% male. Most the respondents were white (53.7%), following by Latinos/Hispanic (33.6%) and African-American (6.2%). We were not surprised by the low percentage of African-Americans because their percentage in the West Texas population is low. However, we expected to see a larger Hispanic response because of the large Hispanic population in West Texas. It may be that the Hispanic population is less receptive to responding to surveys. We also expected to see a low percentage of females in the survey.

[1] Calculation made using the http://www.surveysystem.com/sscalc.htm.

Chart 25. Ethnicity and gender



Comparing age and ethnicity, However, concerning to the ethnicity, the majority of Hispanic/Latinos are in the age group of 31 to 39 years, and the dominating age of white and African Americans are over 50 years old.

The survey revealed that the oil and gas workforce is mature as the majority of the laid-off workers are 40 and above (50%). The breakdown by age group is as follows:

- over 50 years old (30.4%)
- age group of 31 to 39 years old (26.3%)
- 40 to 49 years old (19.8%)
- 26 to 30 years old (15.7%)
- 18 to 25 years old (7.7%).

It appears that the younger generation is not interested in working in the oil patch or the oil industry prefers more mature workers as less than 8 percent are in the 18 to 25 age category. The dominant age for African-American and white workers is over 50 while the Hispanic population is much younger as the dominant age for this group is 31 to 39.

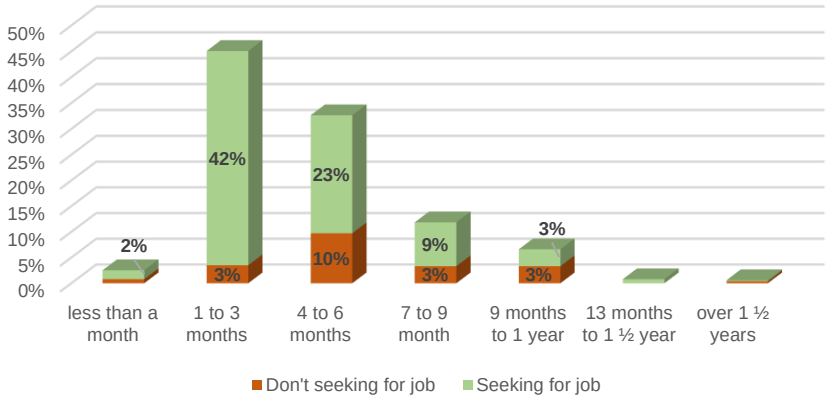
Almost two-thirds of the respondents were laid off from drilling, field services or well service. This makes sense as drilling basically shut down when the price of oil dropped. Three-fourths of the laid off workers had been trained or were required to have a certificate to do their job. However, 58% of the employees were trained by the company either on the job or through specialized training provided through the company. Only 16% received their training or certificate outside the company. This

indicates that outside training is not considered as important as training on the job. Also, the majority of the laid-off workers were not unskilled.

Another indication of the skilled and experienced workforce is that almost two-thirds had worked in the oil and gas industry more than 6 years. Only 11.5 % had worked two years or less. These workers have experienced a number of downturns as 84.4% had been laid off from the oil field at least once before. It would appear that a large majority are willing to risk the fluctuations in the job market for the benefit of a large paycheck and because their training and skills are largely applicable only in the oil patch.

Considering the survey population was anyone on unemployment between July 2015 and March 2016, 69 percent of the respondents remain unemployed. Fifty-seven percent were laid off in 2015. Chart 26 gives an indication of the percentage not yet employed and how long they have been unemployed. Over two-thirds of the respondents have been unemployed 6 months or less but that is expected as most of the layoffs occurred after the middle of 2015.

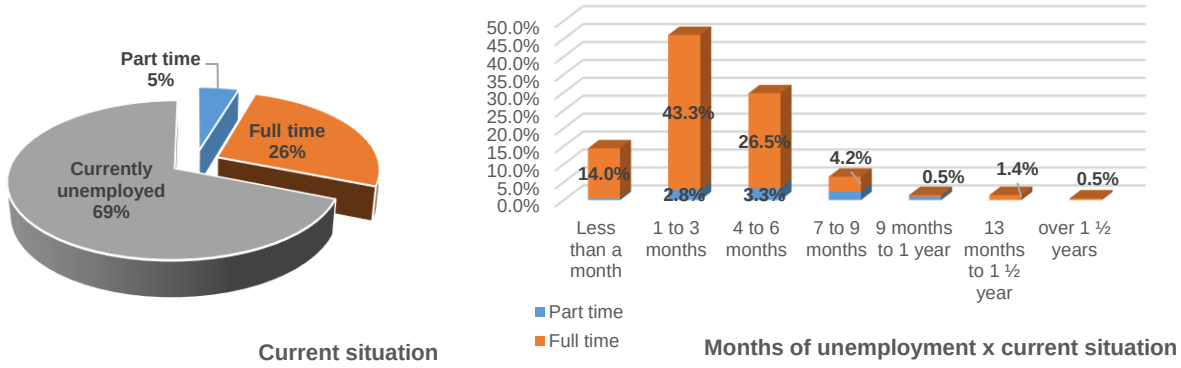
Chart 26. People that are currently unemployed and the number of months they have been unemployed



Of the 31 percent, who were able to find work, one-third remained unemployed four months or longer. Only 14 percent found a position within one month (

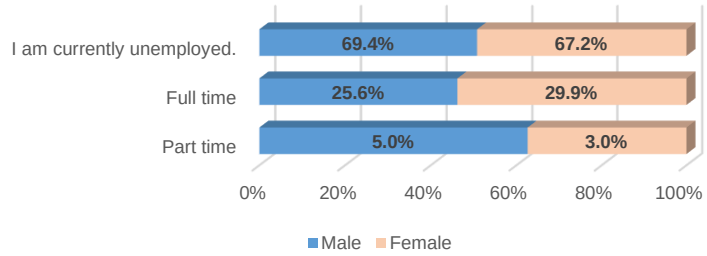
Chart 27). Most of them were able to find a full-time position. Over a third of the reemployed workers (36%) found jobs in the oil and gas industry, which is an indication that some firms are still looking for experienced workers as other firms are laying off. The other major fields in which the unemployed workers found jobs were transportation and construction at 8% each and manufacturing at 5%.

Chart 27. Current employment situation and months of unemployment from those that are currently employed



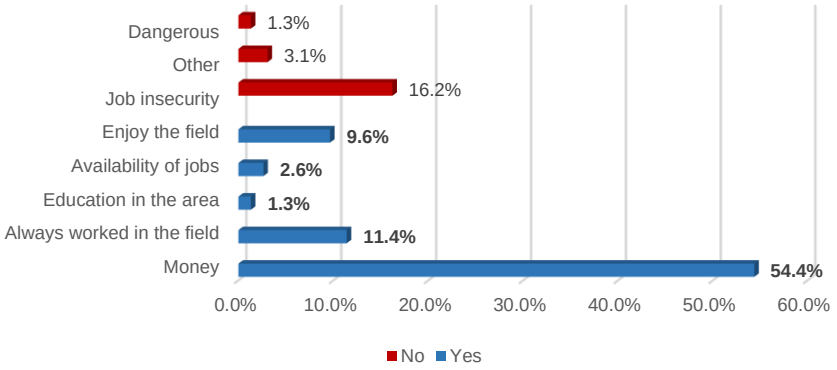
In terms of finding a job, women are doing slightly better than men. This is indicated in Chart 28. Slightly higher percentages of men remain unemployed and women are doing better at finding full time employment than men.

Chart 28. Gender and current employment situation



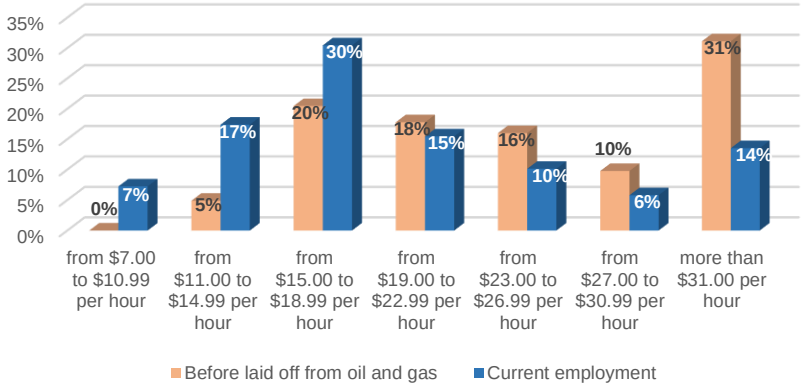
When the currently employed were asked whether they would come back to the oil and gas industry if they had the opportunity, 79.4% said yes (Chart 29). The main motivation to return is money (54.4%). Other reasons to come back to the oil field are: they have always worked in the field (11.4%), they enjoy the field (9.6%), the availability of jobs (2.6%) and they have specific education in the area (1.3%). The major reason for not wanting to return to the oil patch was the instability of the job, which was indicted by 16.2%.

Chart 29. Reasons that current employed people would return or not to oil and gas field



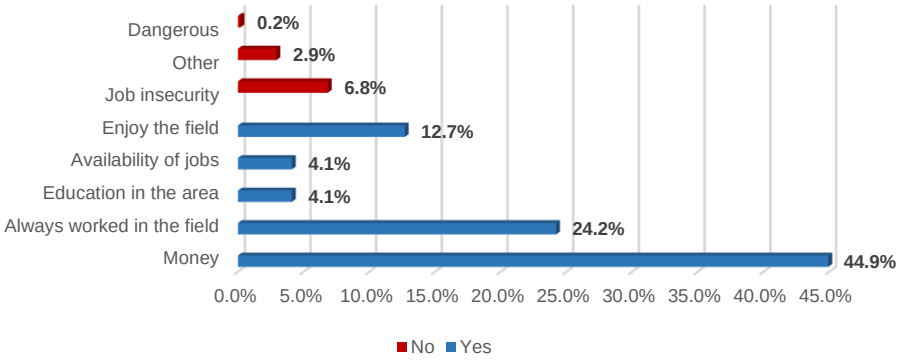
Those finding jobs are generally finding them at much less compensation than they made in the oil patch. Chart 30 shows that the majority of those, who found jobs, are making between $11 and $22 per hour. Prior to the downturn, 31% of those reemployed were making more than $31 per hour compared to 30 percent now making from $15 to $18.99 and only 14 percent making more than $31 per hour.

Chart 30. People that are currently employed (full or part-time): wages before been laid off from the oil and gas industry compared to wages in their current employment



Ninety percent want to return to the oil fields. Chart 31 indicates the reasons people gave for wanting to return to the oil field. The major reason given was the money. The major reason for not wanting to return was job insecurity but only 6.8 percent gave this reason.

Chart 31. Reasons that current unemployed people would come back or not to oil and gas field



Money is an attractive incentive to wanting to return to the oil and gas field because the majority (38.6%) of the currently unemployed workers made more than $31/per hour when they were working. Their income expectation for 2016, according to the majority response (24.6%), will be $25,000 for the year. The annual income expectation for 2016 for 64% of the unemployed respondents will be less than $50,000. This is a substantial reversal from the income once received. There will be some difficult lifestyle changes.

Migration analysis

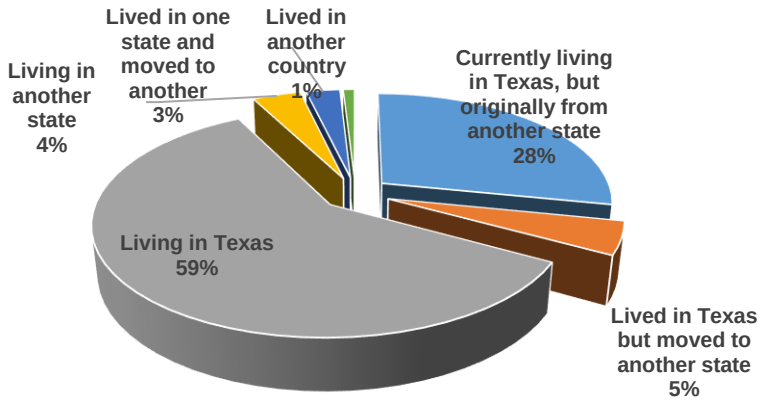
Based on the response to our sample, 88 percent of the workforce in the West Texas oil fields is from Texas. Extrapolating from our sample size, 53 percent of the Texas workforce is long-time residents of West Texas. There were large numbers attracted to the Permian Basin oil fields from other areas. We did cross tabulations to obtain a picture of migration patterns of oil workers from outside the area. The migration data are organized considering the following structure:

- Respondents who are currently living in Texas but are originally from another state are indicate in the charts as ‘currently living in Texas.'
- Respondents who lived in Texas and worked in the oil industry but are currently living in another state are indicated on the charts as ‘lived in Texas but moved to another State.'
- Respondents who always lived in Texas and never moved. Those are indicated on the charts as ‘living in Texas.'
- Respondents who came to Texas just to work, never established residency and returned to their place of residence after being laid off. These are indicated on the charts as ‘living in another state.'

- Respondents who came to Texas just to work, never established residency and moved to another state after being laid off. For example, they lived in New Mexico before, worked in Texas, and moved to Arkansas. These are indicated on the charts as 'lived in one state and moved to another.'
- Respondents who are currently living in Texas but are originally from another country and came to work in the oil industry. These are indicated on the charts as 'lived in another country.'

In response to our questions as to where they currently live and where they lived before moving, 59 percent indicated that they always lived in Texas, while 28 percent currently live in Texas, but moved in recently. Others live in other states with 1 percent coming from Mexico to work in the oil field (Chart 32).

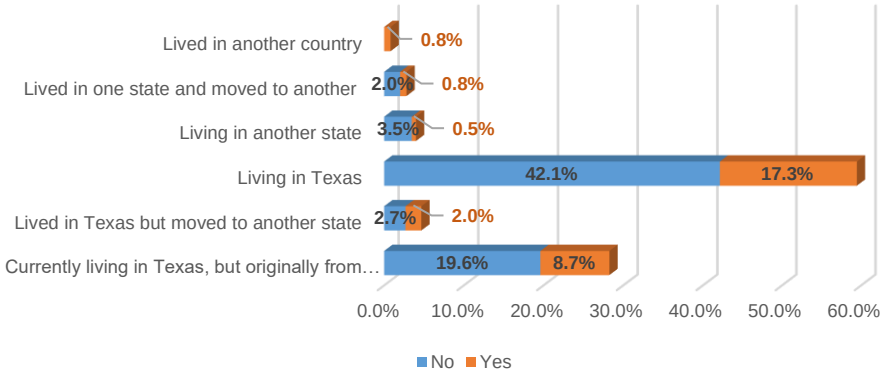
Chart 32. Migration Patterns into the Oil Fields of West Texas



Considering ethnicity, the majority of migrants are white at 24%. The next largest group is Latinos at 10.7% followed by African-Americans at 2 %. The remainers are 1.5% American Indian or Alaska Native, 0.4% Asian and 1.2% other or refused to say. All who moved from another country and are currently living in Texas are Latinos, but that is only 1% of the migrants. The majority of Latino migrants are either Texas residents (23%) or they moved in from another state (8.7%). We thought that a job in the oil industry would be the overwhelming reason for their migration. While 50.5% gave this reason, 29% indicated family as the main reason.

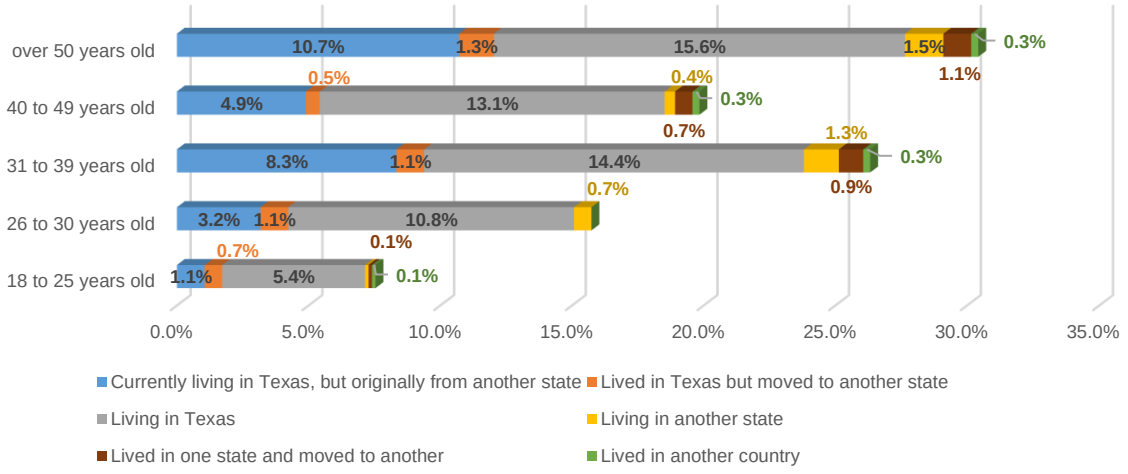
We also assumed that the majority of the migrants would move when laid off to seek jobs elsewhere. However, only 30% indicated that they had plans to move for better job opportunities. The majority, then, plan to stay in the area at least for now. It may be that they brought their families with them and had decided to stay in anticipation of jobs opening up again. Chart 33 indicates the moving plans of respondents by their original location before coming to West Texas.

Chart 33. Plans of Migrants to Move



We expected that migrants would tend to be younger. We were surprised that over 50 % were over 40 years old. The largest single category was over 50 years at over 30%. The next largest age category was 31 to 36 at over 25 percent followed by 40 to 49 age category at over 20%. Chart 34 indicates migration patterns and age.

Chart 34. Age of Migrants and migrant patterns



Laid-Off Workers and Education

We asked questions about education in the survey. Chart 35 shows that two-thirds of those on unemployment had an education of less than a college degree. The largest category is high school diploma at 28% followed by some college at 27%. The next largest category was bachelor's degree at 19 percent. Only 10 percent had an associate's degree. The oil and gas extraction industry is highly regulated. A certification is often required to do specific jobs. Almost half (48%) of the respondents

indicated that they had a certification of some kind. Most of the survey respondents were seeking employment in the oil field, construction, or a field related to their oil and gas skills. Of the 21% of the respondents, who are not currently seeking jobs, over half (62%) were those with less than high school, a high school diploma, or GED.

Chart 35. Highest level of education

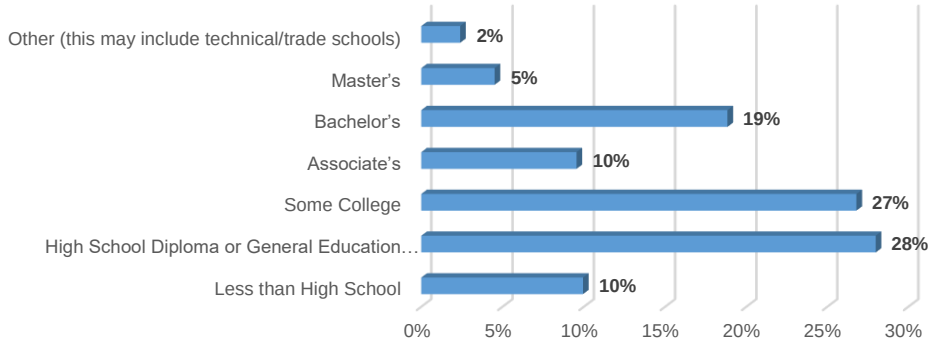


Chart 36 shows that less than 10 percent of the respondents were enrolled in any type of education program. The largest single category was community college. However, the majority of the responses were enrollment in technical, or certificate courses undoubtedly to enhance their training for jobs in the oil patch. Of the less than 10 percent attending training and education, 75 percent indicated that they were receiving financial support. Chart 37 shows that females dominate most of the different types of educational opportunities except technical school and training for certificate programs.

Chart 36. Education enrollment

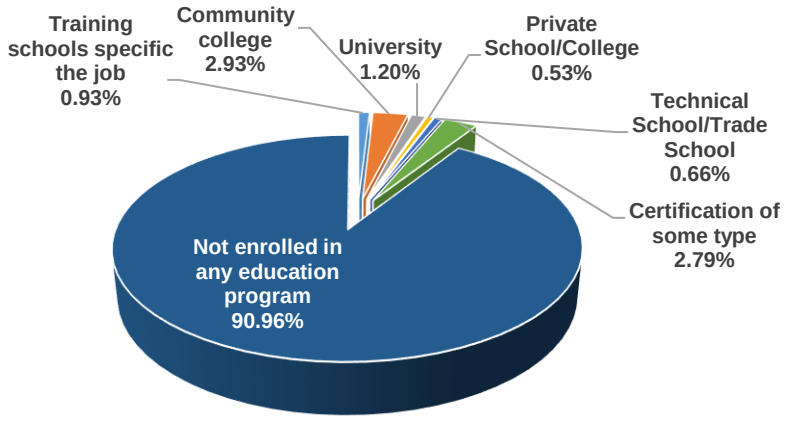
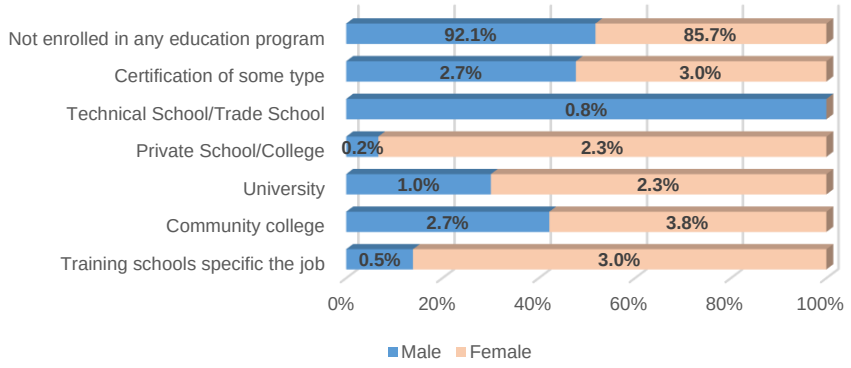
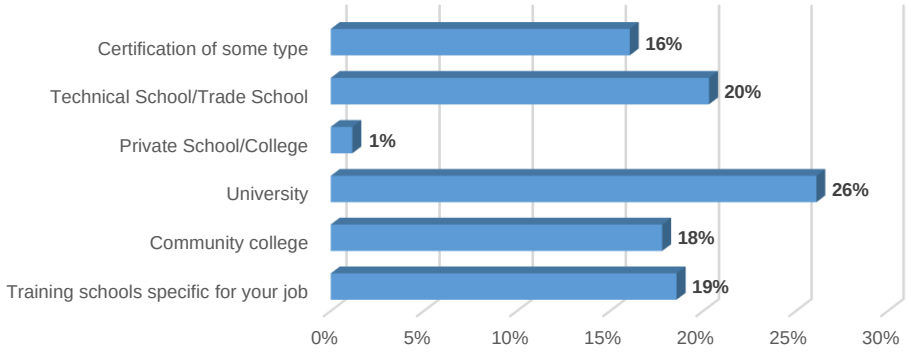


Chart 37. Gender and type of educational program in which people are currently enrolled



When asked if they had plans or a desire to further their education, only 26 percent answered in the affirmative. However, 75% of the total respondents indicated that they would like to further their education and training if financial support was available. Chart 38 indicates the types of programs in which they would enroll if financial aid were available. These programs were generally programs that would enhance their training and skills related to the oil and gas field. These included technical/trade school (20%), specific training related to their job (19%), and certification programs (16%). Twenty-six percent indicated a desire to enroll in university programs while 18 percent specifically indicated community college programs. It is clear that many more would enroll in programs to upgrade their skills and education if more funding were available. (See the discussion on funding through Workforce Solutions later in this report.)

Chart 38. Educational programs that respondents would attend if financial support was available



Age makes a difference not only whether they would seek more training and education but also in the type of programs in which respondents would enroll if funding was available. This is shown in Chart 39 below. While those over 50 make up 30 percent of the respondents, less than 25 percent indicated that

they would take advantage of training if funding was available. This is compared to all those in the other age categories who would seek additional training if financial support was available. It is also interesting that a university education was the dominant choice only of the respondents in the 26 to 30 and the 31 to 39 age groups. Most in all age groups were interested in some type of training specific to their jobs, technical training, or certification.

Chart 39. Age and program of interest if financial support was available

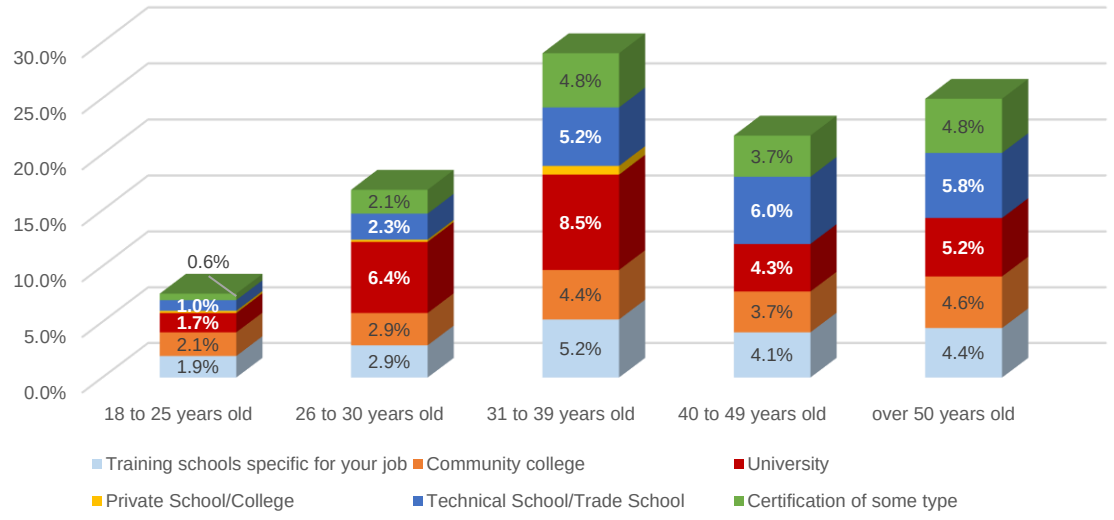
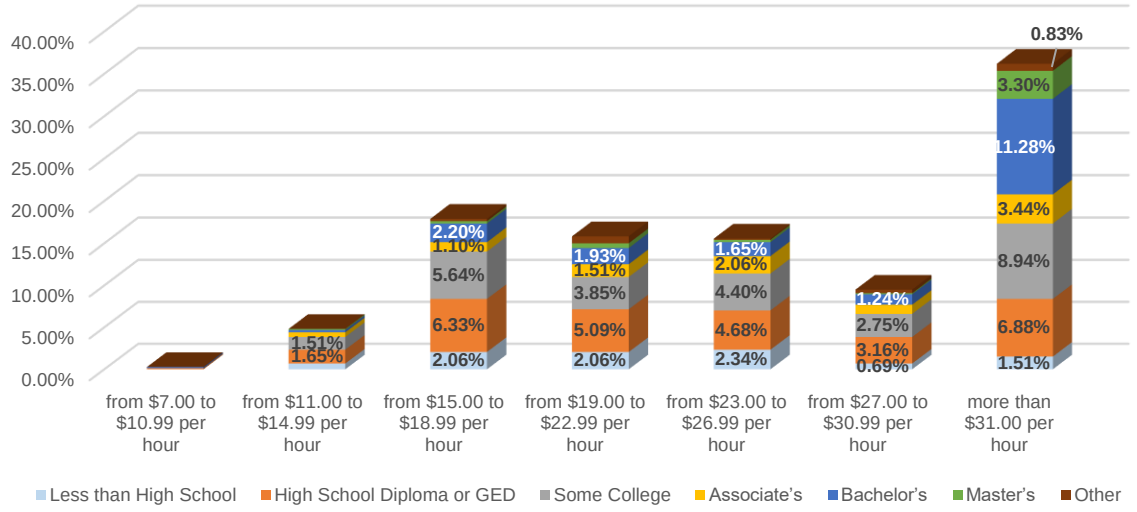


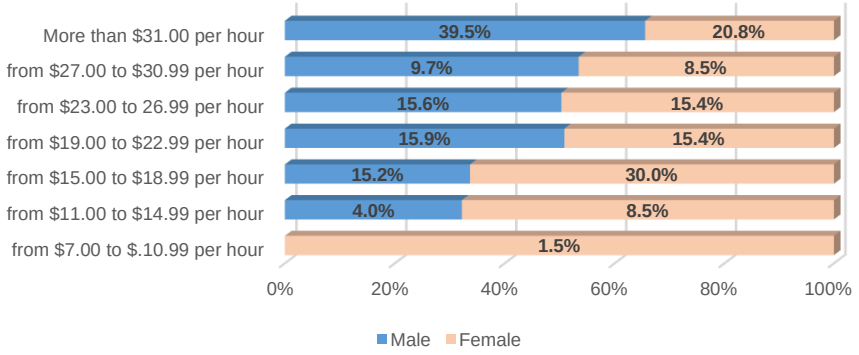
Chart 40 combines education attainment with hourly wage. The chart shows that the largest category paid more than $31.00/hour were those with bachelor's degree at 11.28%, followed by some college at 8.94%, and high school/GED at 6.88%. The chart shows that while formal education does help with pay, specific training, and skills that one could learn on the job or in technical courses are just as important if not more so. The chart also shows that those with less than high school fare poorly in their ability to command high wages.

Chart 40. Compensation of Unemployed Workers Prior to Lay Off and their Education



As in many other fields dominated by men, women tend to be paid less. Chart 40 shows the hourly wage by gender prior to layoff. Male workers were almost twice as likely to make over $31 per hour as women. In the other categories above $19 per hour, the gender pay was fairly similar. However, women were twice as likely to make under $19 per hour as men. No male worker made less than $11 per hour whereas 1.5% of the females did. Moreover, the chart shows that workers tended to be well paid before they were laid off.

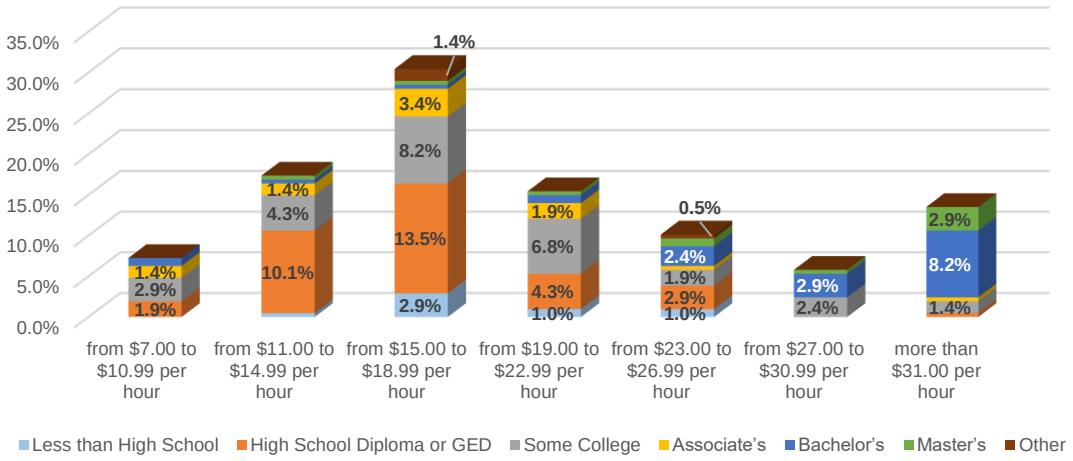
Chart 41. Gender and hourly pay before lay-off from the oil industry



Education level does not seem to make a difference for reemployment in the oil field. Oil companies apparently are looking for trained and experienced workers regardless of their educational levels. The largest educational categories of oil and gas reemployment were high school (11%) and some college (11%) with bachelor's third at 6%. However, education does make a difference in the level of compensation of re hired workers. Chart 42 shows that the majority of those, who found jobs making more than $31 per hour, have a bachelor's or higher degree. The education level of those making between

$15 and $19 per hour is predominately less than a bachelor's degree. It would appear from Chart 13 that a worker's chances to be reemployed in the oil field above $31 are better with a degree. The chart also shows that the compensation level for re hired workers is not as high as it was during the boom as the majority of re hired workers receive between $15 and $19 per hour compared to over $31 for the majority during the boom.

Chart 42. People that are currently employed (full or part-time): wages in the current job and level of education



THE ROLE OF TEXAS WORKFORCE SOLUTIONS AND COMMUNITY COLLEGE TRAINING AND EDUCATION PROGRAMS

In order to obtain unemployment compensation, a person must register with Texas Workforce Solutions. Those on unemployment compensation must be actively looking for a job or be enrolled in an approved educational program. The PB offices had over 1,000 in their database in Feb. 2016. Workforce Solutions has its own job websites and links to other job websites. They also hold job fairs for employers seeking employees.

Workforce solutions will subsidize attendance of approved training and education program to a total of $7,000 in the PB and $5,000 in SP. The approved program must be one of the training or education programs that each Workforce Development Board determine are shortage occupations in its development area. Each development area has a separate board that develops and approves the list of critical or growth occupations specific to its development area. Members of the board are usually human resource professionals from various companies in the area. (See appendix 3 for the list of shortage occupations in the PB and the SP workforce development areas.) Most of the education and training programs listed in Appendix 3 are provided at community colleges. It is interesting that the list for the PB development area is concentrated in the blue collar profession and nursing, while the SP is more expansive and includes a number of white collar professions. This would be an indication of the differences in the economic base between the two areas. Workforce Solutions works closely with community colleges on training programs. Some private institutions also offer approved programs.

Individuals, who qualify for these programs, are enrolled in the training program, and Workforce Solutions sets up an account obligating all costs related to the training including tuition, books, and fees until the grant is exhausted. If the student qualifies for a Pell Grant or a scholarship, the Workforce Solutions funds cover costs not covered by these other funds to the amount of the grant. The Workforce Solutions training budget is not able to assist all desiring further education and training. There is a waiting list of those on unemployment wanting support for increased training or education in the PB but not currently in the SP. However, the numbers on lay-off from the oil industry are much greater in the PB. As indicated in the survey (see the section on the survey education analysis), more on unemployment would take advantage of education if financial aid was available.

A snapshot in September 2016 showed that Permian Basin Workforce Solutions was supporting 67 individuals for training. Of these, 42 percent were taking courses designed to enhance their skills in the

oil and gas industry or related areas. Half of the 28 involved in this type of training were seeking to obtain their CDL license. Truck driving is attractive as it is a shorter course, there is a shortage of truck drivers, and a CDL license can be used in multiple sectors of the West Texas economy. Health-related programs were the next most popular program with 18 enrolled followed by teaching with 13 enrolled.

It is interesting to note that over half of those enrolled in training through PB Workforce Solutions are seeking careers not related to the oil industry. Only 7 men out of the 28 taking courses are seeking education and training for careers outside of the oil field. Of the 39 women taking courses all but 5 are in programs for careers outside of the oil field. Over 70 percent of training and education programs are under 40 years old. Only 8 are 50 years or older. Fourteen of those enrolled in education programs have a bachelor's or higher degree with 11 of those seeking a teaching certificate.

The training funds for the 2015-2016 budget year for the PB Workforce Solutions were $92,989. They were able to supplement these funds with $190,000 from other sources to provide additional training support. The training budget has been cut 10 percent compared to last year according to an official from Workforce Solutions.

The number receiving training assistance is extremely small, and the amount available per individual will not cover costs for programs other than short courses. That is probably one of the reasons why so many are enrolled in truck driving courses. Given the waiting list for educational assistance, the large number on unemployment, and the number who would take training if financial assistance was available, a case could be made that additional training funds would be a good investment in reducing unemployment rolls and improving the economy.

WORKFORCE SHORTAGE IN THE TECHNICAL AND CONSTRUCTION TRADES[2]

According to Jeff Joerres, chairman and CEO at Manpower Group, the workforce shortage problem is a mismatch of trained workers and jobs available (Bloomberg, 2015, January 10). According to the Conference Board (2016), several skilled trade labor occupations are in short supply due to a large demand and supply gap and a lack of flexibility. Figure 2 shows a list of skilled trade labor occupations and the number of workers in each, ranked by the value of the labor shortages index. The employment numbers in many of these occupations are small, consisting of less than 50,000 workers. Many of these occupations require a specific set of skills and experience that are specific only to their occupation.

The shortages in skilled trade occupations are in part because so few young workers are entering these occupations. A contributing factor is the very small number of immigrant workers in these fields. Foreign-born workers face many obstacles to entering skilled trade occupations, which require long training programs. Among those who do meet these requirements, few enter the United States to pursue technical trade degrees. Another factor is the general stigma to a technical trade. There is a strong focus in the United States for young people to obtain a 4-year college education. Most of the technical trade careers require training and education at a community college or a trade school. There is also the perception that jobs and compensation are less in these fields than in fields that require a bachelor's degree. For these reasons, participation rates are unlikely to increase unless a concerted effort is made to attract young people into training programs to prepare them for careers in these fields.

[2] Much of the information for this section is based on The Conference Board (2015). *The US labor supply problem: which states are at most risk*. Retrieved from https://www.conference-board.org/topics/publicationdetail.cfm?publicationid=4023

Skilled trade labor: labor shortage index for selected occupations

	Labor shortage index	Demand-supply gap (% of 2014 employment)	Employment (2014)
Computer control programmers and operators	96.7%	31.1%	173,900
Construction and building inspectors	96.2	26.6	101,200
Fire inspectors	95.6	23.1	14,100
Ship and boat captains and operators	94.9	26.6	39,800
Locomotive engineers and operators	94.5	34.4	46,100
Pumping station operators	92.7	34.1	32,100
Crane and tower operators	91.2	28.1	45,500
Ambulance drivers and attendants, except emergency medical technicians	91.0	19.0	19,600
Machinists	89.9	24.4	399,700
Elevator installers and repairers	88.8	17.1	20,700
Stationary engineers and boiler operators	88.5	20.6	39,100
Water and wastewater treatment plant and system operators	88.1	19.4	117,000
Geological and petroleum technicians, and nuclear technicians	87.9	22.3	23,300
Miscellaneous plant and system operators	87.7	24.7	109,100
Miscellaneous transportation workers including bridge and lock tenders and traffic technicians	87.5	33.1	50,500
Power plant operators, distributors, and dispatchers	85.7	21.6	60,000
Transportation inspectors	84.2	17.7	26,400
Motor vehicle operators, all other	83.3	26.5	62,000
Security and fire alarm systems installers	83.1	16.10	64,000
Animal trainers	82.6	22.9	36,800
First-line supervisors of mechanics, installers, and repairers	80.4	8.5	447,100
Electricians	80.2	9.4	628,800
Supervisors of transportation and material moving workers	75.8	13.7	378,600
Miscellaneous life, physical, and social science technicians, including social science research assistants	74.1	21.2	193,400
Firefighters	73.6	10.7	327,300
Earth drillers, except oil and gas	73.2	12.9	20,000
Electric motor, power tool, and related repairers	72.3	10.7	19,300
Bus drivers	71.7	13.7	665,000
Boilermakers	71.2	8.1	17,400
Railroad conductors and yardmasters	70.3	18.9	45,100
Heavy vehicle and mobile equipment service technicians and mechanics	67.5	9.8	186,500

Note: Labor shortage index and its subindices are presented as percentile rankings over all 457 occupations in our analysis. 100% for a given occupation means that it faces a higher shortage risk than all other occupations, 50% for a given occupation means that it faces higher shortage risk than half of all occupations, etc.

Source: The Conference Board

Figure 2. Skilled trade labor: labor shortage index for selected occupation

Businesses across all business sectors in the U.S. that rely upon skilled workers are faced with a demographic shift in population and a shrinking skilled workforce. Manpower Group reported in 2015 that skilled trade workers and drivers were the two hardest jobs to fill while technicians ranked seventh on the list (Manpower Group, 2015).

The United States has an aging workforce in the technical trades. The U.S. Conference Board reports that retiring Baby Boomers are vacating jobs faster than young workers can replace them, especially in the skilled trades, manufacturing and health care professions (The Conference Board, 2016). Manpower Group (2015) states that in 2012 53% of skilled-trade workers in the U.S. were 45 years and older and 18.6 % were between the ages of 55 and 64. The skilled trades job category with the oldest workers is electrical and electronics engineering technicians with 38% of jobs held by workers 55 years and older. Younger workers are not replacing older workers as they retire, creating a critical skilled technical trades shortage. Indeed, the number of workers aged 35 to 44 will decrease likely causing a widespread shortage of middle managers, and the youth demographic (ages 18 and younger) will shrink in size compared to the adult population.

Construction Labor Research Council (CLRC) (2014) predicts that 185,000 new workers will be needed annually for the next decade. There were 337,000 jobs for welders, cutters, solders and brass workers in 2010, according to U.S. Department of Labor, a number which is expected to grow by 15% in 2020 (BLS, 2012). In contrast, the number of jobs requiring a bachelor's degree is expected to be only 20 percent of the total workforce by 2020.

According to Manpower Group (2015), approximately three-quarters of employers globally cite a lack of experience, skills or knowledge as the primary reason for the difficulty filling positions. Only 1 in 5 employers is concentrating on training and development to fill the gap, and only 6% of employers are working closely with educational institutions to create curriculums that close knowledge gaps. Skilled workers are becoming increasing hard to find in East and West Texas, and the Coast Bend region. Anecdotal information indicates that construction projects in West Texas are being delayed due to a shortage of skilled construction workers.

As indicated above, there is an image problem among young people regarding a technical trades career. One recent survey of high school students (80% males and 20% females between the ages of 14 and 18 currently enrolled in school, with a total sample size of 1023) by Rigid (2009), supplier of professional

grade tools, gave the following reasons for lack of interest in skilled trades (They could choose more than one answer.):

- 53 percent indicated that working in the trades just doesn't interest them.
- 25 percent indicated that they are not mechanically inclined, while 24 percent say they are not good at fixing things.
- 21 percent indicated they don't know enough about it.
- 15 percent don't believe there is a lot of opportunity in the skilled trades.
- 11 percent don't think the trades are cool.
- 10 percent indicated that the skilled trades were not high tech enough.
- 54 percent believe there is a better future working in computers than working in skilled trades.
- 37 percent believe working in an office is more respected than working with your hands.
- 25 percent believe skilled trades jobs are old-fashioned.

As labor markets tighten, it will become more and more difficult to hire workers in the hardest-hit states as the competition over talent intensifies. Nationally, firms are already finding it increasingly difficult to fill open positions and to find qualified talent. In states like Texas, where the unemployment rate is already below the national rate, it is extremely difficult to find qualified talent. At the same time, more employees will probably switch jobs as the labor market tightens, and compensation growth is also likely to increase as the labor market tightens.

The fact of the matter is clear: the US labor supply will grow at a historically low rate over the next 15 years, with varying severity across states. Businesses would benefit by working proactively with educational institutions to recruit future workers and develop training programs to meet their current and future needs for a skilled workforce.

EDUCATING AND TRAINING THE WEST TEXAS WORKFORCE

Companies seeking to relocate are usually looking for an educated and technically skilled workforce or a workforce that can be readily trained to meet their specific skillset. Jobs increasingly require skill sets that are not taught in high school. These skills may not require a bachelor's degree, but they usually require education and training beyond high school. Table 5 provides a snapshot of the educational attainment of the workforce in the three largest populated counties in the study area compared to the United States.

Table 5. Percent Educational Attainment of the Workforce over 25 in Ector, Midland, and Lubbock Counties and the United States 2014

Category	Ector County	Midland County	Lubbock County	United States
Less than 9th Grade	8.7	7.4	6.1	5.6
9th to 12th Grade No Diploma	14.1	9.5	8.2	7.5
High School Diploma or Equivalency	30.4	24.6	26.9	27.7
Some College, No Degree	24.5	25.4	24.6	21.0
Associate's Degree	5.5	7.4	6.8	8.5
Bachelor's Degree	11.8	18.2	16.9	18.7
Graduate or Professional Degree	5.0	7.4	10.6	11.4

Source: United States Census bureau
http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_1YR_DP02&prodType=table

The table indicates that the workforce is not as well educated as the United States as a whole insofar as associate's or higher degrees are concerned. However, those skill sets that companies engaged in oil extraction are often seeking are not necessarily bachelor's degrees. All the counties do well compared to the U.S. on some college, which would include specialized training or certificate programs. They are also reasonably comparable with high school diploma or the equivalency. A trained workforce is an essential element for economic development. It is clear that the workforce in the Permian Basin is a capable, skilled workforce for the oil industry. However, enhancing one's skills is critical as the oil industry continues to become more sophisticated.

The Role of Community Colleges in Educating the Workforce

Community colleges offer both credit and noncredit courses in applied technology. Credit courses can lead to an associate's degree in Applied Technology, which is generally a two-year program. Noncredit

training is much shorter in duration. Interviews were conducted with personnel from Midland, Western Texas, and Odessa community colleges. These colleges have had an increase in enrollments both in credit and noncredit programs since the downturn in oil prices. Students seeking to change careers will tend to take credit courses while those who want to upgrade their skills in oil-related work will take noncredit short courses.

Midland College offers professional development courses directed largely at professionals in the oil field through its Petroleum Professional Development Center. These are short courses providing information on specific topics lasting from one to five days. The courses are open to professionals in the oil field from throughout the country who need continuing education credits or specific knowledge in a particular area. The companies that send their employees pay for most of these courses. Since the downturn, these courses are often canceled because of the expense to individuals and tight company resources.

Some companies will give generous contributions and work with community colleges on training and education. With the high cost for each community college to equip a technology lab with state-of-the-art equipment, community colleges usually seek outside funds or partnerships with industry. Most applied technology programs have advisory boards composed of people from the industry. A good example of company involvement is the Saulsbury companies. Odessa College works closely with Saulsbury on training programs, and Saulsbury has donated sufficient funds to have a building named after the company. Saulsbury has its corporate headquarters in Odessa.

Western Texas College is another example of a close working relationship between the college and the industry. Western Texas College received a Title III STEM grant in 2011, which provided resources to help fund the creation of four distinct educational programs: petroleum technology, welding, electrical distribution systems, and process technology. Each of the four educational programs takes two years or at least 60 semester hours to complete, and the students are awarded an Associate of Applied Science degree upon completion of the program. An advisory committee that includes Conoco Phillips, Chevron, Kinder Morgan, CML Trucking, and White Transportation Services oversees these programs. The advisory committee gives advice on the curriculum, as well as input on specific skill building within the programs.

The average enrollment in each of these programs has been fifteen students per class for the last several years. The majority of students are traditional students, straight out of high school. The STEM grant and contributions from industry are necessary for rural community colleges to develop technology programs requiring state-of-the-art equipment to conduct realistic hands-on training. Some examples of the

donations the college has received include PLC's (programmable logic controllers), steel pipes, and cutouts of pipe configurations that allow the students to see the inner workings of various valves and the flow of fluid. A key part of the programs at Western Texas College is the capstone and internship requirements. The capstone is a practical semester-long project that the students work on. The internship requirement has led many students to receive job offers from the company where they interned. These two requirements provide the student with experience in a large hands-on project as well as some industry experience

However, the support for training by companies is hit and miss. One interviewee recounted a situation where a company gave a consortium of community colleges over a million dollars to train its workers in a noncredit course in a critical skill for which the company could be fined if the employees did not have the training. The grant was for training during the boom. The supervisors of the employees, who needed the training, refused to allow them to attend because they were needed in the oil field. They were more willing to risk paying the fine. The training did not happen, and the grant had to be returned. In the downturn, the company does not have the need or the resources for the training.

Despite the above and the inconsistencies, companies are concerned with training. The oil industry is heavily regulated, and it is important for companies to have a skilled workforce. Several companies, with the resources to do so, have established their own training facilities in the Permian Basin. Chevron and Occidental are two examples. Occidental in Fall 2015 opened a new training facility in Midland to train its workforce for the entire North American area. They bring in people for three or four-day courses to upgrade their skills and do cross-training. It is classroom and hands-on with state-of-the-art equipment. Much of the equipment has been donated by their vendors. They have had more than 1,000 employees attend training since it opened.

Most managers interviewed indicated that their companies do their own training. Their priority is to hire trained and experienced workers. If they cannot find trained and experienced workers, they will train on the job or give them a short course in their processes. Unless they require license or certificate, they prefer to train employees in their facilities or through on-the-job training. They discount community college technical training as being too general and not specific enough for their needs.

THE EMPLOYMENT OUTLOOK WITH THE DOWNTURN IN THE PRICE OF OIL

In this section, we analyze the employment and economic outlook for jobs. We also look at possible ways to further diversify the economy to reduce the shock from the price fluctuations in the price of oil.

One indication of the effect on employment by the downturn in oil prices is to analyze job postings. Data were obtained for the South Plains Workforce Development Area and the Permian Basin Development area, which include all but two of the rural counties of the study area. For comparison purposes postings for months in 2013, the height of the oil boom, and months in 2016 were compared. As one would expect, depending on the category of worker and the months compared, the job postings were down anywhere from 30 to 80 percent. For example, the postings for workers in oil and gas extraction comparing May 2013 and May 2016 were down 50 percent from 420 to 212 (Texas Industry Profile, n.d.).

It is interesting, however, that companies were still looking for workers in May 2016. For example, the job category of roustabouts had only declined by 26 percent from 19 in January 2013 to 14 in May 2016, a decline of only 26 percent. Compared to other workforce development areas with a large workforce in the oil patch, the PB is still doing remarkably well. While job postings for oil and gas service workers declined 58 percent between January 2013 and May 2016, the decline was not as steep as in the other areas in the state. In addition, in May 2016 there were still 32 job postings for oil and gas service workers in the PB, more than any other area of Texas. It is an indication that the oil companies are still investing and have confidence in the future of the oil industry in the PB.

Help wanted ads will also give an indication of the types of jobs that are in demand in the region that can be useful for education and training purposes. It will also be useful for attracting compatible companies to the area. The major employment category in demand in 2016 relates to the transportation industry in the South Plains and the Permian Basin with heavy and tractor-trailer drivers at the top of the list with 10,893 postings between May 2015 and 2016. The next major category is the healthcare industry with registered nurses at the top of the list at 8,057 postings. The third major category is in retail trade with supervisors and managers at the top of that category at 4,032 job postings. (See appendix 4 for the top 25 job postings for the combined South Plains and Permian Basin and Appendix 5 just for the Permian Basin between May 2015 and 2016). The major difference between the SP and the PB is that workers for the oil patch are still needed in the Permian Basin.

Additional information on job demand can be obtained by analyzing job fairs. We requested examples of job fairs held by SP and PB Workforce Solutions. The PB job fairs provided to us for job fairs in 2016 show that many firms involved in construction and the oil industry are holding job fairs. In fact, most of the job fair information provided from the Permian Basin were for construction and companies involved in the oil industry. Examples include Mortensen and Halliburton construction companies, and Bosque and Francis Drilling. This is another indication that even though the price of oil is down, there are still available jobs in the industry. For the South Plains, due to the diverse economy, the oil downturn did not have a visible negative effect on types of job availability. Job fairs seem to be consistent in terms of companies represented and types jobs from one period to the next.

For further information, as to job availability in the economy, we report on a 2014 online survey of 132 employers in Lubbock commissioned by the Lubbock Economic Development Alliance (LEDA, 2014). This was a convenience sample of a variety of employers. Admittedly, this is a small sample and is not representative of the study area, but it provides further information as to the types of jobs that are in demand by employers. Fifty-Six percent of these employers indicated that they had plans to hire more professional/technical workers and 40 percent indicated that they planned to hire skilled labor over the next two years. They also indicated that these jobs, other than management, were the hardest jobs to fill, indicating a need for a better-trained workforce. Some of the more difficult jobs to fill were information technology, nurses, drivers, engineers, and management.

As the above shows, there are jobs in demand in the economy. However, these jobs require skills and training. As indicated above, there is an apparent disconnect, between technical education programs offered by the educational institutions and the specific training needs of the employers. Over 50 percent of the respondents from the LEDA survey and all the oil company executives interviewed indicated that they do their own training in-house or in conjunction with their vendors. While the educational institutions provide general technical training, the companies appear to want skill training to meet their specific needs.

PROGNOSIS FOR AN ECONOMIC REBOUND

The Lubbock Economic Index has been on an upward trajectory since 2011 from its low of under 120 in 2011 to a high of 146.3 in April 2016. (The base year 1996 = 100.) The Lubbock employment situation remains among the best in the state with strong employment growth and a low unemployment rate (KCBD Television 2016). It took the Lubbock economic index 12 years to achieve a high of 130 before the Great Recession when it dropped to under 120. Since then, it has added 26 points in less than five years. (Some rural counties in the South Plains Development Area are substantially impacted by the swings in the oil prices and for our analysis here are considered as part of the Permian Basin area.)

The Permian Basin economy has not fared as well as the Lubbock economy. The combined Midland-Odessa metropolitan area has endured 16 months of contraction through May 2016. It reached its high point of 233.7 in January 2015 and had since dropped 33 points to 200.6 (The base year 1996 = 100). During the oil boom, it increased 100 points (Midland Economy, 2016). The Permian Basin economy is heavily dependent on the oil and gas sector and will likely remain so.

The big uncertainty is the price of oil. It has rebounded from its low of below $27 a barrel in February, and the price range is currently in the $40 to $50 range. The Energy Information Agency (EIA) projects the price of oil will be in the $40 price range for the next year and hover around $45 per barrel in December 2017. The number of oil rigs, according to the EIA, will start to increase slightly in 2017 as long as the price stabilizes in the $40 range (McEwon, 2016).

Another prognosis is that the price will remain below $50 per barrel for all of 2017. The current world oil glut has been reduced, but there is still a lot of oil in the system. Demand for oil is likely not to be as robust as it was in the first half of 2016 as many Chinese refineries overbought when the price was below $30. Growth in the Far East economies is still sluggish. In addition, gasoline futures in the U.S. traded for $1.50 a gallon at the height of the summer driving season, lower than in September 2015. Moreover, new supplies in other parts of the world are expected to come online. Goldman Sachs Group also projects a slow recovery and a prolonged period of low prices, more akin to the 1986 to 1999 downturn than the swift recovery after the 2008 financial crisis (Bloomberg, 2016)

A recent World Bank (2016) analysis projects that the price of oil will settle in the range of $53 to $60 by 2020 when supply and demand are expected to be in balance. Prices are not expected to revert to the triple digit prices experienced in the last oil boom. Middle East oil exporting countries are reducing subsidies

to their public and spending because of deficits. Saudi Arabia appears to have relinquished its role as the swing producer that absorbs fluctuations in global demand and supply. The Bank suggests that "With over 4000 idle oil wells and a reaction time in ramping production up or down of about 4 to 6 months—compared with several years for conventional producers—the US shale oil industry is becoming the marginal producer, effectively setting oil prices in the market." (World Bank, 2016).

The big question is U. S. shale production. Will shale oil drilling resume at $50-$60 per barrel? There is some indication that companies are starting to gear up for more production at the current price. Citi analyst Edward Morse reported that there are nearly 2,000 drilled but not completely constructed wells in the U.S. With higher prices, companies will begin to bring these wells into production. Morse forecasts that these wells could bring U.S. production back to 9 million barrels a day by July 2017 (Bloomberg).

Some companies are starting to plan new drilling. Pioneer Natural Resources and Devon Energy announced plans to plow an additional $600 million into their shale oil fields in Texas and elsewhere (Collin, 2016). Texas drillers may start hiring soon, as long as prices hold up. While there is disagreement as to what the price of oil needs to be to restart new drilling on any scale, most observers agree that it must be stable and be around $60 per barrel. This will mean more hiring, but hiring always lags the price. If the past is an accurate predictor of the future, companies become more efficient after each downturn with fewer employees needed to do the same amount of work, which will result in fewer employment opportunities with each boom and bust cycle.

Renewable Energy

Renewable energy is a factor that must be considered in the energy calculus. The Frankfurt School-UNEP (2016) reveals that 53% of all generating capacity installed last year around the world was renewable. Renewable generation investment for 2015 was $266 billion vs. $130 billion for Coal and Gas. The U.S. Department of Energy predicts that wind energy could grow to 20 percent of U.S. electrical generating capacity by 2030.

According to the U.S. Department of Energy, Texas currently, has the largest installed wind power capacity in the U.S. with 17,173 MW. The state in second place is California with 6,108 MW. Figure 3 gives a state-by-state breakdown. Wind is a clean, affordable, and renewable energy resource, which plays a significant and growing role in the U.S. and Texas energy markets. According to the Wind Energy Foundation, wind is currently the fastest-growing source of electricity production globally. Wind

generation technology is mature and proven, and increasingly cost competitive. Texas has over 20% of the nation's installed wind capacity. If Texas were a country, it would rank sixth in installed capacity.

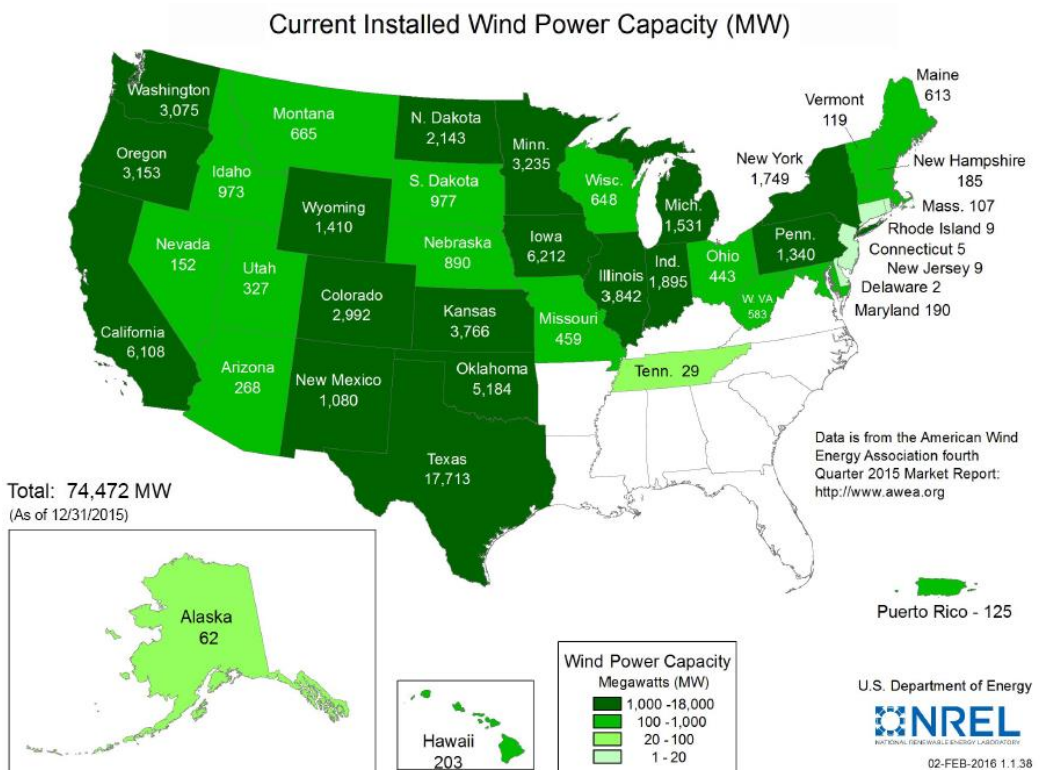


Figure 3: Currently installed wind power capacity
Source: U.S. Department of Energy

South Plains and the Permian Basin have a high potential to develop wind energy. As Figure 4 shows, the region has wind speeds that vary from 7.5 to 8.5 m/s. Figure 4 also shows, compared to the rest of the U.S. and even with the rest of Texas, the SP and PB are in a propitious area to develop wind energy. The windiest location in the state is in west and north Texas and along the gulf coast.

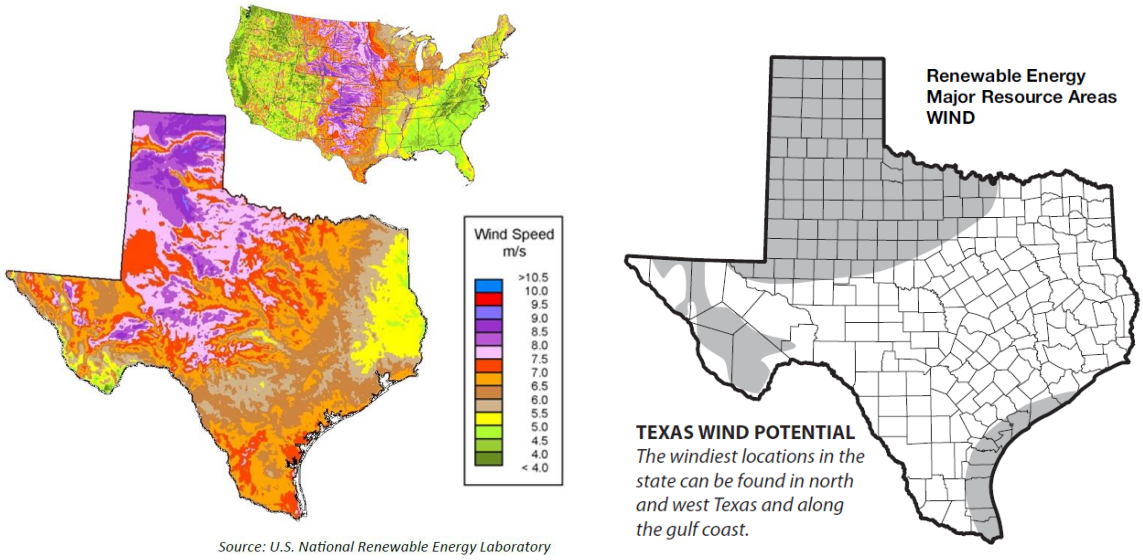


Figure 4: Wind resources in Texas and the U.S.

Source Office of the Governor Economic Development and Tourism Business Research (2014). *The Texas renewable energy industry.* Texas wide open for business. Retrieved from http://gov.texas.gov/files/ecodev/Renewable_Energy.pdf (on the left) and State Energy Conservation Office, retrieved from http://www.seco.cpa.state.tx.us/schools/infinitepower/docs/factsheet07.pdf (on the right)

In addition to energy generation, Texas also plays an important role in the national and global wind energy manufacturing industry. The American Wind Energy Association (AWEA) estimates that at least 45 Texas facilities are involved in the windmill manufacturing business (Office of the Governor Economic Development and Tourism Business Research, 2014). The state is home to manufacturing facilities for all three primary components of windmills: towers, blades, and nacelles. (Nacelles are the boxes attached to the top of towers that contain the turbine, gearbox, and other electronic equipment.)

Due to its abundant sunshine, specialized manufacturing base, and growing research institutions, Texas is well positioned to compete in the solar energy market. Texas is ranked No. 1 nationally in solar potential, according to the Texas State Energy Conservation Office. West Texas, in particular, has some of the nation's highest levels of solar radiation, making it ideal for utility-scale solar power plants (Figure 5).

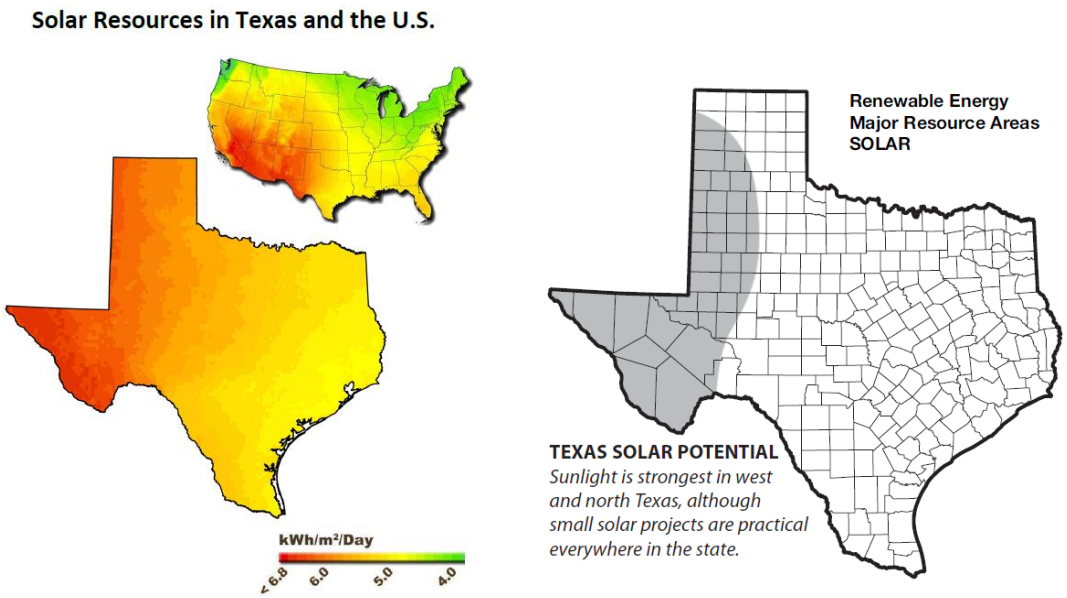


Figure 5: Solar resources in Texas and the U.S.
Source Office of the Governor Economic Development and Tourism Business Research (2014). *The Texas renewable energy industry*. Texas wide open for business. Retrieved from http://gov.texas.gov/files/ecodev/Renewable_Energy.pdf (on the left) and State Energy Conservation Office, retrieved from http://www.seco.cpa.state.tx.us/schools/infinitepower/docs/factsheet07.pdf (on the right)

Texas and particularly West Texas is well positioned to compete in renewable energy. It leads in many areas of renewable energy as indicated below (Office of the Governor Economic Development and Tourism Business Research, 2014):

- First State in wind energy capacity.
- First State in the wind energy-related manufacturing.
- First State in wind industry employment.
- Second State in total renewable energy employment.
- First State in biodiesel production.
- First State in solar potential.
- Sixth State of solar energy industry employment.
- Fourth State for clean energy-related patents.

According to the Office of the Governor Economic Development and Tourism Business Research, Texas has attracted renewable energy investment from all around the world. According to information from the Clean Jobs Index, Texas had over 28,000 renewable energy workers in 2012 (Figure 6). These statistics include employment in industries from wind turbine maintenance to semiconductor manufacturing.

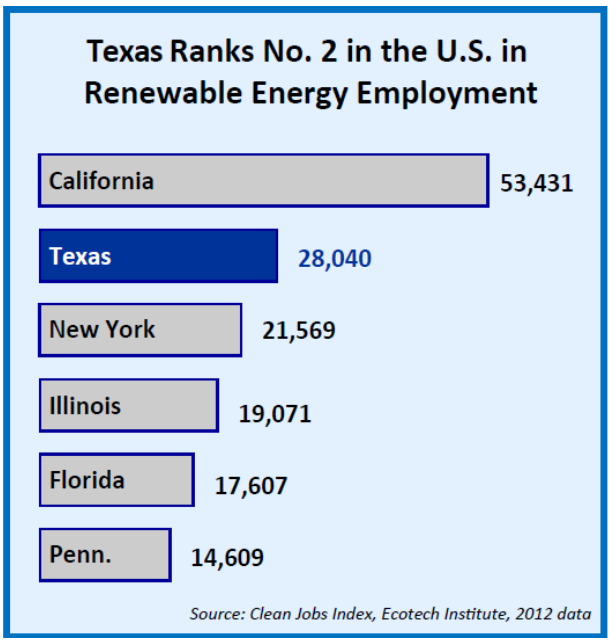


Figure 6: Ranking of renewable energy employment
Source: Clean Jobs Index, Ecotech Institute, 2012 data

DIVERSIFYING THE ECONOMY

One major element of this study is the employment of workers laid off from the downturn in the price of oil. Another element is an analysis and recommendations on diversification of the economy to cushion future shocks to the economy from the swings in the price of oil. As has been shown elsewhere in this study, all but a few of the rural counties in the South Plains part of the study are economically oriented to Lubbock, which has an economy that is not dependent on oil and gas. Certainly, the Lubbock area can further diversify and attract business that is compatible with one or more of its major economic drivers: Texas Tech University, agribusiness, and its medical complex. The swings in oil and gas prices have a negligible effect on Lubbock employment and the Lubbock economy.

This section looks at ways to grow the economy through diversification with an emphasis on the Permian Basin. There are a number of factors and concerns that should be considered relative to efforts to diversify the Permian Basin economy. These are listed below:

- The Permian Basin should embrace the fact that it is one of, if not, the major premier oil producers in the United States. It is one of the most economical and technologically sophisticated oil producers in the country. The cost of pumping oil in the PB is one of the lowest in the nation. The PB should capitalize on this and seek to attract ancillary and compatible businesses to further enhance and build its reputation as the premier oil area in the nation.
- It has a skilled and knowledgeable workforce for the oil fields. It should seek to enhance its workforce with additional training programs in a collaborative partnership with the oil industry.
- As the population in the PB grows, the service industry increases. The service industry can absorb some of the laid-off workers to cushion the shock on the economy from oil price drops. This is evident with the current price drop compared to the price drop in the 1980s. In the 1980s with a smaller population and service sector, the laid-off workforce could not be as readily absorbed resulting in a higher unemployment rate and a major shock to the economy.
- There are efforts to diversify the economy in the PB. For example, the Midland Economic Development Corporation has launched an effort to attract aerospace/aviation-related companies**.** Midland established a commercial spaceport and a business park for aerospace companies adjacent to its international airport. Energy-related companies are continuing to make investments in the PB. Summit Energy has plans to build a 400 megawatt coal plant that will capture more than 90 percent of CO2 emissions and will then sell that carbon to oilfield customers. Saulsbury Industries, headquartered in Odessa and the largest private employer in

Odessa, is diversifying by adding nuclear energy to its recent focus on natural gas processing plants.

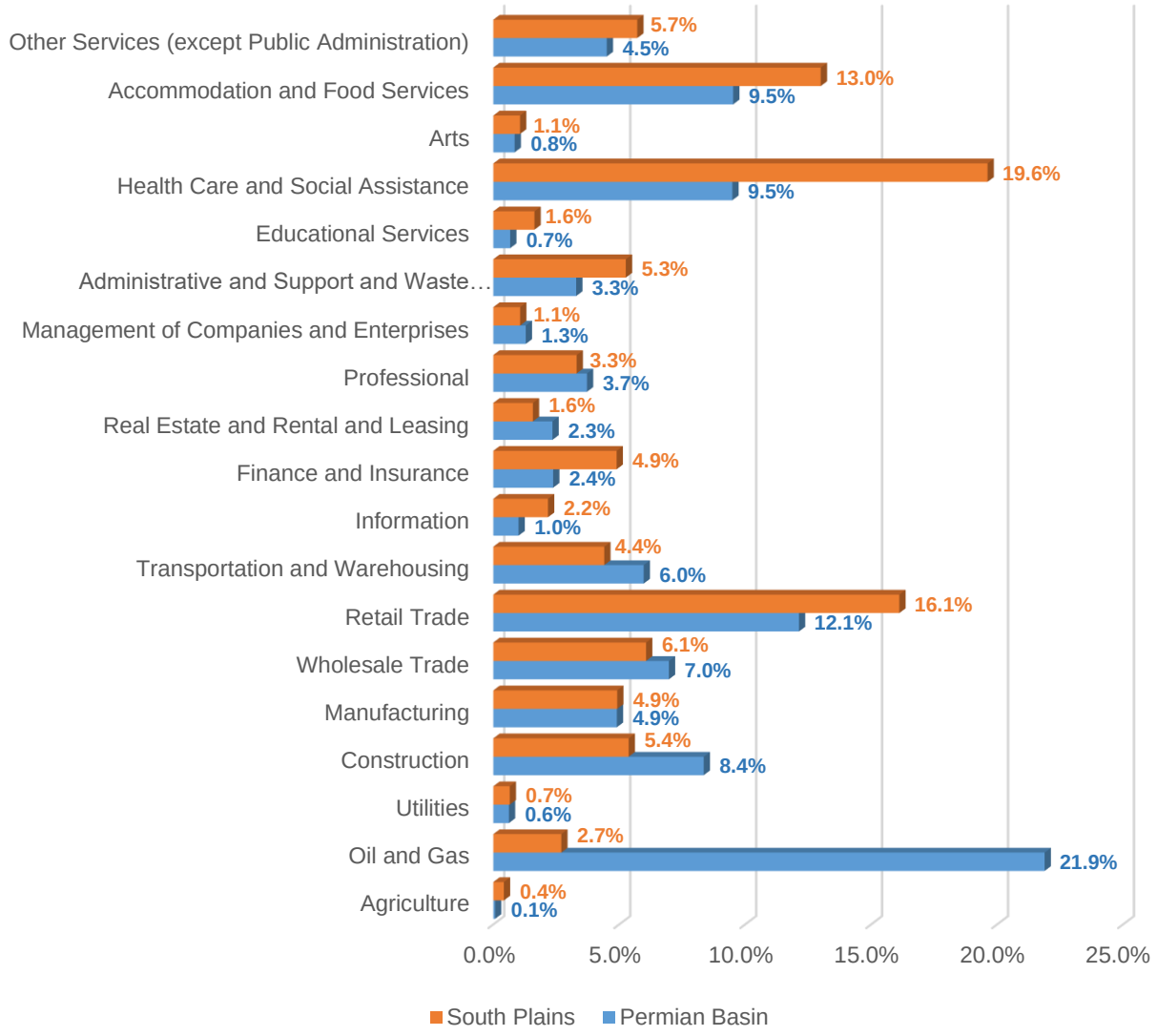
- Obviously, if the price of oil rebounds, many workers will return to the oil patch.

Business is normally attracted to an area where it can have a comparative advantage. Each region has a unique mix of industries which drive the economy. The size and diversity of those industries is a function of the region's comparative advantage. In other words, each region has advantages that serve to attract and contribute to the growth of particular industries. Comparative advantage can be natural resource-based such as oil, a function of proximity to a transportation nexus such as a seaport or railway, driven by abundant, skilled labor, capital availability, or other advantages. Some businesses locate and grow because of happenstance, such as the founder/entrepreneur was raised in the area or attractive area amenities.

Chart 43 shows the percentage distribution of jobs per category according to County Business Patterns (US Census Bureau) in 2014. It is clear the economies of the areas are driven by different industries. The top 5 activities in the Permian Basin are 1st oil and gas (21.9%), 2nd retail trade (12.9%), 3rd accommodation and food service (9.5%), 4th health care and social assistance (9.5%), and 5th construction (8.4%). In the South Plains, the top 5 activities are 1st health care and social assistance (19.6%), 2nd retail trade (16.1%), 3rd accommodation and food service (13%), 4th wholesale trade (6.1%), and 5th other services, except public administration (5.7%). It is important to note that both regions have substantial percentages of employment located in one category. However, the South Plains employment appears to be spread out more evenly over more sectors than employment in the PB. Moreover, the large dependence on health care and social assistance part of the economy in the South Plains is not subject to price and demand fluctuations as the economy in the PB.

From the information provided in the chart, it would appear that compatible businesses to support the health and social assistance industry would be prime candidates for location in the SP and compatible businesses that support the oil and gas industry would be prime candidates for location in the PB. With an educational focus in those major job sectors, there should be a skilled workforce to support the dominant industries.

Chart 43. Jobs per category in 2014 in Permian Basin and South Plains



Source: Bureau of Labor Statistics - Labor force data by county, annual averages from 1990-2014 retrieved from http://www.bls.gov/lau/#tables and United States Census Bureau – Business Pattern –retrieved from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl

In addition to analyzing the distribution of jobs in the region, another way to assess the competitiveness of a region and to determine the region's comparative advantages is to analyze the employment in the region relative to the distribution of employment in the United States. If the region has relatively more employees than would be expected, that region might have a comparative advantage in that industry. The region could then grow the economy by attracting additional compatible businesses and helping existing business grow. This approach does not necessarily diversify the economy, but it is an excellent approach to expand the economy. As the economy expands, it will be able to better withstand price shocks. With

the general growth of the PB economy, it has been better able to absorb laid-off workers in the current downturn, compared to the previous major downturn in the 1980s. Long- time oil workers and residents still consider the lengthy downturn of the 1980s as the worst of times for the industry and the PB economy.

The location quotient (LQ) is one indicator of employment and employer concentration. The LQ is an indicator of relative employment concentration in the region compared to a larger, presumed self-sufficient area. The concept behind LQ is that region's economy grows through exporting goods and services. The LQ of occupational groupings will indicate what portion of each occupational group, if any, is for exporting. If a region has a large LQ, it does not necessarily mean there is, or will be, job growth in the future. It does mean that on a relative basis this sector plays a significant role in the region's export base. Location quotients can point to industries where a comparative advantage exists.

To determine export industries for an area, an LQ is calculated for each occupational grouping in the area by comparing employment in the region in the occupational grouping with employment in that grouping in the United States. If the result is greater than 1, that excess over 1 is considered to be involved in export outside the region. If the number is less than 1, it is considered to be a non-expert industry. That is, the product is consumed within the region. The LQ is an excellent tool to help formulate plans for attracting compatible business. Table 6 shows the top ten export occupational groupings for the South Plains and the Permian Basin.

Table 6. Top 10 Export Occupational Groupings Based on NAICS titles for the South Plains and the Permian Basin Based on 2012 Employment

South Plains Development Area, Occupational Grouping and		**Permian Basin Development Area, Occupational Grouping and**	
Categories	**LQ**	**Categories**	**LQ**
Oilseed and Grain Farming	5.93	Machinery & Equipment Rental & Leasing	11.78
Other Crop Farming	27.01	Other Crop Farming	11.5
Cattle Ranching and Farming	8.24	Pipeline Transportation of Crude Oil	34.15
Support Activities for Mining	5.24	Oil and Gas Extraction	35.17
Grain and Oilseed Milling 8.39		Pipeline Transportation of Natural Gas	7.63
Wireless Telecommunications Carriers	5.20	Support Activities for Mining	43.22
Home Health Care Services	2.64	Sheep and Goat Farming	9.75
Commercial Machinery Repair/Maintenance	2.79	Ag., Construction, and Mining Machinery	6.40
Support Activities for Crop Production	2.72	Chemical Merchant Wholesalers	7.37
Farm Product Merchant Wholesalers	3.93	Utility System Construction	6.25

Source: Calculated from figures provided by the U.S> Bureau of Labor Statistics http://data.bls.gov/location_quotient/ControllerServlet;jsessionid=37EB5F1B8013761BB6C2DB79083A8184.tc_instance3

As can be seen from the table, the LQs are substantially different for each region. This leads to the conclusion that the regions, although bordering on each other, with each region's metropolitan area within two hours driving distance, appear to have little in common insofar as economic development potential. It is also clear, when comparing the LQs with the distribution of jobs in Chart 43 that an export industry does not need to have a large number of jobs. The major export advantage that South Plains has is on farm and farm products while the Permian Basin is oriented in oil and gas, construction and related businesses. However, the SP does have a high LQ for mining support activities which would be compatible with the PB orientation. Areas that are major employers in the SP, such as education and health, while export industries, were not in the top 10. Education had an LQ of 1.44 while healthcare had a 1.03 LQ, barely an export industry. If one were to combine all the oil and gas employment categories together in the PB, the LQ is 22.54 indicating dominance of the energy sector. Combining all farm and food related categories in the SP results in a respectable LQ of 2.51.

Another way to understand a region's comparative advantage is through shift-share analysis. Shift-share analysis is used to describe and document employment changes within an economy over a specific period of time. It paints a picture of how well the region's current industries are performing compared to growth at the national level by examining changes in the employment mix over time. A shift-share analysis provides a dynamic account of total regional employment growth that is attributable to the growth of the national economy, a mix of faster or slower than average growing industries, and the competitive nature of the local industries. The analysis provides a representation of changes in employment growth or decline, and it is useful for targeting industries that might offer significant future employment opportunities. By use of shift-share analysis, one can explore the advantages a local area may enjoy, as well as identify growth, or potential growth industries that are worthy of further investigation. It can also be used to allocate resources for educational programs to support continued job growth in these sectors.

Data for the shift-share analysis through the Texas Workforce Commission were only available through the fourth quarter of 2013, at the height of the oil boom. However, it does give a snapshot of the comparative advantages of businesses in the area at the time, which would be useful for economic development agencies marketing the area. The top industries for the PB and South Plains showing the greatest likelihood for potential growth are indicated in Appendix 6 and 7. It is obvious that the greatest growth opportunities for the PB for compatible business are in the energy field. In the South Plains with its more diversified economic base, there are a number of compatible industries that could be attracted to the area. Healthcare, transportation, and construction are some of the most prominent possibilities. Texas

Tech University must also be considered as a major economic driver. More information on how Texas Tech is contributing to the economic growth of the area is presented below.

Despite the seemingly divergent economic drivers, both areas have advantages that can complement each other. For example, Texas Tech University, the major research university in West Texas can offer research and development support for the energy industry, not only in oil and gas research and education but also in renewable energy. The University of Texas Permian Basin can also provide applied research to support the development of the energy industry. The Permian Basin has some agribusiness that can complement Lubbock's agribusiness. There can be synergies from combining the advantages of each area in a collaborative, partnership approach to economic development. Both areas could work together for mutual advantage in attracting economic development. Moreover, the economy in the SP is substantially diversified and could offer amenities and advantages that would be attractive to companies from a number of different sectors, not just the ones discussed above. While there are advantages to diversification, the PB should capitalize on its dominance and market itself as a major energy area.

SWOT ANALYSIS: STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS

The SWOT analysis is another analytical tool to assess an area's strengths, weaknesses, opportunities, and threats for development. It brings all these elements together for further discussion, analysis, and action. The following is not an exhaustive description of the South Plains' and Permian Basin's strengths, weaknesses, opportunities, and threats but a beginning for discussion and moving the process forward.

Strengths of the economy

Texas has a pro-business climate. It has a more permissive regulatory environment for oil than in most other states. It is generally less expensive to produce oil in Texas than most other states. The PB has a strong oil industry presence with major branch locations and headquarters of major oil and gas companies. There are still large oil reserves. The area often is the leader in technological innovation in extracting oil. Oil companies have substantial financial resources with a large commitment and stake in the area. The educational system is strong and vibrant. Texas Tech University has many innovative educational programs that attract students from across the nation and the world. It is a leader in education and research in many areas including sustainable energy. Texas Tech University's Health Science Center is a major education and research center, and the Lubbock health complex is a major center for providing health care covering the tristate area. In the South Plains, the economy is diversified with low unemployment. Agriculture and higher education are major drivers of the South Plains economy. Large agribusiness firms like Monsanto and Bayer Crop Science are currently building large facilities in Lubbock. The cost of living is moderate, and the people of West Texas are hardworking, dependable, and independent. There is a small-town, religious-oriented, friendly atmosphere. There is a capable and skilled workforce for the agriculture, construction and oil industries.

Weaknesses

The percentage of the workforce with bachelors' degrees is below that of the United States as a whole. (See the Table 5.) There is a lack of economic diversity in the PB with the oil industry too dependent and focused on oil extraction. The resource commitment for economic and community development from oil companies headquartered in Houston or outside the area is questionable. Even though there are some regional associations and collaborative/cooperative efforts (see the discussion later in this report), they should be expanded and more targeted to the region. Marketing the region covered by this report could be improved by developing a common, recognizable brand, working more collaboratively together and

combining resources for greater effect. There does not appear to be much effort to include the rural parts of the region covered in this report in economic development efforts. The South Plains appears to be more oriented to Amarillo for many cooperative efforts than to the Permian Basin. The culture and history of the area are individualism and autonomy evidenced by a farming and oil wildcatting culture. People are independent, and there is a general aversion to any public programs that might increase government interference or result in increased taxation. There is extensive competition between communities. North/south road and rail transportation is not well developed between Lubbock and the Permian Basin. Cooperation among community colleges should be improved. The funding for community colleges from the state is continually being cut, which creates hardships in developing and offering expensive technical training programs. State funding cuts are especially hard on rural community colleges with a small tax base. The public and industry perception of the utility of community college technical training programs for the oil and gas industry needs to be improved. Although there is some civic engagement and resource commitment from the business community for general economic and community development, this could be improved for the benefit of the region. There could be greater collaborative partnerships among industry, government, and educational institutions in addressing public policy.

Opportunities

The downturn in oil prices is an opportunity for leaders from industry, educational institutions, and government to step back from the hectic pace of the boom period and make plans for the future. This is an opportunity to explore collaboration and partnerships to bring the leaders of the community together to explore how they could cooperate and collaborate to improve the region. It is an opportunity for community leaders and economic development agencies to think beyond their communities to focus on the region as a whole and what can be done to take advantage of the synergies that the region has to offer. The region's development agencies should come together to explore branding the region as the Energy Corridor and committing resources to implement a plan to market the region to attract compatible businesses. This is an opportunity for community college leaders to work together to further develop partnerships with industry for technical and specialized programs and short courses for pre-service and in-service students to avoid unneeded and expensive duplication of programs. This is an opportunity to focus beyond oil and gas to energy generally including renewables and compatible businesses. This is an opportunity to work more closely with both the University of Texas Permian Basin and Texas Tech University for the development of education and training programs for the energy industry. The educational institutions could develop collaborations between the community colleges and the universities in the area to advance technology in energy and the health sciences. By collaboratively working together,

government industry and educational leaders could put added pressure on national and state governments and major railroads to improve north-south rail and road transportation systems. Even though the economies of the SP and PB are divergent, there are excellent possibilities for synergies between them.

Threats

The price of oil could rebound quickly; employment starts to pick up, and the crisis urgency dissipates with the result that there is little interest in bringing the region's leaders together to develop collaborative plans and partnerships. There is a strong orientation on competition, and parochial agendas may not be surmounted. Area government, business and education leaders and appropriate organizations may not be able to agree and work collaboratively together to develop agreements and public/private partnerships. The government, education, and private leaders may not be willing to commit time and resources for regional development. Community college may not be able to develop plans and processes to share resources and not duplicate expensive programs. Private companies may not be willing to commit time and resources to community and economic development and may not be willing to put resources into further developing partnerships with community colleges for education and training programs. There might be a lack of resource commitment from the state government for road upgrades. BNSF and Union Pacific railroads may not be able to agree on developing and supporting a strong north-south rail line. The cooperation and collaboration programs must overcome the general aversion to anything that appears to be increased regulation and that diminishes the individualistic culture that exists in the region. Lack of water is always a threat. Use of water and water rights between farmers and urban dwellers is a contentious issue and must be addressed in any development program. The primary economic drivers, oil and agriculture, are subject to rapid price fluctuations that will always have a major impact on the economy of the area.

Analysis and Further Discussion of SWOT

The two regions would benefit by working together to develop collaborations and partnerships among government, nonprofit, industry, and education to market and brand the area. The various entities should be working together to help the region reach its economic potential (Obviously, agriculture and ranching are also major industries and need to be nurtured and supported. Agribusiness is a growth industry, particularly in the South Plains). The area needs to promote itself as the place for training and education in all areas of the energy sector including four-year degrees, technical degrees, certifications and short training courses.

The concept of economic diversification is to mitigate the effects of employment fluctuations in the economy. However, a region should take advantage of its comparative advantages to specialize, that is, strive to be the eminent source of expertise in a particular sector. The specialization should be more than just in one aspect of that sector. If a region is a home to a number of technologically related industries, then that region ought to be the epicenter of innovation in those industries. In addition, a region should be able to quickly adapt to changing circumstances or be flexible (e.g. technology, know-how, changes in supply/demand) in order to remain competitive. Thus, regional economies must be agile in order to compete with other regions (Washington & Jefferson College, 2014). The problem in the Permian Basin has been its major dependence on the price of oil. It should be oriented to more than just oil. It should combine with the SP to focus on energy generally, and all that energy connotes (renewables, etc.).

Branding the area as the Energy Corridor

It is important to establish a brand for the region for economic development purposes. This will facilitate marketing. More important, it will provide a unifying theme internally to bring the area together in collaborative partnerships. With a brand, instead of competing, communities will be able to pool their resources for economic development purposes. It will also allow the two regions to work together to complement each other rather than trying to duplicate each other. For example, the Permian Basin will be better able to benefit from the research and educational resources of Texas Tech University in renewable energy. The South Plains as part of the energy corridor will be able to take advantage of the training programs offered in technology through the community colleges in the Permian Basin. The leaders of the two areas will be able to work better together to improve the north-south transportation system. Branding the regions as the Energy Corridor will eventually change the culture of the area from a culture of separateness and competition to a more unified and working together culture for the betterment of the region. Many benefits will accrue as the culture changes.

To develop a regional identity, the region needs to be branded with a name that resonates with residents and businesses. As an example, Dallas and Fort Worth at one time were continually in competition with one another. When the airport was built, it was built between the two cities and the name “Metroplex” was coined to provide a regional identity. The name has caught on with the public, and the region is popularly known by that name. There is still competition between the two cities, but they also recognize that their future is regionally tied together. The Dallas-Fort Worth airport is an asset that brought the region together for economic development purposes. It provides a unifying regional identity. The cities

of the South Plains and Permian basin, particularly Odessa and Midland, should also recognize the synergies for economic development that can accrue from working together. They are the major cities in the most productive oil region in Texas and should be able to develop collaborative governance and a regional identity around an oil theme.

One benefit from collaboration and branding is that the educational institutions can work together to develop programs and market them as the premier place to obtain specialized and technical training, bachelor's and advanced degrees in the energy field. As the area becomes known as the energy training center, the area will attract more students from across the United States.

The region, especially the Permian Basin, will always have a strong dependence on oil, but it needs to expand beyond oil into energy generally. It would benefit economically by becoming the center of the energy industry. Renewables are becoming a more important part of energy generation. This is an opportunity for the region to capitalize on an emerging field to diversity its economy. One trade journal reported that between 2012 and 2025 biomass energy generation would grow over 30 percent, about the same as oil, while solar, the wind and geothermal will grow over 50 percent (Barns, 2015).

Marketing the area

Economic development marketing is labor and resource intensive. There is intense competition for development nationally and globally. The area would benefit by pooling its marketing dollars. It should be able to market the area more effectively by focusing on attracting businesses that are compatible with other businesses and that have a comparable advantage by locating in the area. The types of growth businesses identified through the shift/share analysis and those with a comparative advantage in the region identified through the location quotient analysis should be sought and supported to locate and grow in the region. Moreover, the area should nurture and support its major employers. Two examples of growth centers in the SP are the health complex and Texas Tech University.

The area should make greater use of incentives to attract business and support expansion of existing businesses. It should make appropriate use of the state program that allow cities and counties to incentivize business to locate or expand through Chapter 380/381 Economic Development Agreements and other available incentives. Chapter 380/381 authorizes cities and counties to offer incentives such as loans and grants of funds or services to stimulate business and commercial activity. (See Appendix 9 for information on Chapter 380.) Incentives for cities can include the refund or rebate of sales taxes generated

by the business. Counties are authorized to abate property taxes. An example of the use of Chapter 380 by Austin is its agreement with Apple Corporation. In exchange for Apple Corporation investing $56.5 million in phase 1 and $226 million in phase 2 between 2015 and 2021 in property improvements, new machinery and creating a specified number of additional jobs, the city agrees to rebate any property taxes on the new construction and improvements for a number of years as well as taxes on the new machinery and equipment (City of Austin, n.d.).

Transportation

A major component of effective economic development is a good transportation system. The transportation network between Lubbock and the Permian Basin cities is a major weakness. The interstate transportation systems run east and west. Interstate 20 connects points east through Dallas and Midland-Odessa to Interstate 10 and west to California. Interstate 40 is a major interstate connecting the east and west coasts through Amarillo. There is an Interstate 27 spur from Amarillo to Lubbock, but no north, south interstate connecting the two major east-west road systems. The major railroads are similarly situated. BNSF operates an east-west line running through Amarillo. Union Pacific operates an east-west line that runs through Midland-Odessa. There is no major rail company operating a north-south line connecting the two major rail lines. The railroads operating the north-south systems are small and generally undercapitalized. They do not have the resources to develop, operate, and maintain a competitive north-south railroad.

Higher Education Institutions

The Texas Tech University System has facilities and programs in a number of locations including the PB. It is one of only 115 universities in the nation classified by the Carnegie Foundation as the "highest research activity." The university officially opened its Innovation Hub and Research Park on August 5, 2016. The facility will promote entrepreneurialism, innovation, and partnerships between Texas Tech, the Texas Tech Health Sciences Center, and the business communities to further research and innovation. The university has obtained millions of dollars in grants.

One grant of interest is a $13 million grant that it received from the state's Emerging Technology Fund. With the grant, the university established the Global Laboratory for Energy Asset Management and Manufacturing (GLEAMM) to support collaborative research and entrepreneurship between the

university and the business community. The university is working in partnership with Group NIRE, a private company, to test, certify, research, develop and support the manufacturing of new electrical grid technologies and next-generation power devices for public and private partners. Its focus is renewable energy. The ultimate purpose of the grant is to connect research with commercial ventures.

The University of Texas Permian Basin also offers educational programs in areas that are beneficial for preparation or advancement in the oil industry including petroleum engineering, nuclear engineering, and industrial technology. It also offers the Energy Certificate program and minors for professional development. This certificate program offers many concentrated classes to increase practical skills. The Center for Energy and Economic Diversification is an applied research arm of the university that works with the petroleum industry on applied research. It has received over $3,500,000 in grants to study CO2 and Residual Oil Zones during the past decade.

Community College Collaboration and Public/Private Partnerships

Community college technical training programs are designed to provide general technical training, not company specific training. Therefore, it is understandable that the industry would train their employees on their particular techniques regardless of their prior training. Companies might also have proprietary concerns regarding their processes that they want to keep in-house. Technical training is extremely costly for each community college in developing a lab, equipping it and keeping the equipment up to date. There is substantial duplication in this system of education among community colleges. Many company training centers also appear to be a duplication of resources and effort. However, only the oil companies with sufficient resources will establish their own training centers.

There is another model. This model is for the community colleges and the oil companies to collaborate in developing a training facility that is subsidized by the private companies but allows the community colleges to carry out their mission of education and training. Community colleges would need to allow the private companies access to training their employees on their specific processes or share their processes with the community college instructors. These would obviously be short training programs of one or two-day duration. Working in partnerships would allow community colleges to do what they do best and allow oil companies to do what they do best. This model would also not duplicate facilities and be less costly to operate and maintain the most current equipment. This model would require a close partnership between the private companies and the community colleges in order to be successful.

There are a number of examples of companies partnering with community colleges and providing funding or equipment for technical training programs. What is envisioned here is collaboration on a larger scale. There is an operational example of this model. It is the San Juan Community College in Farmington, NM. This college has a School of Energy. Oil and gas companies work closely with the school. The school just moved into a $17 million facility. BP contributed $5 million to start the fundraising and received naming rights. Other companies contributed and together raised over $10 million for the construction. The companies not only supported the capital campaign to build the facility, but they also provide operating subsidies. Companies send their employees to the college for training. They also hire graduates from the various programs offered. Administrators from the School of Energy work closely with the companies to ensure that they are providing the training that the companies require. As there are proprietary issues in companies wanting their employees trained in certain techniques, companies are able to schedule the lab for themselves and bring in their own trainers if desired.

As indicated, the college offers one-day training courses for current employees. It also offers courses of various lengths for both in-service and pre-service students for credit, to renew licenses, or prepare students to obtain certificates or licenses. It also offers a two-year applied associate's degree. A listing of a few of its many programs and courses is found in Appendix 8.

COLLABORATION AND PARTNERSHIPS

A collaborative partnership is a concept whereby the actors work together for mutual benefit. Entering the collaboration is a voluntary action, and no one actor is totally in charge of the collaborative effort and receives all the benefits. Collaborative partnerships involve multiple sectors working together for the general betterment of the community where all contribute and all benefit. It also means that all partners must contribute something for the collaboration to be successful. The contribution could be time, and resources, combining public and private resources into a mutual endeavor whereby all parties benefit in the achievement of a public purpose that cannot be achieved or achieved as efficiently and economically by the parties acting independently. The partners must be willing to give up parochial agendas. For collaborative partnerships to be effective, the parties must move from a culture of competitive autonomy to a culture of collaboration. The benefit from the partnership might not be immediate and might be intangible. However, the bottom line is that the community as a whole benefits from the collaborative partnership.

Collaborative partnerships are usually based on an economic development imperative to enhance the economy of the region. The business sector must be a major partner in the collaborative partnership. Effective business sector involvement is usually through a civic organization that is dedicated to the betterment of the community, not organized to support and service its members. This type of civic organization, funded and directed by business leaders, would engage government and nonprofit organizations in public policy issues that will enhance community and economic development. Broad community involvement is also necessary to ensure lasting success of the collaborative partnership. All involved stakeholders should be brought to the table during the discussion and planning stages. Implementation of plans will only be successful with the support of the various stakeholders.

The various sectors working together can address policy issues that are of concern and hinder community and economic development, such as the environment, transportation, job creation, housing, and education. A collaborative partnership can bring resources and talent to the table to address policy issues that any one organization or sector working alone would be less effective in addressing. Often, a crisis of some sort is needed to bring the various sectors together to address the problem.

To summarize, the following are important elements for successful collaborative partnerships. Collaboration can take place without some of the elements in place, but the more successful collaborative endeavors exhibit most of these elements

- The business sector should be organized. The one element that is mentioned most often in successful collaborative endeavors between the business community and government is the need for a thriving civic sector and an organization whose sole or major purpose is the betterment of the community. The civic sector is the neutral zone between government and business where issues can be discussed, and relationships can be developed without political boundaries and immediate business agendas interfering.
- Top business leadership must be actively invested in the effort. Business leaders must give liberally of time and resources to make an effort successful.
- An identifiable crisis is important to mobilize not only the business community but the political leaders and residents of the area to jointly work towards acceptable solutions. Without a crisis or an appealing opportunity, the possibility of achieving success in collaborative initiatives is considerably less. Indeed, the crisis or opportunity needs to capture the attention of the leaders of the community in order for the leaders to put in the time and effort to work towards a solution.
- Broad involvement from other leaders and citizens in the region is important for successful efforts. All geographic areas and sectors of the community affected by the issue should be involved in the deliberative process that arrives at a solution. The business community is a major factor in providing funding, organization, and direction to collaborative efforts, but it generally requires a broad coalition to bring policy initiatives to fruition.
- Obviously, there must be public sector leaders who are receptive to partnering with the private sector, and they must be able to affect public policies. Appropriate political leaders from throughout the region should be actively involved in the process to facilitate government support and action.
- On regional issues, there is no one constituted government over the region, so it is important that the government leaders work together for the greater good of the region. The vehicle for this is often a regional body such as a council of governments or other bodies that are authorized to work across government boundaries.

Examples of Collaboration and Partnerships

Evidence of successful regional development is usually the result of collaborative endeavors among the various sectors of the community. Even successful community development within municipal boundaries is usually because of collaborative partnerships. Several examples of successful collaborations in diversification and economic growth are provided below.

One needs only to look at the Pittsburgh experience to appreciate the importance of collaboration and partnerships for economic development and resilience. The steel industry began to decline in the 1970s, and by the end of the decade had all but collapsed. As the steel industry faltered, so, too, did the region's economy. Between 1979 and 1983, the unemployment rate nearly tripled, with unemployment reaching 17.1 percent in 1983. The city had few other manufacturing-based industries to absorb the economic shockwave that followed steel's decline. In order to regain its footing, Pittsburgh was forced to reinvent itself and its economy. The region's business leaders, through the civic associations, partnered with the city political leaders and the universities to engineer a shift away from dependence on steel to high-tech industry, health care, research, and services. Employment statistics show that heavy metal manufacturing shrunk from 100,000 employees in 1979 to a mere 28,600 employees in 1987; but health care, technology, and other professional services increased. By the mid-1990s, the region had almost fully transitioned to a high-end technology, research, education and service economy (Washington & Jefferson College, 2014).

In Denver, some of the region's business leaders decided to work together to find ways to jump-start the economy. They reached out to other public, private and nonprofit organizations to form a regional economic development partnership that includes 70 cities, counties, and economic development organizations in the seven-county Metro Denver and two-county Northern Colorado region. Its collaborative approach to economic development includes support for the arts, bipartisan dialogue among the region's mayors, and proactive efforts to attract major sporting events. The organization has raised $13.3 million from the private sector to be used in an aggressive five-year plan to bring economic development to the region and brand the metro Denver area as a sustainable hub for companies, entrepreneurs, and employees.

The Denver metropolitan area has established a number of regional organizations to promote the region. The public has bought into the regional branding. Voters approved a sales tax that dedicated one cent of every dollar to regional support for sports, culture, and the arts. For example, the Metro Denver Sports Commission (Denver Sports) is a regional group, that includes local businesses, area colleges and universities, local and state government entities, civic organizations, and professional sports teams. Through the commission's efforts, Denver has hosted events such as the NCAA Men's Basketball Tournament, and the 2008 NCAA Frozen Four Hockey Tournament. Denver was the first North American city to host Sports Accord, an international gathering of over 1,200 sports decision makers. It hosted the Denver Big Air World Cup Snowboarding competition, the 2012 NCAA Basketball Women's Final Four, and the 2014 FIL Men's Lacrosse World Championships.

The Charlotte, North Carolina region provides an example of the benefits that can result from cooperation and collaboration with the private sector. The Carolinas Partnership, with public and private sector members from the 13 counties, metropolitan area, markets the region for economic development. The collaborative economic development efforts have had some success. In one case a Japanese firm sought a new factory site in the area. The Charlotte Chamber of Commerce provided data on two sites in the region–both outside of Mecklenburg County. The firm chose one of the sites, which brought the area a $250 million construction project and about 700 jobs. Although the firm did not locate in the county, the region as a whole benefited and undoubtedly, some of the jobs went to Charlotte residents.

Collaborative ventures that are becoming more common in the United States are partnerships between governments and private companies. that combine new public management (NPM) and cooperative/collaborative governance (CCG) concepts. In this type of collaboration, the private company provides the resources and management expertise, not necessarily to make money from the service but to benefit through general community development. The NPM concept assumes that the private sector can provide and manage the service more cost effectively. The CCG concept is that the nongovernmental entity can provide a public benefit, and the result of the private offering is beneficial to all parties. One NPM/CCG example that shows promise is the agreement between the New Balance Corporation, the state of Massachusetts, and the Metropolitan Boston Transit Authority. New Balance has agreed to build a commuter rail station by its new headquarters and 15-acre real estate development. New Balance will not only pay all the costs of building the facility but the maintenance costs for the first 10 years. It is viewed as a win-win for the company and the residents in an underserved area (Semuels 2015).

Another example of CCG is the partnership between Phoenix and Arizona State University (ASU) to create new uses for garbage. The city has garbage that it wants to dispose of as cheaply as possible. The university has research and management expertise. In this CCG, the city will make available land for a research park that will be managed and operated by ASU. The intent is for the research park to be a hub for finding innovative ways to use or dispose of waste. Of course, the city will also provide its solid waste. So far, over 117 proposals from companies seeking to locate in the park have been received. In addition, a consortium of private companies has offered low-interest rate loans to help develop the site (Daigneau 2015).

Austin's business, education and community leaders have worked together to enhance economic and community development. Working together the collaborative partnership has brought many high-tech firms to the Austin area. They encourage a climate of innovation and research working with and through

the University of Texas to attract investments to accelerate research programs and technology commercialization. High-tech companies locate and grow in the Austin area because of the skilled workforce and a positive and innovative business culture. The University of Texas has been a critical component of Austin's success (LEDA, 2015).

In the Houston region, talent management was identified by the leaders of the business community as a pressing need if economic growth was to be maintained. The need was to fill the Houston area's middle-skill deficit. This preparation is most often served by community colleges in technical skills training. These individuals require more than a high school education, but less than a four-year college degree. Working together in a collaborative partnership, Upskill Houston was established. This is a campaign to draw attention to job opportunities with education and training in this segment of the job market. It is dedicating $6 million to the initiative over the next six years to support efforts to increase awareness and training in this area (LEDA, 2015).

An example of collaboration between educational institutions is the collaboration between Texas Tech University's Wind Energy Institute program and Western Texas College in Snyder, Texas. It is an outreach and engagement project. Western Texas College wanted to develop and associate degree that would be transferable to Texas Tech University's Bachelor of Science in Wind Energy. It obtained a title III STEM grant to develop this program along with other programs. It worked with Texas Tech University on curriculum and developed an articulation agreement whereby its courses would be accepted into the university's bachelor degree program. According to available information, it is the only two-year associate degree program in wind energy that can be transferred to a four-year wind energy program.

Lang and Nelson (2011) argue that the future of economic competitiveness in a global economy will require regional cooperation and collaboration. They extend the concept of regional cooperation to megapolitan regions. These are corridors that connect two or more metropolitan areas in reasonable proximity to one another. They claim that the individual metropolitan areas, cooperating, have synergies that complement each other in economic development. For example, they identify a Sun Corridor composed of Phoenix and Tucson where cooperation can result in synergies. Tucson brings a strong research capacity in space science and optics and the main branch of Arizona's only medical school to the table. Phoenix contributes an international airport with global access. Phoenix has the access, and Tucson has the technology, which can lead to an export economy based on emerging technologies. The two regions that have had a history of animosity and competition should benefit by cooperating instead of competing.

Regional Efforts in West Texas

There are some associations in West Texas that provide a regional focus. The regional focus of these organizations often covers an area larger than the SP and PB, which often dilutes their focus. They also often tend to be restricted as to purpose, which restricts them from addressing broader economic development goals. Finally, these organizations tend to have minimal staff, usually one professional and one clerical. These organizations are a great start to regional collaboration but need to be more geographically focused, better staffed, and less restrictive as to purpose in order to have a larger regional impact. Three regional associations are listed below.

The West Texas Energy Consortium (WTxEC) was established in 2013 in response to the region's need for skilled workforce and community development. The consortium consists of counties located in the Concho Valley, West Central Texas and the heart of the Permian Basin reaching all the way up into southeast New Mexico. With its main office in Abilene, WTxEC covers over 60,000 square miles in the region. Their main focus is on manpower development. The consortium holds training and information sessions, and job fairs in conjunction with Workforce Solutions. WTxEC provides information to members on energy related issues and sponsor a website giving information about training programs for the oil and gas field available at area community colleges and private training institutions.

Ports-to-Plains is an alliance of business and governments based in Lubbock. It is dedicated to development and improvement of a north/south transportation system that covers 5,000 miles stretching through America's heartland and into Canada and Mexico. Its major focus is the development and improvement of the road transportation system that can move products rapidly and easily along this energy and the agricultural corridor from Canada into Mexico. Over the past decade and a half, almost $2 billion in federal and state funding for road improvements have occurred in the Ports-to-Plains region. The organization does lobbying and holds forums and information sessions. This organization appears to be one of the most active and well-funded regional organizations in the area.

The High Ground of Texas is a regional development agency. Its emphasis is marketing the region to prospective new industry, networking, economic development, education, and providing a common voice on economic development issues that affect the region. It started in 1988 with its office in Plainview. Members include economic development agencies, cities, counties, chambers of commerce, and private (electric and telephone) companies that have a vested interest in the growth of the region. High Ground attends trade shows, markets the region, and makes contacts with prospective businesses seeking new

locations and refers them to local economic development agencies. Its geographical area is the 60 northern counties of West Texas.

CONCLUSIONS

The U.S. is the only country that is drilling for shale oil. The Middle East does not have shale oil. Other countries might have shale oil, but the U.S. is exploiting it. For example, France has shale oil but is not drilling because France does not have an adequate process to reward landowners for drilling on their land. The U.S. has highly skilled labor, the technology and the private capital to exploit shale oil extraction. Land owners can be adequately compensated for extracting oil from their property.

Middle East countries need a price at over $100 per barrel to pay for all the government services that oil revenue provides. The Middle East countries, since the price downturn, have had substantial deficits. A World Bank analysis reports that fiscal balances in the Middle East and African nation oil exporters swung from a surplus of $128 billion in 2013 to a deficit of $264 billion in 2016. They expect to lose another $100 billion this year. Saudi Arabia depleted $178 billion in reserves, followed by Algeria ($28 billion), and Iraq ($27 billion) in 2015. These countries are reducing social services and raising the price of oil products to their citizens (World Bank, 2016).

Other countries are also struggling. It is reported that Russia needs a price of around $70 a barrel to break even. OPEC has not been able to agree on reducing supply. Saudi Arabia appears to be no longer the country that absorbs the fluctuations in the supply and demand to control the price. Iran is now exporting oil. Other major oil fields outside of the United States are expected to come online in the near future. Some countries are exporting more oil to generate the revenue that they had when the price was higher adding to the price pressure. The projection, as discussed elsewhere is that the price of oil will be depressed for a number of years. It will not be a short downturn as it was in other oil price downturns of the 2000s. The general prognosis is that the price of oil will stabilize in the $40 to $60 range. Demand will not be as strong as it was in the 2010-2014 boom.

Renewables, although a small part of the energy demand, will continue to eat into the demand for oil. Regardless of the impact of renewables, the diversification of the economy in West Texas, and the price and demand, oil will continue to be the major energy source for many years and a major contributor to the economy in Texas and the Permian Basin. Even with the downturn in 2015:

- The oil and natural gas industry directly employed 410,000 Texans.
- Oil and natural gas supports another 1.4 million indirect jobs in supporting industries and sectors.

- Several sectors of Texas oil and natural gas industry remain steady and are creating jobs. (pipelines, petrochemical manufacturing, etc.) (Ports-to-Plains Alliance, 2016).

America is the largest oil producer in the world but is not energy independent. According to estimates, the U.S. can be energy independent in 3 to 5 years. Our refinery capability is not adequate to refine all the oil we use. EPA rules make it difficult to build refineries.

The oil industry is one of the few industries left where a willing person with a strong back and little education can still make a good income. However, life in the oil industry is fraught with unemployment cycles dependent on the price swings of oil. One moment, workers in the oil patch can be making substantial incomes, and the next moment, they might be on the unemployment line. When income is good, the lifestyle changes and subsequent expenses grow. With the growth in expenses, some of which might be fixed such as a new house, it is difficult to reduce expenses when the income decreases suddenly. This is the major issue with life in the oil patch. It is either feast or famine and not knowing when the feast or famine will end. If people knew the feast would end and how long the famine would last, they could prepare. But not knowing gives a sense either of hopelessness in the famine or false sense of security in the feast time.

Another concern that has been brought out through this research is that the uneducated and untrained aspects of jobs in the oil patch are fading. The oil and gas extraction business is becoming more technological sophisticated. It increasingly requires workers with technological skills and fewer workers with little or no education and training. The technological skills that the oil and gas industry is increasingly requiring is not necessarily a bachelor's degree but more than a high school certificate. It is increasingly looking for workers that are trained or educated in that educational space occupied by the community college or private technical schools. However, as the research has shown, the industry is often bypassing the community college system and establishing its own training centers. The community colleges should step up and claim or reclaim their role as the preferred place to provide technological education and training.

Major issues confronting the SP and PB region are indicated in the SWOT analysis. From available information obtained through this research, there is no business-supported civic agency dedicated to working on public policy to enhance community and economic development. Collaboration and cooperation among community colleges could be substantially improved for the betterment of technical education programs. While it was noted in this report that there is collaboration between individual

community colleges and elements of the business community, this could be improved. There is some engagement of Texas Tech University with the business community on applied research and job creation, but this, while holding potential, is in its infancy. There is little appearance of the governments in the area working cooperatively together or working with the business community on regional issues or on community development generally. Connections between the government and business community appear to be bilateral with the goal of benefiting the particular business and not the community generally. Collaboration and working cooperatively together among government, economic development agencies, business, and community colleges would improve the region's community and economic growth potential. Developing partnerships among the various sectors of the community would change the region's orientation from competition and autonomy to working together for the overall betterment of the region.

RECOMMENDATIONS

Recommendations for Educational Institutions

One goal of this research was to make recommendations on training and educational programs. Community colleges are, or can be, a key provider of technical training and educational programs that are important for the continuing development and viability of the West Texas economy. Technology requirements, not just in the oil extraction industry, but also in most other fields is growing faster than there are trained candidates to fill them. The analysis of the survey data and other research also indicates that the majority on unemployment would take advantages of educational and training opportunities if funding was available. Although technology programs are expensive to provide, community colleges must find ways to provide them. One major way is collaborative partnerships that include working together to avoid duplication of expensive programs and working with private sector partners to provide for their specific training needs. While recognizing that there are existing collaborative partnerships between industry and community colleges, these should be increased and significantly expanded. The industry should work closely with community colleges on training programs to supply their needs for a technically trained workforce.

There will, at least in the foreseeable future, always be a need for workers in the oil and gas industry. Technical education in this region should be a priority item to support the energy industry. Technically trained and skilled employees are constantly in demand. Companies need trained workers and community colleges want to train and educate the workforce. There needs to be stronger partnerships and agreements between companies and community colleges whereby community colleges can meet the specific training needs of the companies while providing a well-rounded education.

Connecting the unemployed to existing Workforce Solutions programs is a key to the overall health of the West Texas economy. However, the available funding for training purposes through Workforce Solutions is limited and from all indications, will be reduced even further. Moreover, the reductions in state funding for community colleges in Texas have adversely impacted many colleges by forcing them to prioritize certain educational programs. These prioritizations could lead to a decrease in the number of trade skill-oriented educational programs for students as these are the most capital intensive and expensive courses to offer.

One of the problems indicated through this research is that the oil industry generally discounts community college training and education. Oil companies should provide resources and work closely with community colleges in developing synergistic solutions to meet their training needs. This could include centralizing most of their technical training in community colleges. Corporations should have work study and co-op programs through community colleges. They should provide resources and use the community colleges for the short certification and training courses for their employees.

Additionally, community colleges must increase funding and effectively market the technical training programs that are available on their campuses. They should undertake a marketing campaign to reduce the stigma of a technical education and market the advantages of technical and certificate programs. A societal shift in the perception of technical training programs is unlikely to happen, but effective marketing would increase the pool of students into these programs. The unemployed must be informed of the many educational opportunities available to them at community colleges and trade schools, which lead to employment in the manufacturing or energy industry.

The education and industry leaders should collaborate on the establishment of a centralized education and training center for the oil and gas industry for in-service and pre-service workers to meet industry specific needs. The centralized education and training facility should bring community colleges together with industry. Universities should also be involved in providing research support and articulation agreements for those wanting to earn a bachelor's degree. The center should provide technical training and certificate programs. It should be marketed across the country as the place for the industry to bring its employees for additional training and for pre-service students seeking a career in the energy field. There should be substantial industry resources and commitment by the industry to utilize the training center. The success of the center requires close collaboration between the industry and the community colleges on training to meet industry manpower needs. The community colleges should work together, not in competition, and energy companies should feel a responsibility to give generously not only to the development but also to the operating support of the center.

The major universities in the area should continue to develop programs like GLEAMM described above. Texas Tech, with its strong research component in energy, should be able to incubate and provide a nurturing environment for many energy company start-ups. Texas Tech can be a major resource in helping to brand the area as the energy corridor. Texas Tech should work closely with the energy companies in renewables and energy related areas. In addition, the universities must work closely with the community colleges in developing technical skills for the energy workforce of the future.

Recommendations for Regional and Community Economic Development/Government

The following recommendations for economic growth are provided as numerical points with some explanation. Most of the discussion surrounding the recommendations is provided above.

1. **A region-wide economic development corporation to combine resources**. The entire region benefits from development in any one part. Combining resources avoids competitive duplication, frees funds for a larger impact and provides a united front to prospects.
2. **Large oil and construction company involvement.** These companies must put in substantial resources and be leaders in development. Development will not happen without their involvement. They must think beyond just oil extraction in regards to this region. The example of Toyota with its move to the Metroplex is a good model for the big oil companies to emulate.
3. **Collaboration and public/private partnerships.** These will provide synergies that individual entities working alone will not be able to achieve.
4. **Improve the north-south transportation system.** This includes not only highway but rail. This is an area where working together will move the effort along much faster than working alone. Ports-to-Plains would be a good partner to work with in this endeavor.
5. **Brand the area and work to change the culture**. The region should be branded as the Energy Corridor from Lubbock to Midland/Odessa. The region should embrace all aspects of energy from renewables to battery power; not just focused on oil and gas extraction. Education should be part of the brand. The educational institutions from the community colleges to the universities should be on the cutting edge of energy research and development and prepare technically trained people to work in the energy field and in the new and developing industries.
6. **Marketing the region.** The marketing dollars should be spent to establish the brand and should be focused on attracting businesses that are compatible with other industry and provide a comparative advantage to the businesses being attracted.
7. **Provide appropriate incentives to attract business.** The area should use Chapter 380/381 Economic Development Agreements and other incentives to attract business to the region and help businesses to grow in the region.
8. **State and federal grants.** The region should utilize state and federal grants to the extent possible to develop the area. A West Texas Caucus combining state and federal elected officials along with local government, private and civic leaders would substantially enhance the ability to lobby and gain favorable treatment and legislation for West Texas.

9. **Improve Quality of Life.** This report has not addressed quality-of-life issues. The region has its own unique beauty and obstacles. Every effort should be made to improve the quality of life of all those who reside in the area. Sufficient parks and recreational opportunities as well as concerts, and festivals should be encouraged and supported. The region has advantages that should be marketed including small town atmosphere, friendly people, easy commuting, moderate cost of living, and warm climate among other amenities.

Recommendations for the Business Community

The business community must be an integral part of any collaborative program. Indeed, the concept of partnerships in regional and community development is the various sectors working together. The private sector is often the lead partner in collaborative endeavors. Obviously, the private sector needs the support and involvement of the public sector to effectuate any community development programs. However, the public sector benefits from the resources, clout and leadership of the private sector in any economic development endeavor. Most of the recommendations for the business community are included in recommendations outlined above for community colleges and marketing/government. They will be repeated here to indicate the strong need for business involvement for the economic future of the region.

Although technology programs are expensive to provide, community colleges must find ways to provide them. One major way is collaborative partnerships that include working together to avoid duplication of expensive programs and working with private sector partners to provide for their specific training needs.

Industry must be an integral partner in the development of a center for technical training and education in the energy sector. Community colleges and industry must work together to make the center successful. There should be industry resources and commitment to utilize the training center for its prospective and current workers for the center to be successful. There needs to be close collaborate between the industry and the community colleges on training needs. Energy companies should give generously not only to the development but also to the support of the center.

Oil and gas companies should be an integral part of marketing and development of the region. Industry leaders should put in time and resources on regional development. Development will not happen without their involvement. They must think beyond just oil extraction in regards to this region. The example of Toyota with its move to the Metroplex is a good model for the big oil companies to emulate.

Private companies should establish a civic agency dedicated solely to the betterment of the region. It should have the involvement of business leaders on its board and a dedicated staff that can work collaboratively with government, education, and other civic associations in community and economic development. The civic agency can be the glue that will make collaborative partnerships possible. Collaboration and public/private partnerships will provide synergies that individual entities working alone will not be able to achieve.

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APPENDIX

Appendix 1

Members of the Steering Committee and those who attended meetings during the course of the study

Christine Allen	**Lubbock Economic Development Alliance**
Chad Averette	**Howard College**
Roy Bartels	**Western Texas College**
Virginia Belew	**Permian Basin Regional Planning Commission**
Rob Blair	**South Plains College**
Kelly Davila	**South Plains Association of Governments**
Sara Harris	**Midland Development Corporation**
Stephen S. John	**South Plains College**
Scott G. Jones	**Odessa Chamber of Commerce**
Cecily Miller	**South Plains Association of Governments**
Tim Pierce	**South Plains Association of Governments**
Hope Reese	**Andrews Economic Development Corporation**
Erik Rejino	**City of Levelland**
Robin Satterwhite	**South Plains College**
Robert Segura	**Texas Tech University Health Science Center, Permian Basin**
Danny Soliz	**Workforce of the South Plains**
Grant Vaughan	**Workforce of the South Plains**
Pam Welch	**Midland Development Corporation**
West Texas City Managers	**Texas City Managers Association, West Texas Region 2**
Donald Wood	**Odessa College**

Appendix 2

Original Work Plan

Deliverables for the EDA Grant with the South Plains Association of Governments (SPAG)
Work Plan Draft (August, 5, 2015)

The Texas Tech Center for Public Service (CPS) is a subcontractor for SPAG. Working with SPAG, the following deliverables will be provided and/or facilitated given the tasks outlined in the Scope of Work approved by the EDA in awarding the grant:

The focus of the grant is to investigate the impact on the South Plains (SP) and the Permian Basin (PB) from the rapid decline in employment in the oil and gas industry. In addition, the study will investigate and make recommendations on training and education programs that will provide those individuals laid off from the oil and gas industry employable skills in other sectors of the economy. A final component of the study will be recommendations on diversification of the economy of the South Plains and Permian Basin to avoid or cushion the boom and bust cycle of the oil and gas industry.

Task 1

A major component of the study to be conducted by the CPS will be an employment analysis of the oil and gas industry in the geographic areas covered in the grant. The study will provide the following:

- A longitudinal analysis of employment in the oil and gas industry and service organizations for the years preceding the boom, the employment in the boom years and employment in the downturn in the SP and PB. This will include the number of workers who have been laid off. The study will project lay-offs in the near term and based on past cycles, project future employment trends in the oil and gas industry.
- A random survey of the current laid-off workforce to determine their skills, certificates, education and/or level of training. One purpose is to ascertain their basic training needs in order to determine the kinds of educational programs that might be appropriate for employment. Questions such as current employment status, and plans for the future and what they did before they were employed in the oil patch re important to gain a complete picture of the reasons people are attracted to the oil patch and from what sectors of the economy they are attracted. All surveys will be conducted in Spanish or in English.
- An analysis of the migration patterns of the workers in the oil and gas industry to determine the percentage of workers who have come into the region and not likely to stay when they are laid off, those who are not place-based and could fairly easily leave, and those who are likely to stay and look for other employment when laid off. Moreover, the study will attempt to find out what percentage of the laid-off workforce commuted to the PB from the SP.
- Stratified survey of employers by industry sector to ascertain hard to fill job openings, the demand for these job openings and the required education for the job openings. A part of the survey would be to ascertain their plans for expansion and the need for trained workers. Some surveys may need to be face-to-face in order to receive an acceptable response.
- In an effort to increase the diversity of the economy and to prepare a trained workforce for new compatible business that could be attracted to the area, a SWOT analysis will be conducted to

indicate what types of business are compatible to the area economy and could be attracted to the area and the educational and training needs that would be needed for these businesses. The study will identify emerging businesses that would be compatible to the area, and the growth of established businesses in order to project educational and training needs.

- Current efforts and plans of educational institutions and governments relative to the layoffs, emerging businesses and growth of current businesses.
- Short- and long-term projections of employment by industry and technical training needs
- A survey of the oil companies working in the SP and PB and those businesses servicing the oil and gas industry to obtain an understanding of their plans with the downturn. One question is whether they plan to diversify.
- An analysis of the advertisements in newspapers, job placement organizations, and websites serving the SP and PB to determine the types of technical and nontechnical job openings, job specifications and, if possible, determine the length of time required to fill the job.

Based on the analysis we will establish a baseline for the technical training needs to meet the projected workforce needs of the economy and technical training needs to diversify the economy. A final component of the study is recommendations for building diversity into the economy and plans for cushioning the downturns in the boom and bust cycle.

Task 2

A working group has been or is being established to oversee the EDA grant and give input into the study as it progresses. The project is meant to be a study that can be refined as it progresses. This group will be composed of representatives from both the SP and the PB. After the study has been conducted, The CPS working with and through SPAG and the other members of the working group will facilitate a workshop with interested stakeholders in the community invited to discuss the study and the next steps in the implementation of the study. The purpose of the workshop is to give visibility to the study and establish plans and goals for implementation. Another purpose is to obtain the support, commitment, and resources needed to move forward on the implementation of the plans developed through the workshop. It might be appropriate to hold two workshops, one in Lubbock and one in the Permian Basin.

Task 3

CPS will establish a website that should serve as a data repository for the study and any materials associated with economic and manpower development in the SP and PB. It should serve as one place where the organizations working in can place information, have links and find information on what other organizations are doing in economic and manpower development. This would be available to the interested public as well. Once the website is established and the initial data and reports uploaded, the website would be turned over to another organization, preferably the committee established to oversee the implementation of the goals established at the workshop. The SPC will work with the members of the working group and hold focus group sessions with other stakeholders as appropriate to determine what should be included on the website.

Tasks 4 and 5

Given present and past experience of boom and bust cycles in the oil and gas industry, the study deliverable in task 1 will include recommendations on technical training programs for diversification of the regional economy. The SWOT analysis will include a general analysis of the strengths and advantages offer by the area that would attract compatible industry and the workforce needed to supply workers to these industries. The study will also research other areas of similar size with and without higher education and training facilities to ascertain population growth and economic development patterns. Questions such as the following will be addressed in this analysis:

- What technical training and educational preparation should be provided by area colleges and universities to support the present and future workforce needs?
- What compatible businesses would be attracted to the area given a prepared workforce?
- What infrastructure is needed for the current and future economy?
- What is the institutional capacity to provide for the training needs to prepare the workfoce for the new and expanding industries?
- What support resources are available to business start-ups?
- What needs to be done to attract businesses and nurture start-ups?
- Do areas with population size of 200,000-250,000 experience rapid growth to 350,000?
- Is there a spike in bankruptcies or foreclosures as a result of the oil and gas slowdown?
- What support services are available for the laid-off workforce to assist them as they transition into other employment?

Task 6

One intent of the workshop is to obtain the commitment and resources of the community to implement the plans and goals established. It would be appropriate to reconstitute the working group as a standing committee and include other stakeholders as appropriate to facilitate the implementation of the plans and goals emanating from the workshop. This implementation committee should have an institutional home and staff support to give it continued visibility and viability.

Partners and Stakeholders

The above work plan will require working closely with organizations from the PB including community colleges, the chamber of commerce, and economic development agencies. Much of the data might be available from studies done by these organizations. Much of the employment data will be gathered from working closely with Workforce Solutions and the Texas Workforce Commission. Some of the oil production data should be available from the Texas Railroad Commission. Economic impact and economic diversity information can be available from Lubbock Economic Development Alliance (LEDA). The community colleges will be able to provide some training and specialized education information. Some statistical information will be available from federal agencies. It will be necessary to conduct surveys of employers and laid-off employees to obtain information necessary for the study. Finally a number of interviews will need to be conducted with stakeholders to obtain further insights into the impact and future of the oil and gas industry on employment in the region.

Study Process and Timeline

The extensive data requirements, the surveys and interviews that need to be conducted to obtain a complete picture of the impact on the economy and employment in the SP and PB, and the need for cooperation and data collection from a number of organizations will be time consuming. We will be dependent on other organizations for some data. It is projected that the study can be completed no later than August 31, 2016. Every effort will be made to complete the study earlier.

It is proposed that a steering committee be designated to oversee and give feedback as the study progresses. It is anticipated that, at minimum, quarterly reports will be made to the steering committee on the progress of the study.

Appendix 3

Targeted or critical jobs for training purposes from Workforce Solutions in the Permian Basin as of June 13, 2016

Bookkeeping/Accounting/Auditing

Bus/Truck Mechanics/Diesel Specialist

Business Operations Specialist, NEC

Carpenters

Construction Managers

Dispatchers, Ex Police/Fire/Ambulance

Electrical and Electronic Engineering Technicians

Electrical Power-Line Installation/Repair

Electricians

Elementary School Teachers, Except Special Education

Executive Secretaries/Administrative Assist

Heating/Air Cond/Refrigeration Mechanics

Industrial Machinery Mechanics

Inspector/Tester/Sorter/Sampler

Licensed Practical/Vocational Nurses

Machinists

Maintenance and Repair Workers

Mechanical Drafters

Medical Assistants

Medical Secretaries

Manager/Supervisor, Construction Trade Worker

Manager/Supervisor, Mechanics/Installers

Manager/Supervisor, Office/Admin Support

Manager/Supervisor, Production/Operator Worker

Manager/Supervisor, Transportation/Moving

Nursing Aides, Orderlies, and Attendants

Occupational Health and Safety Specialists

Operating Eng/Construct Equipment

Petroleum Pump System/Refine Op

Plumbers/Pipefitters/Steamfitter

Radiologic Technologists and Tech

Registered Nurses

Secondary School Teachers, Except Special and Vocational Ed

Truck Drivers, Heavy/Tractor-Trailer

Truck Drivers, Light or Delivery

Welders/Cutters/Solderers/Brazer

Targeted Jobs for the South Plains Workforce Commission as of June 13, 2016

SOC=Standard Occupational Code Number	SOC	OCCUPATION TITLE
1.	13-2011	Accountants and Auditors
2.	11-9041	Architectural and Engineering Managers
3.	49-3023	Automotive Service Technicians and Technologists
4.	43-3031	Bookkeeping, Accounting, and Auditing Clerks
5.	49-3031	Bus and Truck Mechanics and Diesel Engine Specialists
6.	15-1121	Computer Systems Analysts
7.	15-1151	Computer User Support Specialists
8.	11-9021	Construction Managers
9.	47-2111	Electricians
10.	25-2021	Elementary School Teachers, Except Special Education
11.	11-9051	Food Service Managers
12.	11-1021	General and Operations Managers
13.	19-2042	Geoscientists, Ex. Hydrologists & Geographers
14.	49-9021	Heating, Air Conditioning and Refrigeration Mechanics and Installers
15.	49-9041	Industrial Machinery Mechanics
16.	29-2061	Licensed Practical and Licensed Vocational Nurses
17.	51-4041	Machinist
18..	49-9071	Maintenance and Repair Workers, General
19.	13-1111	Management Analysts
20.	29-2012	Medical and Clinical Laboratory Technicians
21.	29-2011	Medical and Clinical Laboratory Technologists
22.	11-9111	Medical and Health Services Managers
23.	31-9092	Medical Assistants
24.	43-6013	Medical Secretaries
25.	25-2022	Middle School Teachers, Ex. Special & Career/Technical Education
26.	49-3042	Mobile Heavy Equipment Mechanics, Ex. Engines
27.	15-1142	Network and Computer Systems Administrators
28.	17-2171	Petroleum Engineers
29.	47-2152	Plumbers, Pipefitters, and Steamfitters
30.	29-2034	Radiologic Technologists

SOC=Standard Occupational Code Number	SOC	OCCUPATION TITLE
31.	29-1141	Registered Nurses
32.	29-1126	Respiratory Therapists
33.	41-4011	Sales Representatives, Wholesale & Manufacturing, Technical and Scientific Products
34.	43-6014	Secretaries & Administrative Assistants, Ex. Legal, Medical, & Executive
35.	47-2211	Sheet Metal Workers
36.	15-1132	Software Developers, Applications
37.	15-1133	Software Developers, Systems Software
38.	53-3032	Truck Driver, Heavy Duty Tractor Trailer
39.	51-4121	Welders, Cutters, Solderers, and Brazers
40.	49-9081	Wind Turbine Service Technicians

Appendix 4

Top 25 Occupations by Help Wanted Postings between May 2015 and May 2016 for the Permian Basin and South Plains WDAs

Rank	SOC	SOC Title	Postings
1	53-3032	Truck Drivers, Heavy and Tractor-Trailer	10,893
2	29-1141	Registered Nurses	8,057
3	41-1011	First-Line Supervis./Managers of Retail Sales Work	4,306
4	49-9071	Maintenance and Repair Workers, General	3,666
5	41-2031	Retail Salespersons	3,275
6	35-1012	First-Line Supervisors/Managers of Food Preparation	2,639
7	29-1127	Speech-Language Pathologists	2,484
8	43-4051	Customer Service Representatives	2,276
9	41-4012	Sales Rep., Wholesale & Manufacturing, Except Tech. & Scientific Products	2,161
10	43-1011	First-Line Supervisors of Office and Administrative Support Workers	2,120
11	29-2061	Licensed Practical and Licensed Vocational Nurses	1,880
12	49-1011	First-Line Supervisors/Managers of Mechanics, Inst.	1,638
13	53-3033	Light Truck or Delivery Services Drivers	1,555
14	35-3021	Combined Food Preparation and Serving Workers, Including Fast Food	1,449
15	29-1123	Physical Therapists	1,438
16	15-1151	Computer User Support Specialists	1,363
17	43-5081	Stock Clerks and Order Fillers	1,340
18	49-3031	Bus & Truck Mechanics & Diesel Engine Specialists	1,285
19	43-6011	Executive Secretaries & Administrative Assistants	1,239
20	29-1122	Occupational Therapists	1,217
21	49-3023	Automotive Service Technicians and Mechanics	1,168
22	11-1021	General and Operations Managers	1,157
23	37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	1,144
24	41-3021	Insurance Sales Agents	1,144
25	53-7062	Laborers & Freight, Stock & Material Movers, Handlers	1,142

Appendix 5

Top 25 Occupations by Help Wanted Postings between May 2015 and May 2016 for the Permian Basin WDA

Rank	SOC	SOC Title	Postings
1	53-3032	Truck Drivers, Heavy and Tractor-Trailer	6,870
2	29-1141	Registered Nurses	3,169
3	41-1011	First-Line Supervis./Managers of Retail Sales Work	2,692
4	49-9071	Maintenance and Repair Workers, General	2,278
5	41-2031	Retail Salespersons	1,883
6	35-1012	First-Line Supervisors/Managers of Food Preparatio	1,473
7	29-1127	Speech-Language Pathologists	1,424
8	41-4012	Sales Rep., Wholesale & Manufacturing, Except Tech. & Scientific Products	1,277
9	43-1011	First-Line Supervisors of Office and Administrative Support Workers	1,087
10	49-1011	First-Line Supervisors/Managers of Mechanics, Inst	1,047
11	43-4051	Customer Service Representatives	1,027
12	49-3031	Bus & Truck Mechanics & Diesel Engine Specialists	912
13	53-3033	Light Truck or Delivery Services Drivers	838
14	29-2061	Licensed Practical and Licensed Vocational Nurses	795
15	35-3021	Combined Food Preparation and Serving Workers, Including Fast Food	784
16	11-1021	General and Operations Managers	779
17	43-3031	Bookkeeping, Accounting, and Auditing Clerks	778
18	29-1122	Occupational Therapists	771
19	53-1031	First-Line Supervisors/Managers of Transportation	742
20	29-1123	Physical Therapists	711
21	51-1011	First-Line Supervisors/Managers of Production and	710
22	47-1011	Supervisors of Construction and Extraction Workers	671
23	13-2011	Accountants and Auditors	661
24	15-1151	Computer User Support Specialists	653
25	43-5081	Stock Clerks and Order Fillers	653

Appendix 6

Industries most likely to have a Comparative Advantage and be Compatible with other Industries in the Permian Basin comparing Job Changes between 2010 and 2013

Oil and Gas Extraction
Specialty Trade Contractors
Merchant Wholesalers, Durable Goods
Truck Transportation
Gasoline Stations
Professional and Technical Services
Construction of Buildings
Fabricated Metal Product Manufacturing
Machinery Manufacturing
Accommodation
Repair and Maintenance
Personal and Laundry Services
Building Material & Garden Supply Stores
Electronic Markets and Agents/Brokers
Real Estate
Financial Investment & Related Activity
Couriers and Messengers
Nonstore Retailers
Support Activities for Transportation
Performing Arts and Spectator Sports
Primary Metal Manufacturing

Source: Texas Workforce Commission http://www.texasindustryprofiles.com/apps/shift/ss_Analysis.asp

Appendix 7

Industries most likely to have a Comparative Advantage and be Compatible with other Industries in the South Plains comparing Job Changes between 2010 and 2013

Specialty Trade Contractors
Ambulatory Health Care Services
Gasoline Stations
Truck Transportation
Oil and Gas Extraction
Professional and Technical Services
Motor Vehicle and Parts Dealers
Merchant Wholesalers, Durable Goods
Warehousing and Storage
Heavy and Civil Engineering Construction
Repair and Maintenance
Machinery Manufacturing
Amusement, Gambling & Recreation Ind
Accommodation
Construction of Buildings
Building Material & Garden Supply Stores
Electronic Markets and Agents/Brokers
Insurance Carriers & Related Activities
Transit and Ground Passenger Transport
Fabricated Metal Product Manufacturing
Couriers and Messengers
Financial Investment & Related Activity
Support Activities for Transportation

Source: Texas Workforce Commission http://www.texasindustryprofiles.com/apps/shift/ss_Analysis.asp

Appendix 8

Sample of Programs and Courses offered by the School of Energy at San Juan College, Farmington, NM

The School of Energy offers a variety of degrees and training in the energy industry. With a new 65,000 square foot facility, students will continue to receive training and experience in state of the art training labs taught by educators and professionals from the industry, ensuring students achieve their goal of a career. Students come from across the country, many participating in online courses, which enables them to complete a certificate and degree while continuing to work.

Petroleum Production Operations

As a Lease Operator, you will be a key player in the rapidly growing oil and gas industry, responsible for monitoring, troubleshooting, and operating wells. For technical-oriented students, the School of Energy Lease Operator program at San Juan College can provide the basic knowledge and skills of oil and gas production processes and equipment operations required for employment in this industry. Here you can earn a Certificate or an AAS Degree while getting hands-on training on the machinery and surface equipment used in the field. Our yard has a complete well site including a pumping unit, separator, compressor skid, dehydration unit, and meter run. The program also involves professional on-the-job training (OJT) with local industry to ensure that you will grasp the theory and practice of production operations, including artificial lift.

Industrial Safety Training

In addition to our standard safety courses, the School of Energy offers customized OSHA training, schedule on demand, to fulfill individual and company training requirements. The School of Energy is an authorized SafeLandUSA Training provider and provides training by multiple accrediting organizations

Energy Training

Meet your workforce training needs with the School of Energy's one-day credited courses. We provide training courses that are designed for anyone currently employed in the industry who wants to increase their knowledge and improve their skills.

Courses

Introduction to the Wellhead ENER 112

Basic principles of wellbore, wellhead, and Christmas tree design and operation for lease operators (aka MSOs, field technicians, pumpers). Standard terminology to promote effective communication regarding maintenance issues and potential malfunctions, leading to basic operations and troubleshooting tasks.

Introduction to Separator and Tank ENER 113

Also offered on-line ENGY 113-601. Basic principles of separator and tank design for production operations. Includes standard terminology for effective communication regarding: principles of separation, separator components, preventive maintenance, and operational efficiencies; types of tanks, regulatory compliance, maintenance issues, and reasons for tank failure.

Commercial Driver's License Certificate (Class A)

For Class A Commercial Driver's License. Individuals learn in the classroom, practice hands-on driving on our training course and highway driving, and receive instruction on endorsements and log books. The CDL program is an eight-week class A, 18-credit hour program. Refresher upgrade and Class B programs are also offered. Nine state-certified CDL examiners offer the CDL test, which is conducted on a 30- acre paved lot with 10 backing ranges

Appendix 9

Texas Law on Economic Development

SUBTITLE A. MUNICIPAL PLANNING AND DEVELOPMENT

CHAPTER 380. MISCELLANEOUS PROVISIONS RELATING TO MUNICIPAL PLANNING AND DEVELOPMENT

Sec. 380.001. ECONOMIC DEVELOPMENT PROGRAMS. (a) The governing body of a municipality may establish and provide for the administration of one or more programs, including programs for making loans and grants of public money and providing personnel and services of the municipality, to promote state or local economic development and to stimulate business and commercial activity in the municipality. For purposes of this subsection, a municipality includes an area that:

(1) has been annexed by the municipality for limited purposes; or

(2) is in the extraterritorial jurisdiction of the municipality.

(b) The governing body may:

(1) administer a program by the use of municipal personnel;

(2) contract with the federal government, the state, a political subdivision of the state, a nonprofit organization, or any other entity for the administration of a program; and

(3) accept contributions, gifts, or other resources to develop and administer a program.

(c) Any city along the Texas-Mexico border with a population of more than 500,000 may establish not-for-profit corporations and cooperative associations for the purpose of creating and developing an intermodal transportation hub to stimulate economic development. Such intermodal hub may also function as an international intermodal transportation center and may be colocated with or near local, state, or federal facilities and facilities of Mexico in order to fulfill its purpose.

Added by Acts 1989, 71st Leg., ch. 555, Sec. 1, eff. June 14, 1989. Amended by Acts 1999, 76th Leg., ch. 593, Sec. 1, eff. Sept. 1, 1999.

Amended by:

Acts 2005, 79th Leg., Ch. 57 (H.B. 918), Sec. 1, eff. May 17, 2005.

Sec. 380.002. ECONOMIC DEVELOPMENT GRANTS BY CERTAIN MUNICIPALITIES. (a) A home-rule municipality with a population of more than 100,000 may create programs for the grant of public money to any organization exempt from taxation under Section 501(a) of the Internal Revenue Code of 1986 as an organization described in Section 501(c)(3) of that code for the public purposes of development and diversification of the economy of the state, elimination of unemployment or underemployment in the state, and development or expansion of commerce in the state. The grants must be in furtherance of those public purposes and shall be used by the recipient as determined by the recipient's governing board for programs found by the municipality to be in furtherance of this section and under conditions prescribed by the municipality.

(b) A home-rule municipality may, under a contract with a development corporation created by the municipality under the Development Corporation Act (Subtitle C1, Title 12), grant public money to the corporation. The development corporation shall use the grant money for the development and diversification of the economy of the state, elimination of unemployment or underemployment in the state, and development and expansion of commerce in the state.

(c) The funds granted by the municipality under this section shall be derived from any source lawfully available to the municipality under its charter or other law, other than from the proceeds of bonds or other obligations of the municipality payable from ad valorem taxes.

Added by Acts 1991, 72nd Leg., ch. 16, Sec. 13.06(a), eff. Aug. 26, 1991. Amended by Acts 1991, 72nd Leg., 1st C.S., ch. 4, Sec. 25.02, eff. Aug. 22, 1991; Acts 2001, 77th Leg., ch. 56, Sec. 1, eff. Sept. 1, 2001.

Amended by:

Acts 2007, 80th Leg., R.S., Ch. 885 (H.B. 2278), Sec. 3.26, eff. April 1, 2009.

Sec. 380.003. APPLICATION FOR MATCHING FUNDS FROM FEDERAL GOVERNMENT. A municipality may, as an agency of the state, provide matching funds for a federal program that requires local matching funds from a state agency to the extent state agencies that are eligible decline to participate or do not fully participate in the program.

Appendix 10

The Linear Regression between Jobs in Oil and Gas and other Independent Variables

The independent variables are oil prices, jobs in agriculture (agric), jobs in utilities (utilities), jobs in construction (construct), jobs in manufacturing (manufact), jobs in wholesale and trade (sale_trade), jobs in retail trade (retailtrade), jobs in transportation (transport), jobs in insurance (insurance), jobs in real estate (realstate), jobs in professional (profess), jobs in management of companies and enterprise (management), jobs in administrative support and waste management (admsuport), jobs in educational services (educat), jobs in health care and social assistance (healthcare), jobs in arts (arts), jobs in accommodation and food service (acomfoodservice). The dependent variable is employment in the oil and gas industry. The results of the regression are shown below

```
. reg oil_gas agric utilities construct manufact sale_trade retailtrade transport
inform insurance realstate profess
> management admsuport educat healtcare arts acomfoodservice oilprice

      Source |       SS           df       MS      Number of obs   =       240
-------------+----------------------------------   F(18, 221)      =    221.42
       Model |  3.44370675        18  .191317042   Prob > F        =    0.0000
    Residual |  .190958255       221  .000864065   R-squared       =    0.9475
-------------+----------------------------------   Adj R-sq,uared   =    0.9432
       Total |  3.63466501       239  .015207803   Root MSE        =    .02939

------------------------------------------------------------------------------
        oil_gas |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
          agric |  -1.109621   .0874121   -12.69   0.000    -1.281889   -.9373526
      utilities |  -.8532339   .1084801    -7.87   0.000    -1.067022   -.6394461
      construct |  -1.272165   .0477676   -26.63   0.000    -1.366303   -1.178027
       manufact |  -.8986932   .0464944   -19.33   0.000    -.9903224    -.807064
     sale_trade |  -.8784636   .0554977   -15.83   0.000     -.987836   -.7690911
    retailtrade |  -1.106115   .0495893   -22.31   0.000    -1.203843   -1.008387
      transport |  -.8523566   .0692245   -12.31   0.000    -.9887813   -.7159319
         inform |  -1.390448   .2253714    -6.17   0.000      -1.8346   -.9462954
      insurance |   -1.01284   .0833116   -12.16   0.000    -1.177027   -.8486536
      realstate |   -1.40584   .1800671    -7.81   0.000    -1.760708   -1.050972
        profess |  -1.190383   .1972178    -6.04   0.000    -1.579051   -.8017147
     management |  -.7020448   .2220515    -3.16   0.002    -1.139654   -.2644354
      admsuport |   -.900795   .1229071    -7.33   0.000    -1.143015   -.6585751
         educat |  -.6864802   .2021417    -3.40   0.001    -1.084852   -.2881082
      healtcare |  -.9043059   .0414624   -21.81   0.000    -.9860182   -.8225936
           arts |  -.5570286   .2224998    -2.50   0.013    -.9955214   -.1185358
acomfoodservice |   -.869556    .056378   -15.42   0.000    -.9806634   -.7584487
       oilprice |     .00025   .0000785     3.19   0.002     .0000954    .0004047
```

```
           _cons |   .9230411   .0177532    51.99   0.000     .8880539    .9580282
------------------------------------------------------------------------------

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
       agric |      2.59    0.386526
   insurance |      2.44    0.410056
   healtcare |      2.38    0.419384
 retailtrade |      2.32    0.431820
    manufact |      2.18    0.457900
     profess |      2.13    0.469178
  sale_trade |      2.11    0.473016
      inform |      1.96    0.509435
   admsuport |      1.94    0.515009
   transport |      1.90    0.526002
   construct |      1.65    0.606546
      educat |      1.65    0.607216
acomfoodse~e |      1.57    0.638967
        arts |      1.56    0.639954
  management |      1.44    0.695970
   utilities |      1.41    0.709907
   realstate |      1.35    0.740664
    oilprice |      1.27    0.786258
-------------+----------------------
    Mean VIF |      1.88
```