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Perceived Quality Of Life In Oil Boomtowns: A Case Study Of Western North Dakota

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PERCEIVED QUALITY OF LIFE IN OIL BOOMTOWNS: A CASE STUDY OF WESTERN NORTH DAKOTA

by

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Ian Geller
May 2023

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DEDICATION

I dedicate this thesis to my family and friends who supported me in any way they could throughout this process. Thank you, mom, and dad.

ABSTRACT

The purpose of this study was to evaluate the changes in the quality of life (QoL) perceived by long-term community members in oil boomtowns in Western North Dakota. The study focused on basic QoL indicators and indicators based on oil boom effects. This study explored what QoL indicators mattered most to long-term community members. The main method in this study was a principal component analysis (PCA) done on two surveys from 2012 and 2020 which included many indicators related to oil boom effects. This statistical method grouped together indicators related to each other according to the perception of long-term community members but also showed change over time between 2012 and 2020. Interviews were also done to gain background knowledge on community response to quality-of-life issues and gain insight into what long-term community members value most with QoL in mind. Findings indicate that perceived QoL in most areas improved including economic, certain environmental, sense of community, and political satisfaction indicators. The only indicators that degraded from 2012 to 2020 were perception of safety and security. QoL improvement was associated mostly with economic success according to the PCA. Some of the most important dimensions of QoL were economic (positive and negative), safety/security, and traffic/noise. This study found change over time in QoL and found some important indicators that could be used in boomtown QoL indices in the future.

Chapter 1.

Introduction

Boomtowns have continually arisen in the American West over the last 200 years. Boomtowns are usually focused on mining a precious resource or metal. Some of the oldest boomtowns were mostly focused on gold and silver mining. Many people came to California, Colorado, and the whole Rocky Mountain region in the mid-1800s to strike it rich. The American West experienced another boom in oil extraction beginning in the early 1960s with oil extraction peaking in the early 1980s. Wells ranged from New Mexico, Arizona, Colorado, Montana, Utah, Wyoming, and the Dakotas (Jacobsen and Parker, 2014). Boomtowns across the American West expanded and were reliant on oil drilling. The economic downturn of the late 1980s and a plummeting demand for oil caused oil busts across the American West. Unemployment began to climb, and populations began to fall in boomtowns across the west. Infrastructure created from the boom was now useless and in some instances ghost towns were left behind (Jacobsen and Parker, 2014). One of those boomtowns in the 1980s was Williston, North Dakota situated on the large Bakken Shale Oil Formation. Williston and Western North Dakota have experienced another oil boom in the last fifteen years due to new technology like fracking and high oil prices.

Over the last 15 years, western North Dakota has been transformed from a slower paced lifestyle based around an agricultural economy to a bustling oil extraction hub with thousands of people coming to this geographic area. Western North Dakota did not abandon its agricultural economy but instead has embraced the profits from crude oil extraction. A new technology called fracking made oil extraction possible from deep shale deposits in western North Dakota. The profitability of fracking is debated but high oil prices make fracking manageable. A spike in

oil prices in 2008 provided another reason to increase oil production in North Dakota (Fernando and Cooley, 2016). All these circumstances brought thousands of people to the area for work. Such a large population spike in a short period of time brought difficult circumstances to the small towns of western North Dakota.

These small towns became boomtowns or essential hubs for the labor force of oil companies. Williston, for example, functioned as the main hub for population growth in Williams County. This growth brought copious amounts of money into these small communities. People were paid more, and towns had increased tax revenue to spend. On the other side, pay upgrades and the sheer amount of opportunities made cost of living skyrocket, including housing costs and commodity prices. Local governments, many of which lacked the experience to handle such growth, needed to spend this money to solve a plethora of problems brought on by this population growth. For example, local roads at the time wore down and were an issue of safety at the start of the boom. New roads and freeways needed to be built to support increasing heavy truck traffic. Small police forces had to handle increased crime fueled by drugs and alcohol along with this heavy traffic. New fracking technology allowed wells to produce faster and crack shale deposits. The downside to this new technology was the large amount of salt brine waste produced. Salt brine is deadly to crops and makes soil infertile. This was just one environmental effect of oil extraction, others include reduced air and water quality, and increase in trash and litter (Lauer, 2016). Long-term residents were not used to these changes. They expected to know everyone at their local corner store (Raycroft, 2017). They were used to less noise and a peaceful community. Instead, licenses plates came from every state in the nation. Many long-term community members realized that their slow paced and quiet lifestyles were over in their community.

The goal of this study was to assess perceived quality of life (QoL) in western North Dakota boomtowns based on the positive and negative effects brought on by an oil boom. Long-term community members were the target population since they saw what their community was like before the boom and during the boom. The perceptions and attitudes of this group cultivate a sense of change in QoL that those who were new to the community cannot provide. Western North Dakota is in a unique situation fueled by new oil extraction technology. Continued study of this area and the effects of this oil boom is important for place-based studies in the geographic discipline.

An oil boom causes multidimensional effects on the social, economic, political, and environmental life of residents in the region. Towns that grow significantly in size and house incoming workers looking for economic profits are called boomtowns. Studying boomtowns has historically been the job of sociologists and geographers. Geography is a multidisciplinary field that allows for in-depth analysis of population dynamics, quality of life, environmental effects, and socioeconomic effects. Woodworth (2019) described boomtowns as "nodes and hubs in regional and global extractive regimes." North Dakota has an important interest in the global geography of energy extraction because of the sheer size of the Bakken shale oil supply. These communities grow with new sources of capital and investment into bustling cities focused on black gold. The Bakken and its new boomtowns have created a unique socioeconomic explosion. The situation that has unfolded in the Bakken must be analyzed by many disciplines including geology, economics, sociology, and most importantly, the multidisciplinary field of geography. I analyze life in these boomtowns by answering two research questions.

1. How has perceived quality of life changed over the oil production cycle of the last 15 years in western North Dakota boomtowns?

2. Which dimensions of quality of life do long-term residents perceive as being most impacted by the oil boom in western North Dakota?

The rest of the thesis is organized as follows. Chapter 2 presents a review of literature on boomtown effects and quality of life. Chapter 3 focuses on the research methodology, including descriptions of research design, the study area, participants, instruments, and data collection and analysis techniques. The research results are presented in Chapter 4. Chapter 5 provides an interpretation and discussion of the findings and offers suggestions for future research. Chapter 6 concludes the thesis by summarizing the major findings.

Chapter 2.

Literature Review

The literature included in this review spans mostly over the effects of oil extraction in an area. The first part of my literature review covers the modern boomtown. These literatures discussed an oil boom's effects on the communities involved and follows the social disruption thesis. The social disruption thesis was pioneered by sociologists in the 1980s who expanded off the Boomtown Impact Model (Gilmore, 1976). This model has been adjusted and expanded by people like Jeffrey Jacquet in 2014 who updated the model regarding new technology and extraction methods. One of the leading researchers on oil boomtowns and their effects includes Felix Fernando and his QoL studies along with his paper on the socioeconomic system of a North Dakota Boomtown. This socioeconomic system includes a dark side. Rick Ruddell (2014 and 2017) is one of the leading experts on crime and deviant behavior in boomtowns. Other researchers like Kyle Conway (2016 and 2020) and William Caraher (2016) summarized other economic effects like income and housing. All these effects contribute to the final part of the literature review which is QoL research.

The final part of the literature review referred to quality of life and attitudes and perceptions of residents. Finding out the attitudes towards this model of resource extraction and the effects that it has on peoples' everyday lives is a combination of all the literature. Fernando and Cooley are the leading researchers on QoL in oil boomtowns. They summarize the values of residents in western North Dakota and apply them to QoL. Other studies included in this section discuss tourism and its impact on QoL in different areas. Tourism is like an oil boom because many people are coming into an area and disrupting the local culture and arguably changing the way of life in that area.

My study fits into the literature by showing change in the perceived effects of an oil boom on long-term community members in western North Dakota. My study analyzes two snapshots in time during the oil boom in western North Dakota. It shows the attitudes of long-term community members in 2012 when stress was high in the community. It also shows the attitudes of long-term community members in 2020 when stress was lower, and communities had solved some of the boomtown model problems. The eight-year difference in the surveys offered key insight into the evolution of attitudes and perceptions of long-term community members in oil boomtowns over time.

2.1 The Modern Boomtown and Its Effects

Oil boomtowns draw interest from researchers in many different areas including geosciences, sociology, psychology, and political science. Researchers focus on changes the oil extraction business brings to a certain place and its people. A large part of the research is focused on the analytics of boomtowns and how the oil industry creates great stress on the local government to expand. This stress is also felt by the people of the town, who may be forced to work in the oil field to accommodate for the rise in rent, food, and product prices. This stress creates animosity towards oil production because a person's hometown has turned into a bustling extraction-based society.

John S. Gilmore (1976) developed a model called the "Problem Triangle." This model was based on an imaginary place called "Pistol Shot, U.S.A." This emphasized the three-step process of a degrading way of life, declining industrial sector, and declining social structure (Gilmore, 1976). He combined this model with community models and growth management models to offer solutions to public policy actors. Gilmore's research started an expanding interest from researchers in the socioeconomic aspects of a boomtown. Sociological researchers in the

1980s greatly expanded off early boomtown research and looked specifically into crime, divorce, mental health, and other factors for social disruption. Authors began to explore new community models made for rural tight knit communities. Wilkinson and others began to progress towards current socioeconomic community models. Communities all have different aspects and must be analyzed individually (Wilkinson, 1982). For example, Jeffrey Jacquet's (2014) article updated the boomtown model to fit newer scales of technology and extraction.

The boomtown models of the 1970s and 1980s did not fit the advanced technologies of hydraulic fracking or advanced social technologies like cell phones (Jacquet, 2014). Boomtowns in Gilmore's (1976) point of view were rural areas with small town community values. Now some boomtowns are in larger metropolitan areas like in Texas or Pennsylvania. Even Williston, North Dakota has grown into one of the largest cities in North Dakota. People in these western North Dakota towns do not hold the same rural values as they once did because of easy access to the internet and new technologies. It was increasingly difficult to find differences between an urban or rural person (Jacquet, 2014). Internet access is easy access to communication and world events that can significantly increase quality of life (QoL). The system of a boomtown still affects a more remote location like Williston differently than say Dallas-Fort Worth, Texas.

A boomtown in systems theory is a grey system with many unknown variables that my research looks to speculate on. One of the unknown variables is a boomtown community's growth over time and where the wealth will come from for growth. Taxes on oil tend to be evenly distributed throughout the state. Western North Dakotans could see this as unfair since they were the ones most affected by industrial oil expansion. One source of growth is private investment through mineral rights ownership. In certain boomtown communities, depending on the state, landowners have been able to keep their mineral rights and be paid royalties by oil

companies. This puts an immense amount of wealth into these residents' hands since royalties can be up to twenty percent (Jacquet, 2014). Many North Dakota landowners found out they did not own the mineral rights and were forced to let oil company's drill. The few who did own their mineral rights became exceedingly wealthy. Fernando and Cooley (2016) contend that this creates division within western North Dakota. Mineral rights owners in effect became a separate class of wealth. This was an opportunity to secure futures and retirement for some while most struggled through the immense growth of the oil boom (Fernando, 2016). Accounting for those who do not benefit much from the boom was important and should likely fall on the state government. These residents struggled through the initial boom from 2008 to 2012 but as Williston and other small towns grew other economic opportunities eventually presented themselves from such substantial community growth.

Researchers often organize the socio-economic system of a boomtown into three parts including: economic, infrastructure demands, and social. Fernando and Cooley (2016), two of the leading researchers on the socio-economic system of western North Dakota boomtowns organized their socio-economic system this way. They analyzed the impacts or effects in each part of the community. This can be broken down to well-being or QoL. Australian research on their boomtowns was like western North Dakota in general landscape and community values. North Dakota has emphasized economic variability or being able to perform in different aspects of the broader national economy. North Dakota mostly contributes into the primary sector with agriculture and oil production. This was specifically like western Australian boomtowns (Chapman, 2015). These regions must diversify economic opportunities to effectively improve their socio-economic system. This is one of the main reasons these communities struggle to maintain future generations. Another important similarity between western North Dakota and

western Australia is the indigenous population. During the Australian mining boom in the late 2000s, around 60 percent of mining land bordered aboriginal land (Langton, 2008). This study area was like the North Dakota, Bakken because it borders and encompasses some of the Fort Berthold Reservation. This has created varying levels of income within the Native American communities. It adds a racial element to this area. Reservations also add specific difficulties with tribal and federal land.

The system of an oil boomtown brings many different effects or consequences to a community. Probably the most important effect on the companies and on the people of the community is financial. Economic impacts differ between types of residents. An oil boomtown gives certain people a lucrative economic opportunity while punishing others who cannot keep up with the high pace life of a boomtown (Fernando and Cooley, 2016). This creates class differences and resentment of those making large profits off mineral rights and foreign oil workers cashing in large paychecks. Income, housing, working conditions and community economics were the key areas of boomtown financial effects.

Oil workers make large sums of money but deal with intense working conditions and boom bust cycles (McCollum, 2020). Many oil workers must be mobile to take advantage of work in another area. In 2017, about a third of the population of Williston was non-permanent (Conway, 2017). This was one of the reasons why union membership was so low in western North Dakota. Many workers want unorganized work because it pays well. They want as much money as possible in the paycheck rather than job security (McCollum, 2020). Many workers know a bust could be imminent and they will have to move states soon. Another reason workers refuse to be a part of a union is many are conservative and from anti-union areas like Oklahoma

and Texas (McCollum, 2020). North Dakota and especially western North Dakota share this political attitude with many incoming oil workers, so unionization struggles significantly.

One of the most significant financial effects was an increase in the cost of living. Housing is the main concern with the cost of living. The housing cycle of boomtowns has been especially harsh on residents of western North Dakota. Rents during the height of the boom in 2012 reached $2000 for a one-bedroom apartment. Many long-term homeowners saw their housing skyrocket in price, and many left to retire in other regions. New investors who bought these properties had to raise rents to cover their investment (Fernando and Cooley, 2016). The 2008 recession forced most older residents to sell their house for additional income. The recession also caused many new people to migrate to the region for work. Williston, North Dakota was overburdened with people and could not keep up with the housing demands. The lack of affordable housing also hurt businesses and public services could not find interested workers. Businesses could not hire anyone to work since working in the oil fields was more profitable and was the only affordable employment. Public services could not hire enough law enforcement to meet the new demands of a larger population (Barkdull, 2016). Williston and other Bakken towns were struggling to keep up and this forced many people to resort to temporary housing or the notorious man camps.

Man camps are usually temporary housing set up by incoming oil companies or partner companies. They are mostly small trailers or recreational vehicles. Caraher (2016) studied the make-up and archaeology of these camps. He split the camps up into three different types. Type 1 camps are built by large corporations partnered with oil companies. Type 2 camps are made up of temporary housing brought by the workforce like RVs. Type 3 camps are rare and usually consist of squatters who have no sewage or electricity (Caraher, 2016). Williston and other Bakken towns have come far in community and infrastructure development since the initial

boom. Man camps are still present and are needed for a mobile workforce that the oil fields attract. These poor living conditions contribute to a worse QoL in western North Dakota.

Researchers mostly focus on the disruption of the current community because of oil extraction and the influx of people. Rapid population growth in rural communities causes increases in crime, psychological health problems, domestic violence, and community dissatisfaction (Ruddell, 2014). This makes oil boomtowns a difficult place to raise a family. Other sources focus on the perception of outsiders and their involvement in the community. Public services scramble for solutions to the rapid growth and industrialization. Legerski (2020) found that the scarcity of resources coupled with a lack of care workers due to low salaries left many patients of domestic violence without proper care and shelter. Increasing domestic violence and crime in general overburdened the police as well. This section of my literature review highlights some of the community effects along with social dynamics of western North Dakota boomtowns.

One of the most notable effects according to residents was the crime rate. There are different explanations for the increase in crime rate, but rural counties lack public funding to control this new population. The new population is young, male, and do not have long-term ties to the community. Their jobs in oil extraction are physically and mentally demanding. All these factors make these individuals more likely to engage in deviant behavior (Ruddell, 2014). Deviant behavior mostly includes drugs and alcohol. Before the boom, alcohol and methamphetamines were the most popular drugs but since the boom cocaine and heroin addiction have increased significantly (Reed, 2016). The use of cocaine would directly correspond with the tough schedule of an oil worker.

Demographics of oil boomtowns are heavily skewed to male residents. This has caused a rise in sex trafficking. Burin (2016) pointed out that women are the victims of sex trafficking and prostitution. They are controlled by their pimps through methods of modern-day slavery. The influx of new men and money has caused such a rise in the sex trade, but anti-trafficking legislation was passed in 2015 (Burin, 2016). The sex trade in North Dakota makes it difficult for women to live in peace. Women also experience an increase in family or domestic violence. The stressful high paced life of an oil boomtown allowed crimes and especially sex crimes to go unnoticed. Women in the Bakken region reported hearing about an increase in sex crimes and increase in the severity of these sex crimes (Jayasundara, Legerski, and Dunis, 2020). Many survivors must turn to community and social services in the area which were already overburdened (Ruddell, 2014).The social and community life of women during a boom is poor and many cannot find the support they need.

Another problem western North Dakota boomtowns have is social cohesion. Rural communities often share the same values and pride themselves on knowing everyone in their town. Locals become concerned when they do not recognize people in their local stores. They also hear stories of the crime an oil boom can bring to their community. Fear and distrust of outsiders becomes solidified by the things they "represent" like drugs and violence. This was a new insider/outsider dynamic in place that overlaps the one between whites and Native Americans in western North Dakota (Reed, 2016). For many long-term white residents this combination of distrust was one of the reasons to move away from their community. Local Native Americans and whites share a similar distrust of outsiders. They do not trust oil workers to commit to the community since many only come for the boom and leave when a new opportunity presents itself (Reed, 2016). Community leadership needs to be responsible for

easing the levels of distrust between residents. Leaders must represent each group in the development process. They have control over the culture of their community and how its residents view their future (Anderson, 2014). Social capital only seems to grow among boomtown residents as they handle problems overtime.

The environmental effects of an oil boomtown are extensive, and some effects may be identified far in the future. Environmental stresses are usually related to one another and exacerbate the problem (Keles, 2012). This literature only looks to highlight effects that oil boomtown residents directly experience in their everyday lives. The most talked about environmental effect on the national stage are the oil and salt brine spills. Brine spills are problematic since they affect agricultural soil fertility and water quality. Brine spills are directly correlated with the oil well density in western North Dakota. These spills make water toxic for drinking and aquatic life according to the Environmental Protection Agency (Lauer, 2016). The agricultural lifestyle of many North Dakotans was hindered by these expansive spills. Another unseen effect of the oil boom was poor air quality. Natural gas flaring was the main cause along with truck traffic and particulates. Flaring can sometimes release significant amounts of hydrogen sulfate, a poisonous gas (Ellis, 2016). This gas sits low in the atmosphere and sensors have been instituted to detect hydrogen sulfate. Degrading air quality and water contamination were the two main unseen effects of the oil boom in western North Dakota.

More noticeable environmental effects were most important to my study. Some of these effects include trash and litter, industrial construction and waste, destruction of roads due to heavy truck traffic, and the destruction of natural habitat with oil and industrial expansion. One of the commonly cited effects was increased truck traffic. Truck traffic increases the stakes of your surrounding environment and many people shared that they were afraid to drive (Ellis,

2016). The fear of large trucks could also cause residents to resent truck drivers and the oil industry. The increased population will also cause more trash and litter. Keles (2012) states "The environmental conditions are affected by our culture, which is, in turn, shaped by the environment." During the boom the influx of workers brought people who did not care for the physical or social environment of western North Dakota. It was not just the sheer number of individuals coming to North Dakota but also the reasons why they came, to get as much money as possible and leave. Oil companies also have this attitude of extracting and leaving behind a city or people to deal with their byproducts.

2.2 Quality of Life Research and Perceptions and Attitudes of Quality of Life

My study looks to advance quality of life literature within oil boomtowns with perceptions and attitudes of residents. QoL from a researcher or quantitative point of view will be a lot different than the life concerns of residents. One way to capture QoL is through physical health and well-being. Metrics for well-being are defined by the CDC in the U.S. (Centers for Disease, 2021). Worldwide surveys try to capture the essence to a quality life and some of the basic conditions include health, security, mobility, income, and cost of living (Keles, 2012). These usually focus on physical and mental health along with environmental interaction. Researchers take these metrics with social cohesion, place identity, happiness and satisfaction, and ecosystem quality to roughly measure QoL affected by unconventional oil and gas extraction (Mayer, 2017). Mental health was highlighted because of the long and taxing days of oil field work. Workers often have less family support since many had to leave their family behind in other places. Some of these components can be measured quantitatively and others must be extracted from surveys or interviews.

Felix Fernando (2015) did a comprehensive study of different ways to address QoL in western North Dakota boomtowns. He identified many important studies in QoL. Some QoL studies chose to only include economic factors. Economic factors like steady employment and working conditions outweigh all other factors in an urban lifestyle. Fernando (2015) identified that the rural/remote lifestyle of North Dakota was much different, and many residents include more community-based factors. These community and social involvement components were recreation, or safety and security (Fernando, 2015). Small town residents are comfortable with knowing everyone and having a cohesive community built on traditional values.

The best way to measure quality of life is to survey a population and directly ask them or draw out what things are important to their life. One's own perception of their QoL can point out more detailed concerns within the community. Raycroft (2017) proved the community and political awareness of those living in Bakken. Many respondents were aware of key initiatives like the North Dakota Legacy Fund (Raycroft, 2017). They want government involvement in the improvement of their QoL. Work, family, social, and community experiences were the most important among western North Dakota boomtown residents (Fernando, 2015). This framework of different experiences corresponds to the values of western North Dakotans, but an environmental experience should be added to address the typical environmental degradation associated with boomtowns. Keles (2012) identified different factors associated with QoL including access to environmental infrastructure and services (water and sanitation services), pollution from wastes and emissions, resource degradation (loss of land), environmental hazards, and global nature problems like climate change. Oil boomtowns increase the number of emissions, contribute to the loss of farmland, and contribute to the broader climate change crisis. Boomtowns also have unconventional health and safety risks. Water contamination and flaring

were identified as two major environmental side effects to oil extraction (Ellis, 2016). Both affect the overall QoL through unavoidable means such as air quality and water quality.

Place or place identity is a less researched part of QoL especially in oil boomtowns. Oil production in western North Dakota affected the whole rural countryside and many people did not see this place as their home anymore after the boom. Firstly, people are dependent on a place for economic reasons. Over time they see a place as their home and become attached (Fernando and Cooley, 2016). An oil boomtown can be detrimental to the value of this attachment. Oil extraction that threatens culturally important sites could lower QoL for many. Some oil boomtown communities can eventually form bonds over energy extraction and its importance (Mayer, 2017). This takes time and effort from community members and social groups. In the context of North Dakota, an important example of a community at risk for destruction of place identity would be Fort Berthold Reservation which has already experienced substantial land loss from the completion of the Garrison Dam and creation of Lake Sakakawea in 1954. Future research into the effects of oil extraction on reservations would add a differing viewpoint culturally.

Quality of life is also a large part of tourism research. Tourism and its effects are unique to a population and can be like the oil industry. Tourism research has developed some unique ways of measuring QoL using different principal components and factor analysis. One tourism QoL index developed by Jeon et. al. (2016) measured economic benefits, social costs, and environmental sustainability through a factor analysis survey. The oil industry is similar because of a flourishing economy with social and environmental problems. A similar tourism QoL index split up their factors into five groups including corporate social responsibility, environmental contribution, leadership, economic contribution, cultural understanding, and community

contribution (Liburd et. al., 2012). This analyzed the importance and performance of these factors in a tourist heavy community. The survey analysis for my study will mostly report on the performance of QoL measures. Another tourism QoL index developed by Woo et. al. (2018) observed stakeholder vs. non-stakeholder perception of tourism. The oil industry is similar in this way because many of the residents before a boom have no affiliation with the industry but almost all incoming residents do. This creates an insider vs. outsider rift in the community. Many tourists' QoL indices includes environmental QoL factors. The oil industry creates drastic environmental problems so including an environmental experience group in this study was imperative.

2.3 Conclusion to Literature Review

My study adds to the literature by comparing quality life differences over an entire oil boom. This study shows attitude differences between long-term community members who just experienced a large oil boom and were in the middle of some of the biggest changes in their community in 2012 and long-term community members who were more removed from those stressful times in 2020 before COVID-19 outbreak. Long-term community members are an interesting group of people to study when it comes to oil boomtowns. Older long-term residents are most likely retired and cannot reap the financial benefits of a career in the oil field. Some long-term residents may benefit from owning land with oil preserves. Other long-term residents were just starting their careers and grew up in Williston or Watford City. These residents have more career options to stay in their hometown. Long-term residents also know what life was like before the oil boom, so they are an important source of information. Building a QoL index that corresponds with the Boomtown Impact Model and follows the perceptions of long-term community members will be important to new boomtowns across the country. In conclusion, my

study will be a comprehensive look into QoL of long-term community members in North Dakota Oil Boomtowns.

Chapter 3.

Methodology

3.1 Study Area

Lying in the Williston Basin and covering parts of North Dakota, Montana and Saskatchewan, the Bakken formation (Fig. 1) is the largest contiguous oil deposit in the lower forty-eight states with an estimated 7.4 billion barrels of oil waiting to be extracted (Becker, 2016). The Bakken region has been at the heart of the latest oil boom since the early 2000s, when newer technologies such as horizontal drilling and hydraulic fracturing ("fracking") enabled energy companies to access "unconventional" resources such as shale oil and shale gas that were once considered too difficult or too costly to extract. During the last decade, the Bakken region has become a growing source of oil and gas production for the United States and a driving engine for the economy of North Dakota.

Counties in the Bakken region of western North Dakota were mostly covered in pastures and grasslands used for agriculture and livestock grazing. Agriculture always acted as a stabilizing industry in this area. Farm size has increased over the last 75 years while the number of farms has decreased in this area (Rundquist and Vandeberg, 2018). Oil and gas development has tremendously transformed communities and brought changes in lifestyle for many people in this region. The region has become a more urbanized area especially because of the oil boom with thousands seeking housing in Williston and other boomtowns.

Another important cultural aspect of this region is the Fort Berthold Indian Reservation along the Missouri River. These lands belong to the three affiliated tribes, the Mandan, Hidatsa and Arikara. The construction of the Garrison Dam in the 1950s took 152,000 acres of land from the three affiliated tribes. This dam created Lake Sakakawea which flooded the area. New Town

was created in Mountrail County to replace the communities underneath the water (Rundquist and Vanderg, 2018). Since this tragic event the population has gained wealth through this new oil boom in the last 15 years. The tribe has capitalized on their mineral rights and a select few have gained significant wealth.

Currently, North Dakota has 17 active oil and gas producing counties, all of which are in the western part of the state. This study focuses on four core oil and gas producing counties located in the Bakken region, including Williams, McKenzie, Dunn, and Mountrail. Since 2015, these four countries have accounted for over 90 per cent of oil production of the entire state. In these four counties, surveys were conducted among residents in major oil boomtowns, including Williston, Watford City, Stanley, New Town, Parshall, Tioga, Killdeer, Dunn Center, Alexander, Grenora, Charlson, Epping and White Earth (see Figure 1). Among these boomtowns, the largest cities are Williston (29,000 people), Watford city (6,207 people), and Stanley (2,321 people).

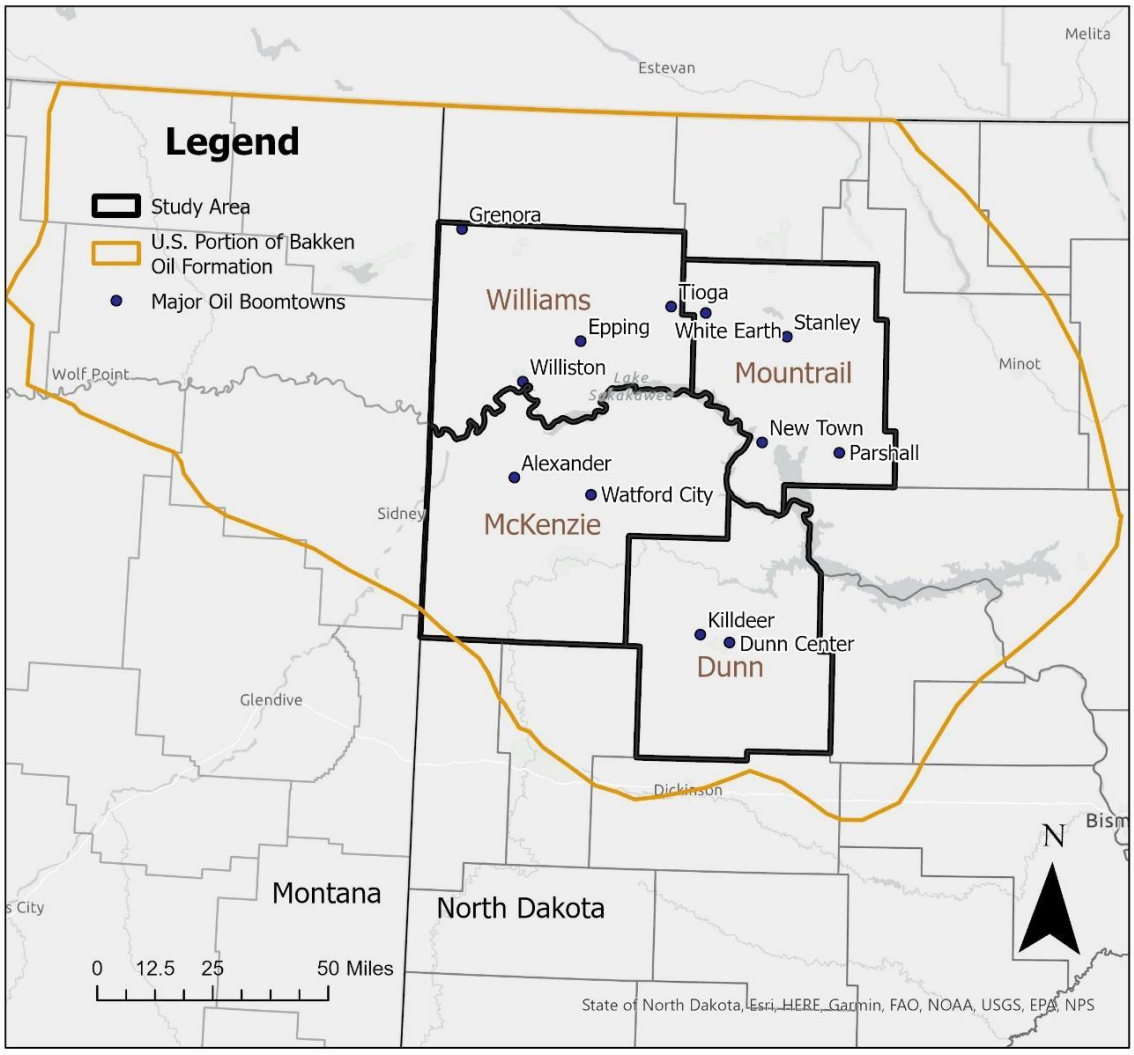

Figure 1 Study Area

3.2 Data

Data used in the research to analyze perceived quality of life (QoL) indicators in western North Dakota boomtowns mainly came from two surveys that were conducted by faculty of the Department of Geography and Geographic Information Science at the University of North Dakota (with assistance from students).

The first survey was conducted in 2012 (Rundquist et. al., 2012). A total of 1,000 surveys were sent via mail to residents of Williston, Stanley, and Watford City in March 2012. Residents who had lived in the area for six years or more were selected using the addresses from the mailing list purchased from USADATA (www.usadata.com). Survey participants were randomly chosen using a random number generator to randomly select addresses in the three cities. The number of participants/addresses selected in each city was largely in proportion to the population of the city. The survey addressed many different QoL parameters. Survey participants answered questions about the economic, social, political, and environmental impacts of the oil boom on their life. This survey was done at the height of the oil boom so many respondents were passionate about the changes happening in their community. Of the 1,000 surveys sent, 50 surveys were returned as non-deliverable. A total of 237 completed surveys were returned with a return rate of 24.95% (237 returned / 950 delivered)

The second survey was conducted in 2020 using an approach like the one used in the 2012 survey (Wang and Carlson 2020). While the 2020 survey was modeled after the one done in 2012 and used most of the same questions, it added questions about the impacts of the "oil bust" (or slowdown of oil production) during 2014-2017 as well as questions that gauge people's feelings about the future of their community and the region. In addition to the three major cities in the region (e.g., Williston, Stanley, and Watford City), the 2020 survey also included smaller

boomtowns such as Alexander, Grenora, Killdeer, New Town, Parshall, Tioga, Mandaree, and White Earth. A total of 1,582 surveys were sent out in March 2020. Only completed 134 surveys were received. The low return rate (15.4%) was likely affected by the unfolding of the COVID-19 pandemic in North Dakota after March 2020. Another factor contributing to the low return rate could be the survey fatigue among residents.

Survey participants were residents over the age of 18 and had lived in an oil boomtown for more than 6 years. Many of the people who responded to the surveys have lived their whole life in western North Dakota. This makes them perfect for my study. The range of ages in my sample were generally around 40-80 years of age. In the 2012 survey, men dominated survey responses making up 65% of responses and women making up around 27% and the rest did not indicate their gender. In the 2020 survey, male and female respondents were about half and half. The mean of years spent in North Dakota was 48.94 years for 2012 participants and 47.46 years for 2020 participants. Another important aspect of participants was involvement in the oil industry. Only around 4% of participants in 2012 and 17% in 2020 were employed by the oil field. The rise from 4 to 17 percent was most likely due to the expansion of the oil industry and the high wages they offered.

In addition to the two surveys, interviews were conducted in 2022 to get a more in-depth view of QoL attitudes. Interviews were only conducted with people who lived in Williston, ND before the oil boom in 2008 and lived in Williston during the boom for at least 6 years. These interviews were done to explain changes in between the two surveys. The interviews were new information and new perspectives from long-term community members. I made sure to gain the perspectives of both men and women who were active in the Williston community. The participants included electrical company workers, a schoolteacher, an engineer, and a university

employee. The diversity of their field of work helped me understand how the oil boom affected people who were not directly involved in the extraction process.

A convenience and snowball sampling method were used to find long-term community members. Contacts in Williston helped find people who have lived in Williston for a considerable amount of time or their whole life. People who were involved and knowledgeable of community issues were targeted in this study. At the start of this research, I pushed for around ten interviews, but this data was only meant to complement the survey data, so it was reduced to five interviews. The interviews were through phone calls, and detailed notes of each interviewees' answers were taken in the process. Fifteen questions were asked, and some were basic to start the interviews. Only long-term community members were interviewed. These were people that have been in their community for at least ten years. Most of them grew up in Williston and some even saw the oil boom of the 1980s.

Each interviewee will be numbered by the chronological order they were interviewed in. Interviews were conducted in late 2022 and early 2023. All the interviewees called Williston their home or where they were from. Interviewee 1 and interviewee 2 lived in Williston for over 50 years. Interviewee 3 and interviewee 4 had been there for over 30 years. The last interviewee 5 grew up in Williston then moved away for college but came back in during the oil boom and stayed for a job. Every one of the participants had experienced the oil boom and its effects. Each interviewee besides two of them had a different profession. Interviewee 1 and 2 both worked in the electrical industry. Interviewee 3 was an engineer. Interviewee 4 is an elementary teacher. Finally, interviewee 5 worked in higher education. For the rest of the summarization of the interviews, similar responses among the participants for each question were compared to differing responses.

3.3 Research Design

Analyzing QoL in oil boomtowns is an under-researched topic. This lack of research forced this study to analyze QoL in different ways. Figure 2 showed how this study used a mixed methods approach to analyze QoL. Three different parts were included in this analysis including an objective analysis, principal component analysis of survey data, and interviewing long-term community members to gain a sense of their attitudes and perceptions.

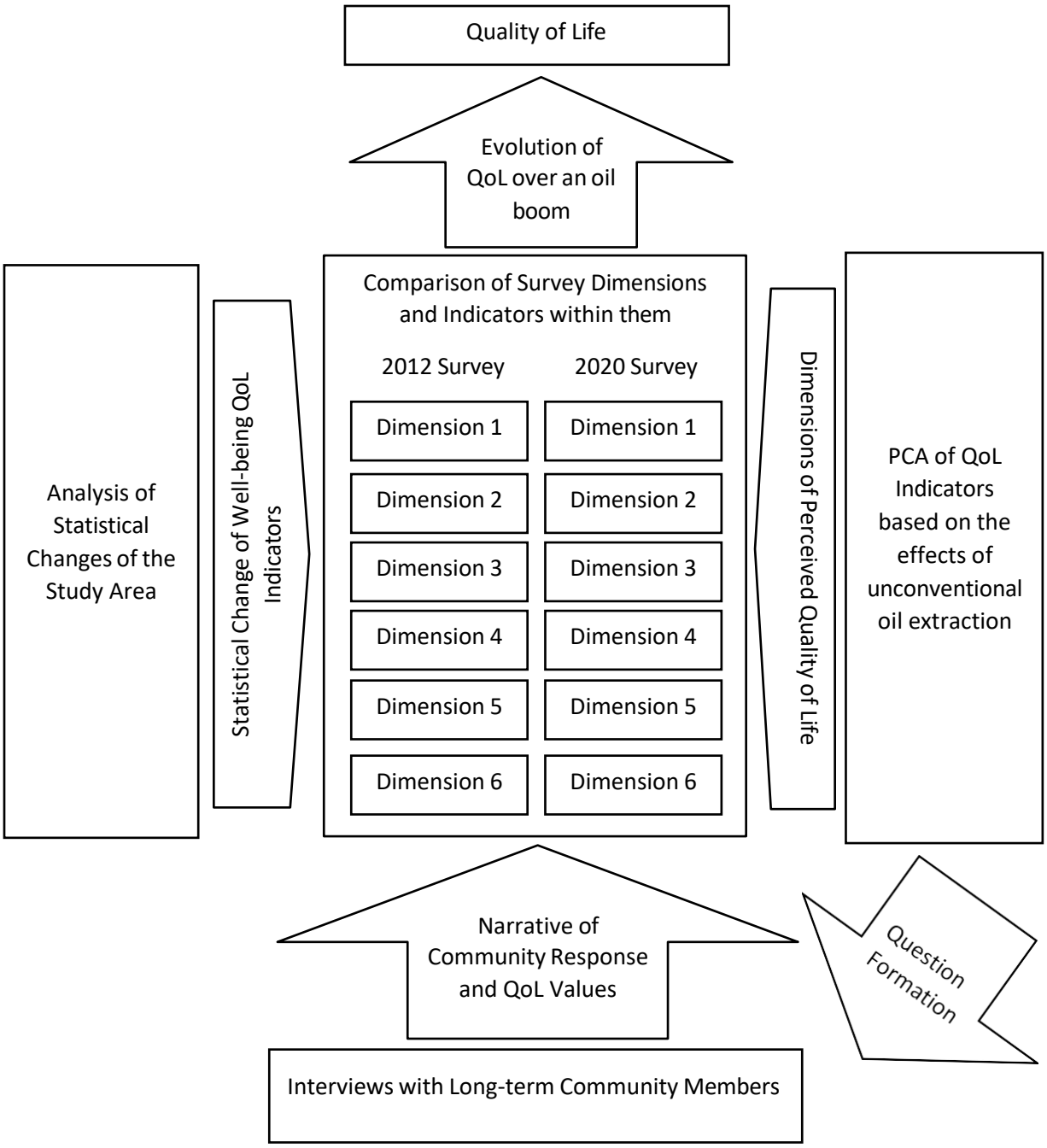

Figure 2 Methodology Process

The first part of the research was the analysis of change in the study area. Demographics, economics, crime, and production statistics were the focus in this section. Measuring how the population changes in age, sex, and economic success was important in determining the people that boomtowns inherently attract. The results of this analysis also provide background

information for the survey results and interviews. Average age and gender makeup are key points of demographic information in boomtowns because many transient young men work in the oil industry. Usually, crime follows this increase in population especially because of young men with no formal ties to the community (Ruddell, 2014). Economic success measurements included oil production, and household income. Finally, cost of living change was measured with housing costs and median housing price from 2010 to 2020.

Many indicators in this study need to be analyzed so a data reduction and grouping tool like a PCA seemed like a natural solution. These variables are perceptions that long-term community members have about their condition or QoL living in an oil boomtown. The goal of this study was to group these perceptions into components that display similar positive or negative reactions. Principal component analysis (PCA) is a data reduction tool used often in statistics for survey data. It is like factor analysis; another data reduction technique used in QoL variable research. SPSS was used (Statistical Package for the Social Sciences) to conduct my PCA. Through SPSS both surveys were put into separate documents. A separate PCA was conducted on both surveys using the same questions on each of them to easily compare 2012 and 2020. To conduct a PCA, your data must pass five assumptions. The five being multiple variables, a linear relationship between all variables, sampling adequacy, data must be suitable for data reduction, and no significant outliers (Laerd 2018). Data suitability was tested with Bartlett's test of sphericity which was implemented in the set-up of the PCA. The surveys used pass all these assumptions and have significant correlations between variables.

The first thing that done to set up my PCA tests was to find variables that were the same between the two surveys. Next, only variables that acted as a participant's own perception of their wellbeing were selected. Certain statements of questions did not clearly address a person's

attitude to their own QoL. Each variable was reverse coded giving them equal values based on whether the questions were inherently negative or positive. One of the most important things when setting up a PCA is the p-value which was set at 0.3. According to Laerd Statistics, this was an appropriate p-value which shows significant indicators within a component. This means that all variables that have a correlation greater than this value will be included in certain components. The first component has variables with high correlations, variables with lower correlations are influenced by the variables with higher correlations. Therefore, so many variables are in the first component of a component matrix. A rotated component matrix groups variables by likeness and delineates components into smaller groups of variables.

The results of a PCA differ based on the conditions used in the analysis. The first thing SPSS computed was a correlation matrix which showed the correlation between every variable. This was interesting but hard to interpret when determining components. SPSS also measured how suitable the data were, as mentioned earlier with Bartlett's Test of Sphericity and Kaiser-Meyer Olkin Test. Bartlett's Test of Sphericity compares the correlation matrix to an identity matrix. If the significance of the correlations is less than 0.05 in this test, then one would reject the null hypothesis and can continue to use the results as a significant PCA.

A total variance explained table is another result generated by a PCA in SPSS. Tables 10 and 11 showed initial eigenvalues and each component. Eigenvalues represent the total amount of variance explained by each component. The first component will have the highest eigenvalue and highest amount of variance among its variables. The last variables will have the lowest eigenvalue and represent the least amount of variance and most likely the least number of variables. Usually the p-value set in the test determines how many components extracted from the PCA. Another method SPSS gives us is the scree plot. This plots the eigenvalues of each

component on the y-axis and the component number on the x-axis. It is supposed to look like an elbow with lower values as the line graph reaches the higher components (Fig. 10 and 11). The joint in the elbow like line is a cutoff point where components past this point may not be as significant or beneficial to keep.

The most important part of the PCA method was the rotated component matrix. This shows what the components represent and defines the components to around 2 to 7 variables based on your p-value. The rotated component matrix was used to make the components for each test. Some variables may be included in certain components and have much smaller correlation than others. The variables with the most correlation in each component of the rotated correlation matrix are the variables which influence that component the most. Certain variables are in multiple components in the rotated correlation table and these variables may have considerable effect on other variables in the PCA. They may also have slight effects on many variables and represent larger ideas in the dataset.

When comparing the two PCAs I looked for changes in component structure. Directly comparing the components will be difficult because one PCA may have more components and components will include different variables. Certain variables will make similar components in each PCA, but people's attitudes and perceptions change over 8 years. I predict the people of western North Dakota have become more accustomed to the changes in their community. Interviews will inform me on why these attitudes have changed over this oil boom. One thing which was directly comparable were correlations and communalities of variables. Groups of attitudes and perceptions will be created for 2012 and 2020. These two surveys represent different times of stress in the oil boom cycle.

I measured basic descriptive statistics like the mean and standard deviation of each indicator in both the surveys. B indicators represent economic attitudes. C indicators represent attitudes toward community. D indicators represent political satisfaction. E indicators represent environmental health and satisfaction. Questions asked were either about positive or negative things the oil boom brought to their community. The interviewees thought about all the experiences that the oil boom brought into their life. At the end of the interview, questions were about QoL. One question was about if their QoL was better during the boom or the bust. Finally, what did QoL mean to them and what a good QoL meant based off their life experiences. These three questions contribute to the creation of new QoL indicators in western North Dakota boomtowns. Interviews added substantially to my discussion section. They will inform many of the conclusions came to in this study with real life experiences of residents.

Chapter 4.

Results

4.1 Transformation of the Study Area

Before getting into the principal component analysis results and interview results, it was important to document the transformation of the study area over the oil boom. Showing the raw statistical data of change over time in things like population, crime, housing, and the economy can give insight into the change of perceptions of long-term community members.

The transformation of western North Dakota in the last decade depends on many different factors. Without doubt, oil and gas production has been a major driving factor, which is influenced by crude oil prices on the global market. Western North Dakota used to be mostly agricultural and sparsely populated. Fracking technologies provided the tools to extract from the Bakken and high oil prices provided a reason to extract by any means necessary.

Figure 3 shows crude oil price over the last two decades (U.S. Energy Information Administration, 2022).

Figure 3: Oil Prices from 2000-2020 U.S. Energy Information Administration

The oil price hike in 2008 corresponded with increasing oil production in North Dakota as seen in figure 4. Oil production since 2013 has continually stayed close to or over 400 million barrels per year.

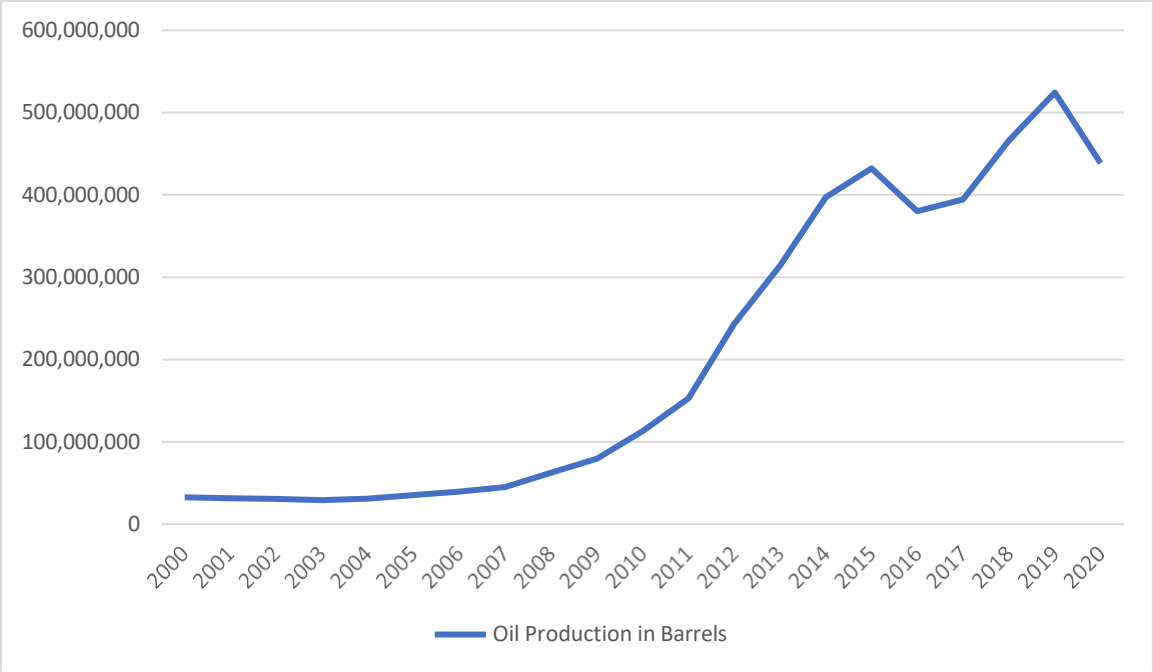

Figure 4: Annual Oil Production in North Dakota (Source: North Dakota Department of Mineral Resources 2020)

Economies are fueled by people, so the first change was the population over time of the four counties included in the study area. Data for this table was taken from the U.S. Census Bureau (2000), (2019) and (2020).

After a decline in the second half of the 1980s, the population of North Dakota remained stagnant for over a decade. During 1990 and 2005, the state's population had an annual growth rate of only 0.09 percent, whereas the population of the United States grew 1.2 percent annually.

During 2005 – 2020, however, North Dakota's population increased by 1.26 percent each year while the population growth of the country slowed down with an annual growth rate of 0.83.

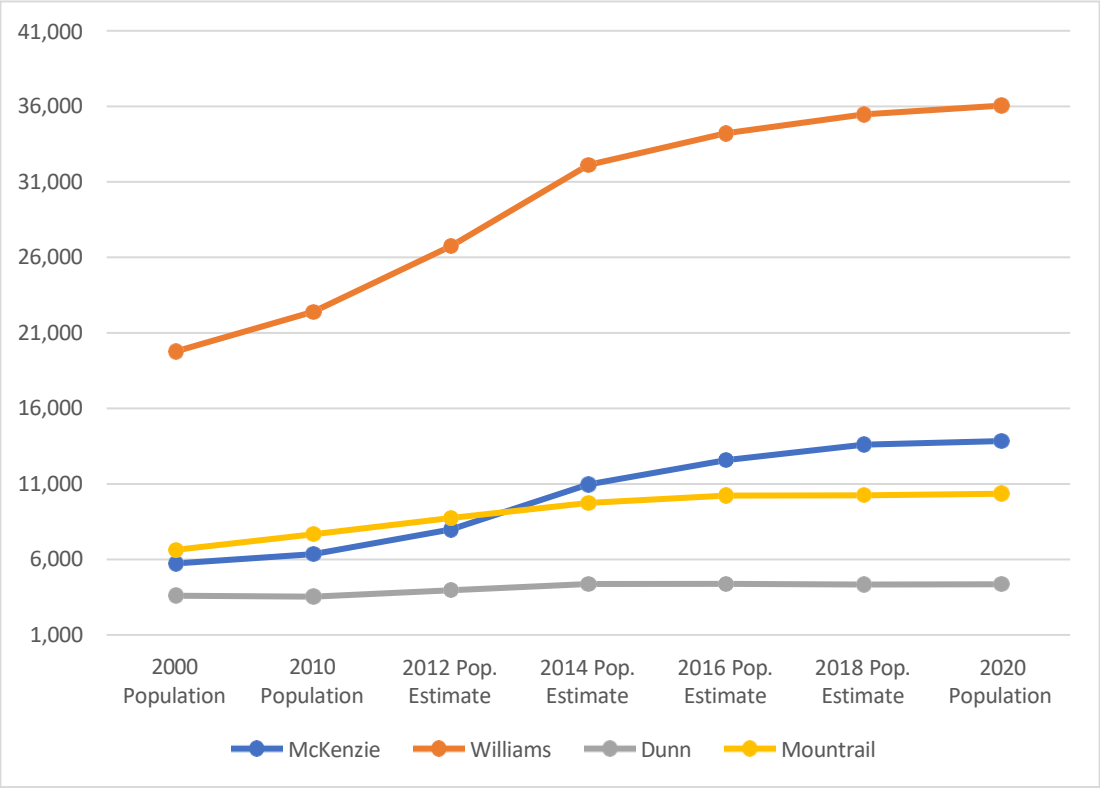

Figure 5: Population of Counties in the Study Area, 2000-2020

Population increases were most significant in Williams County where Williston, the largest city at the center of oil boom in North Dakota, is located. McKenzie County also made large strides by doubling its population between 2010 and 2020. Some people also chose to live a little further away from their work in the oil fields so much of western North Dakota gained population.

Population is increasing so much from migration to this area, but the population did not only increase in this area, but it also has changed significantly. One of the most important aspects of a population is age.

Boomtowns attract young people because of the opportunities they present for work. This can significantly affect the population not only from people coming in but also from these people

having children. Boomtowns are less attractive for older people because of the raised cost of living. All data in the table 1 was provided by the U.S. Census Bureau (2020) in the ACS Age and Sex table. These percentages of the population were based off five-year estimates.

Table 1 County Population Percentage of Each Age Range from 2010 to 2020

McKenzie County Age Range Percentages by Year						
Age Range	2010	2012	2014	2016	2018	2020
0-19	29.2	28.9	30.4	31.6	32.2	34.1
20-39	21.9	23.6	25.7	29.3	29.8	29.1
40-59	28.7	28.4	27.2	25.1	23.6	23.1
60-79	16.1	15.3	14.1	12	12.3	12.2
>80	4.1	3.9	2.7	1.9	2	1.7
Williams County Age Range Percentages by Year						
Age Range	2010	2012	2014	2016	2018	2020
0-19	25.5	25.6	26.6	27.7	29.3	30.6
20-39	23.7	27	30	33.1	33.6	33.7
40-59	29.2	27.7	26.9	24.8	22.6	21
60-79	16.2	14.4	12.6	11.4	11.4	11.9
>80	5.3	5.3	4.4	3.1	3.2	2.8
Dunn County Age Range Percentages by Year						
Age Range	2010	2012	2014	2016	2018	2020
0-19	24.9	23.8	26.3	25.8	26.5	26
20-39	19.5	22	19.2	24.2	24.3	23.8
40-59	30	29.4	27.5	25.1	27.4	26.3
60-79	19.4	18.8	21	20.7	17.6	17.8
>80	6.2	5.9	5.9	4	4.4	6
Mountrail County Age Range Percentages by Year						
Age Range	2010	2012	2014	2016	2018	2020
0-19	27.7	27.3	27.2	28.9	29.5	31.1
20-39	25.5	26.4	29.2	29.6	29.3	27.5
40-59	26.9	26.7	25.7	25	25.1	25.3
60-79	15.2	15.6	15.1	14.1	13.5	12.6
>80	4.6	3.9	2.9	2.4	2.7	2.7

This increase in population brings the stress of housing demand. Housing was one of the largest concerns among survey and interview participants. The U.S. Census Bureau provided many different housing statistics over the last decade.

Median housing unit value in the four highest producing oil counties in North Dakota increased significantly between 2010 and 2020 (U.S. Census Bureau: B25077, 2020). McKenzie and Williams were generally higher with McKenzie County having the highest value increase. McKenzie County increased almost 220%. Williams county increased around 172%. Long-term community members tend to be homeowners because of their commitment to their community. Housing prices were a statistic that applies well to the population in this study. These housing prices made it easy for residents to profit from their home in the Bakken. A different measure of housing costs shows how renters faired over the oil boom in my study area.

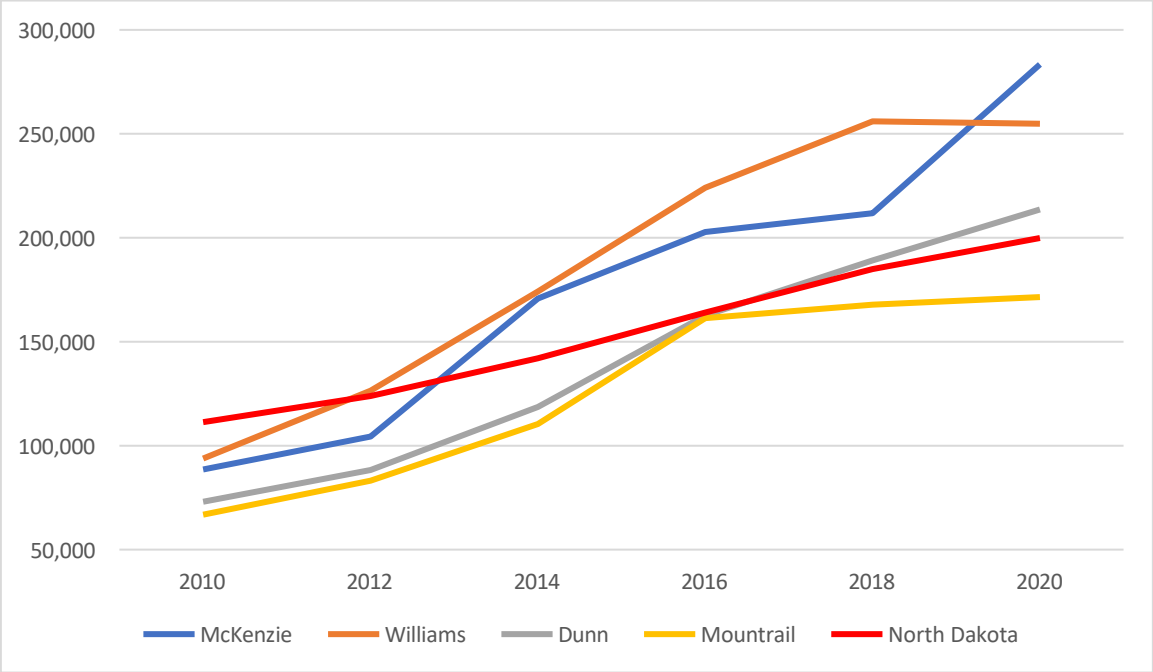

Figure 6: Median Housing Prices in Four Highest Producing Oil Counties (Dollars)

Figure 7 shows a steady increase in rent costs over the last decade (U.S. Census Bureau: S2503, 2020). The oil boom created immense demand for housing, and you can see that by rent peaking in each county in 2020 at just over 1000 dollars besides Mountrail County. Some long-term community members still pay rent, but this was an indicator that most likely affects new residents working in the oil fields.

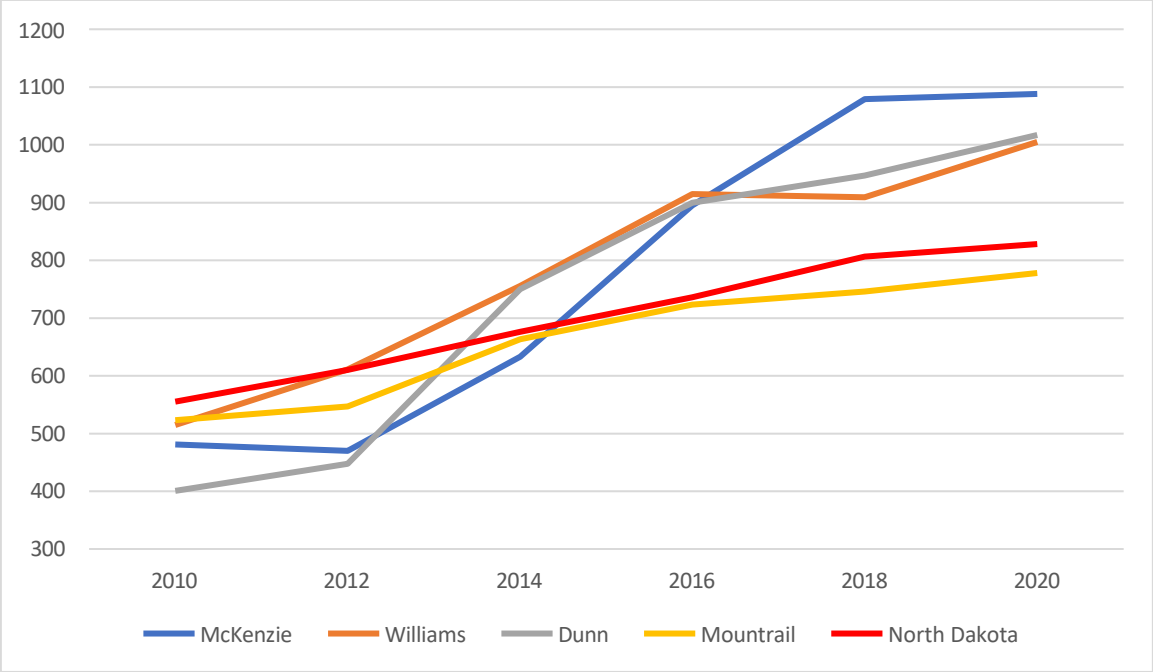

Figure 7: Rent + Housing Costs per Month in the Study Area (Dollars)

Another financial indicator of transformation in a community is median household income. Here is a graph based on data from the U.S. Census Bureau: S2503 (2020).

Household income has gone up significantly over the 2010s in western North Dakota. Mountrail county showed the lowest increase in household income by only increasing around 15,000 in 10 years. Williston County showed the largest amount of household income in 2016 with just over 90,000 dollars. Western North Dakota is now significantly wealthier, and this can contribute directly to addressing some of the community problems through taxes. More property taxes were going to schools and more sales taxes were going to the local government.

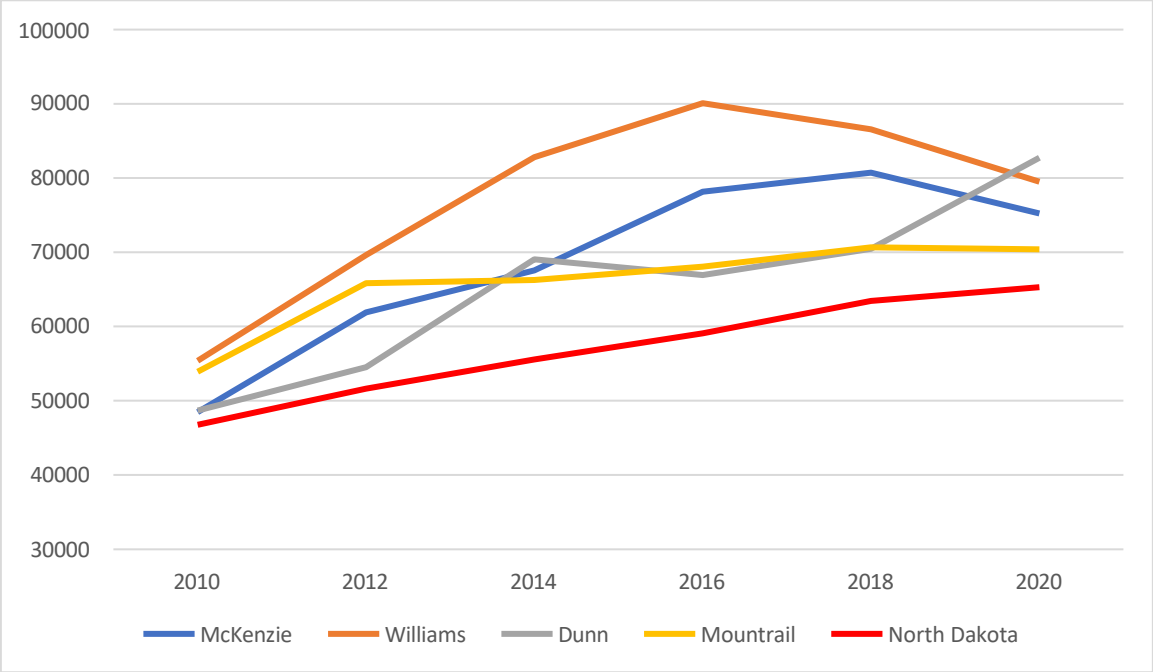

Figure 8: Median Household Income in the Study Area (Dollars)

One negative thing an oil boom like this brings to these communities is crime. Crime was bound to increase with such a large population increase but other circumstances can make it even worse. Crime data in North Dakota is split up into three categories including drugs/alcohol, violent, and property crimes. The data in figure 9 includes drug, DUI, and violent crime arrests. All the city police departments and county sheriffs' offices were included in the four counties. A narcotics task force in Williston was also included in drugs/narcotics arrests. ND Highway Patrol were not included in the arrests because they span all of North Dakota so it would be extremely difficult to track the arrests they did in the four counties included in this study. All the police departments included should be a good indicator of crime trends in the study area. Data in figure 9 can be found at the Official Portal for North Dakota State Government under crime statistics (2022). 2014 was the peak for DUI arrests in the study area with just under 1,200 arrests. The total amount of DUI arrests in North Dakota in 2014 was 6,760. Four counties made up around

17 percent of DUI arrests in North Dakota. Drug arrests peaked in 2018 with around 700 arrests in the study area. North Dakota in total had 5,478 drug arrests in 2018 so drug arrests in the study area made up almost 13 percent of drug arrests in North Dakota.

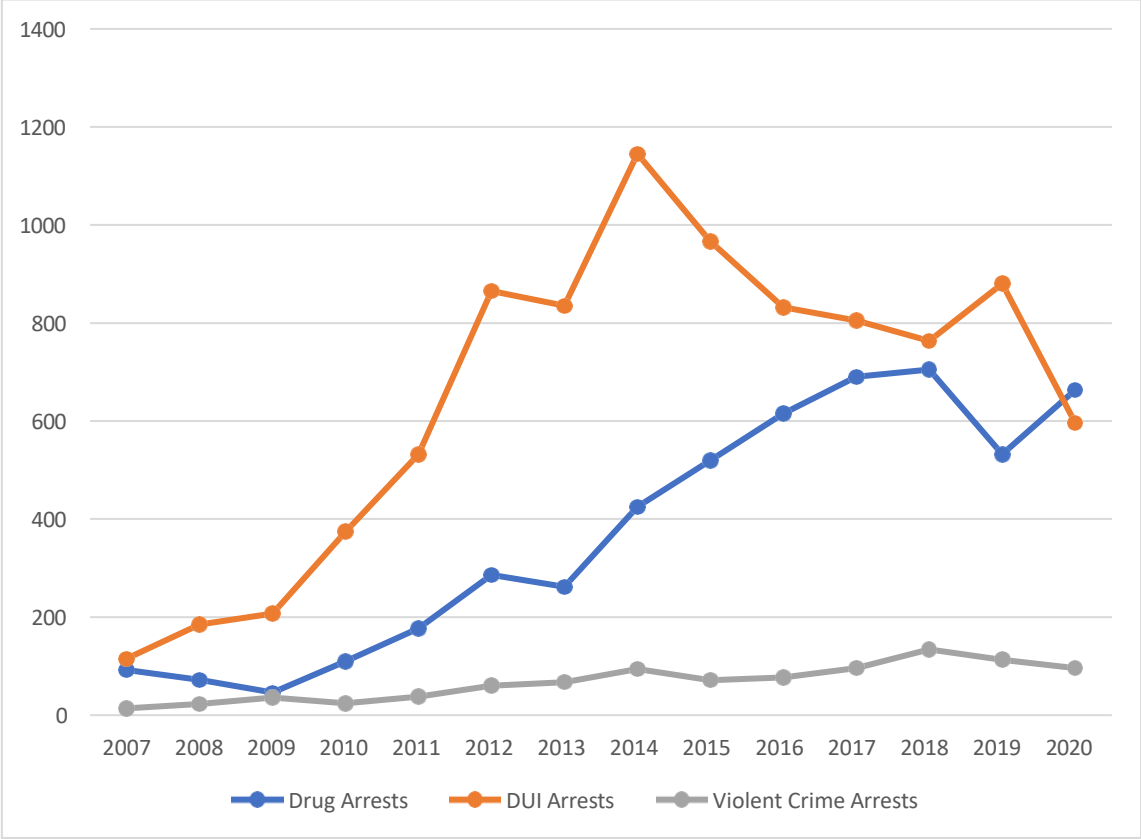

Figure 9: Criminal Arrests in the Study Area

4.2 Data Suitability and Significance of Surveys

The first results of the two surveys indicate its significance and suitability. This was done by the Kaiser-Meyer Olkin Test and Bartlett's Test of Sphericity. The results of those two tests for both surveys are in table 2. The KMO test measures sampling adequacy and the highest value is 1.0. A value above 0.9 is considered marvelous sampling adequacy. Both of my surveys were around that 0.85 mark which was considered great sampling adequacy. Surveys with a sampling adequacy between 0.8 and 1 are adequate for data analysis. Bartlett's Test of Sphericity shows that a correlation matrix is not an identity matrix. An identity matrix has variables that are unrelated and not ideal for analysis. Since the significance was so low for both tests at 0.000 the null hypothesis was rejected. This meant the correlation matrix was not an identity matrix. This means the results were ideal for data analysis.

Table 2 KMO and Bartlett's Test of Surveys 2012 and 2020

2012 Tests		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.844
Bartlett's Test of Sphericity	Approx. Chi-Square	3795.036
	df	780
	Sig.	0.000
2020 Tests		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.853
Bartlett's Test of Sphericity	Approx. Chi-Square	4090.783
	df	780
	Sig.	0.000

4.3 Demographic Data of Survey Participants

The 2020 survey was expanded to different smaller towns in western North Dakota affected by the oil booms as seen in table 3 . While these towns gained population, Williston, Watford City and Stanley were the largest population centers. Thousands flocked to these cities during the boom.

Table 3 Place of Residence of Survey Participants 2012 and 2020

2012 Survey		
City	Number of Responses	Percentage
Williston	**160**	**68.38**
Watford City	**31**	**13.25**
Stanley	**30**	**12.82**
No response	**13**	**5.56**
2020 Survey		
City	Number of Responses	Percentage
Williston	**134**	**55.1**
Watford City	**28**	**11.5**
Stanley	**17**	**7**
Tioga	**16**	**6.6**
New Town	**11**	**4.5**
Parshall	**10**	**4.1**
Killdeer	**6**	**2.5**
Dunn County	**3**	**1.2**
Alexander	**2**	**0.8**
Killdeer	**6**	**2.5**
Dunn County	**3**	**1.2**
Alexander	**2**	**0.8**

These surveys were targeted towards long-term community members. So having a large percentage of participants between 45 and 80 in table 4 was not surprising. There was a larger sample of 23–40-year-old participants in 2020. Many long-term residents moved out and younger worker age people moved in so this could explain this shift in demographics.

Table 4 Age of Survey Participants 2012 and 2020

2012 Survey		
Age Range	Number of Responses	Percentage
<18	**0**	**0**
18-22	**1**	**0.42**
23-40	**10**	**4.22**
41-65	**136**	**57.38**
66-80	**69**	**29.11**
Over 80	**18**	**7.59**
No Response	**3**	**1.27**
2020 Survey		
Age Range	Number of Responses	Percentage
<18	**0**	**0**
18-22	**1**	**0.4**
23-40	**28**	**11.5**
41-65	**120**	**49.4**
66-80	**72**	**29.6**
Over 80	**20**	**8.2**
No Response	**2**	**0.8**

There were major differences between the gender makeup of each survey as see on table 5. The 2012 survey was significantly male with almost 65% of the responses. The 2020 survey was even between males and females with women responding nine more times than men. Neither gender is less or more educated in their community and there were not any gender specific questions.

Table 5 Sex of Survey Participants 2012 and 2020

2012 Survey		
Sex	Number of Responses	Percentage
Male	**143**	**64.56**
Female	**66**	**27.85**
No Response/Prefer Not to	**18**	**7.59**
2020 Survey		
Sex	Number of Responses	Percentage
Male	**114**	**46.9**
Female	**123**	**50.6**
No Response/Prefer Not to	**6**	**2.5**

4.4 Descriptive Statistics

The mean of each indicator is between 1 and 5 with 1 being a negative attitude and 5 being a positive attitude. Variables were coded using the Likert-scale. If a question/indicator was inherently positive a response of strongly agree was given a 5 and agree was given a 4 while a response of strongly disagree was given a 1 and disagree a 2. The neutral response was given a score of 3. If a question/indicator was inherently negative a response of strongly agree was given a 1 and agree was given a 2, while a response of strongly disagree was given a 5 and disagree was given a 4. Economic indicators were some of the highest values especially in 2020. The long-term community population may have shifted a little in 8 years. Many long-term residents who could not live through the conditions the oil boom brought had left, or many got used to these conditions because of the good economic effects the boom brought. 2020 residents feel like their community and themselves have benefitted more from the boom than closer to when it started in 2012.

Work/economic indicators had some of the best perceptions from residents. They felt like the oil boom benefited them financially by offering new opportunities and higher paying jobs either in the oil field or within the community. Work/economic indicators were even better in 2020 compared to 2012 as seen in table 6. The only indicator that decreased was related to mineral rights.

Table 6 Descriptive Statistics of Work/Economic Indicators 2012 and 2020

2012 Survey Indicators			
Indicator	N	Mean	Std. D
B3: Financially, the oil boom was good for my community.	237	3.35	1.258
B4: Financially, the oil boom was good for my family.	237	3.33	1.300
B5: I financially benefitted from the oil boom.	237	3.41	1.428
B6: I had relatives or friends who have benefitted from the oil boom.	237	4.06	.996
B7: Landowners are well compensated for selling their mineral rights.	233	3.57	1.109
2020 Survey Indicators			
Indicator	N	Mean	Std. D
B3: Financially, the oil boom was good for my community.	234	4.26	.916
B4: Financially, the oil boom was good for my family	233	4.10	1.088
B5: I financially benefitted from the oil boom	233	3.92	1.194
B6: I had relatives or friends who have benefitted from the oil boom.	234	4.42	.767
B7: Landowners are well compensated for selling their mineral rights.	226	3.39	1.147

Negatively impacted community variables were usually associated with the influx of population coming to North Dakota as seen in table 7. Residents thought places were overcrowded but most thought they welcomed newcomers accordingly. The housing cost variable (C1) had the lowest means of this study with a 1.02 in 2012 and 1.08 in 2020.

Safety and crime were one of the largest negatives from community variables. The combination of a large influx of people will also bring more crime. Another variable concerned with safety was traffic accidents. Many people felt dangerous in the middle of intense truck traffic. The initial boom created many problems in these communities that took years to fix. Communities in western North Dakota have adjusted to these population increases and created more ideal community conditions. Indicator C13 was an overall indicator for QoL and according to the results it improved from 2012 to 2020.

Table 7 Descriptive Statistics of Community/Social Indicators 2012 and 2020

2012 Survey Indicators			
	N	Mean	Std. D.
C1: Housing costs increased significantly.	235	1.02	.145
C2: There were too many newcomers.	234	1.99	1.084
C3: There were too many out-of-state cars.	234	1.95	1.073
C4: Local residents welcomed newcomers.	232	3.22	.900
C5: Churches were helping newcomers.	232	3.92	.686
C6: My community became less safe to live.	233	2.52	1.118
C7: City services could handle increasing population.	235	1.77	.954
C8: Stores were overcrowded.	232	1.87	.955
C9: Roads and highways became less safe with more traffic and machinery.	235	1.24	.534
C10: There were more criminal activities.	234	1.57	.728
C11: Lack of law enforcement was a major problem.	234	1.94	.963
C12: Drugs & alcohol were becoming more serious problems.	235	1.80	.856
C13: My quality of life improved.	234	2.43	1.133
C15: Newcomers were paid more than local residents.	233	2.70	1.177
C16: New wealth produced a larger social gap.	233	2.67	1.020
C17: Our schools were negatively affected by the oil boom economy.	234	1.32	.721
2020 Survey Indicators			
	N	Mean	Std. D
C1: Housing costs increased significantly.	235	1.08	.282
C2: There were too many newcomers.	235	2.21	1.130
C3: There were too many out-of-state cars.	235	2.20	1.143
C4: Local residents welcomed newcomers.	234	3.43	.857
C5: Churches were helping newcomers.	235	4.11	.728
C6: My community became less safe to live.	234	1.91	1.027
C7: City services could handle increasing population.	235	2.54	1.126
C8: Stores were overcrowded.	232	2.23	1.084
C9: Roads and highways became less safe with more traffic and machinery.	235	1.40	.693
C10: There were more criminal activities.	234	1.45	.655
C11: Lack of law enforcement was a major problem.	235	2.23	1.037
C12: Drugs & alcohol were becoming more serious problems.	235	1.54	.758
C13: My quality of life improved.	232	3.24	1.163
C15: Newcomers were paid more than local residents.	232	2.76	1.132
C16: New wealth produced a larger social gap.	234	2.73	.967
C17: Our schools were negatively affected by the oil boom economy.	234	2.29	1.333

Political satisfaction was lower in almost every variable in 2012 compared to 2020. Residents were only four years into the boom in 2012 and were still experiencing many of the initial effects of population increase and oil production. Many long-term residents have a connection with their community. People seemed to blame land use planners. Political attitudes of western North Dakotans are mostly conservative with many not wanting government involvement but blame still went upon local and state government in the eyes of many in western North Dakotans. People saw improvement in their community and people had greater political approval in 2020 as seen in table 8.

Table 8 Descriptive Statistics of Political Satisfaction Indicators 2012 and 2020

2012 Indicators			
	N	Mean	Std. D
D1: We need more coordinated and effective long-term land use planning.	234	1.78	.976
D4: My community was prepared for the influx of oil workers and companies.	235	1.73	.993
D5: My community commissioners are keeping on top of all problems.	235	2.45	1.132
D6: My city mayor/councilors are keeping on top of all problems.	234	2.53	1.150
D7: We have a good land use plane for the county.	233	2.24	1.011
D8: Our planning officials have sufficient training to address local housing problems.	234	2.21	.975
D9: Our law enforcement officials are able to handle problems that arise.	234	2.53	1.147
D10: Our local representatives in the North Dakota legislature are aware of local problems.	231	3.12	1.316
D12: Our state representatives are representing local interests well.	232	2.67	1.295
D13: Various state offices should do more to protect local citizens affected by the oil boom.	233	2.15	1.133
2020 Survey Indicators			
	N	Mean	Std. D
D1: We need more coordinated and effective long-term land use planning.	229	2.17	.934
D4: My community was prepared for the influx of oil workers and companies.	235	1.92	.997
D5: My community commissioners are keeping on top of all problems.	232	3.11	1.107
D6: My city mayor/councilors are keeping on top of all problems.	233	3.19	1.129
D7: We have a good land use plane for the county.	233	2.95	1.007
D8: Our planning officials have sufficient training to address local housing problems.	232	2.84	1.056
D9: Our law enforcement officials are able to handle problems that arise.	233	3.49	1.022
D10: Our local representatives in the North Dakota legislature are aware of local problems.	232	3.28	1.164
D12: Our state representatives are representing local interests well.	233	3.07	1.199
D13: Various state offices should do more to protect local citizens affected by the oil boom.	232	2.12	.996

Environmental variables were the most experimental group involved in this study because of the little amount of research into how the environment affects the QoL of boomtown residents. Economic interests directly oppose these environmental variables. Heavy resource extraction areas usually must sacrifice some environmental quality. Every environmental variable negatively affected perceived QoL. Environmental safety like road conditions and heavy vehicle accidents had some of the lowest means. Litter was a large problem at the start of the boom and attitudes towards litter did not get much better in 2020 as seen on table 9.

Table 9 Descriptive Statistics of Environmental Indicators 2012 and 2020

2012 Survey Indicators			
	N	Mean	Std. D
E4: My community became a less environmentally sound place.	236	2.15	1.131
E5: Our air was more polluted than before the oil boom.	237	2.42	1.282
E6: Soils were more polluted than before the oil boom.	234	2.47	1.288
E8: There was too much trash and litter.	237	1.42	.747
E9: Water pollution was a problem.	236	2.72	1.216
E10: There were many more heavy vehicle accidents.	236	1.28	.550
E11: Road conditions became worse than before the oil boom.	235	1.20	.600
E12: Plant and animal communities were endangered.	236	2.52	1.229
E13: We need better state environmental laws.	236	2.73	1.256
2020 Survey Indicators			
	N	Mean	Std. D
E4: My community became a less environmentally sound place.	234	2.29	1.161
E5: Our air was more polluted than before the oil boom.	235	2.66	1.269
E6: Soils were more polluted than before the oil boom.	235	2.43	1.229
E8: There was too much trash and litter.	235	1.71	.906
E9: Water pollution was a problem.	235	2.81	1.132
E10: There were many more heavy vehicle accidents.	235	1.57	.715
E11: Road conditions became worse than before the oil boom.	235	1.57	.919
E12: Plant and animal communities were endangered.	222	2.46	1.179
E13: We need better state environmental laws.	228	2.54	1.170

4.5 Principal Component Analysis

A principal component analysis was done on both the 2012 and 2020 survey. A direct comparison between the two was difficult since some indicators will end up in different components. 2012 will serve as a snapshot of attitudes during a stressful time for western North Dakota residents. Many long-term residents were more concerned and still unfamiliar with the changes brought to their community by the oil boom. The 2020 survey was done just before the COVID-19 pandemic. People had become accustomed to certain changes. City governments solved different problems associated with the oil boom. Perceptions and attitudes toward these changes need to be measured over time. The PCAs included many different results. Tables 10 and 11 are total variance explained. Appendices B and C are component matrices, while appendices D and E are rotated component matrices and a line graph of each scree plot was made in figure 10 and 11.

4.5.1 Total Variance Explained and the Scree Plot

The total variance explained by the eigenvalues tables 10 and 11 showed how each component explains a portion of the variance in the data set. This table was one of the indicators for how many components extracted from each PCA. According to the Kaiser Rule, a component should have an eigenvalue of over 1 to be worthy of extraction. Tables were limited to 10 and 11 to components with an eigenvalue of over 1, but not all components were worthy of extraction since the scree plot for each test will determine how many of these components will be extracted.

Table 10 PCA Total Variance Explained, 2012 Survey

Component	Initial Eigenvalues/Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
1	9.770	24.425	24.425	4.296	10.740	10.740
2	2.826	7.066	31.491	4.260	10.649	21.389
3	2.655	6.638	38.129	3.212	8.030	29.419
4	2.369	5.921	44.050	2.527	6.319	35.738
5	1.604	4.009	48.059	2.253	5.631	41.369
6	1.462	3.656	51.715	1.907	4.768	46.137
7	1.323	3.309	55.023	1.897	4.742	50.879
8	1.297	3.241	58.265	1.695	4.237	55.117
9	1.143	2.857	61.122	1.571	3.927	59.044
10	1.089	2.722	63.844	1.536	3.841	62.885
11	1.047	2.618	66.461	1.430	3.576	66.461
Extraction Method: Principal Component Analysis						

Table 11 PCA Total Variance Explained, 2020 Survey

Component	Initial Eigenvalues/Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.209	25.523	25.523	5.212	13.031	13.031
2	3.665	9.162	34.685	4.489	11.222	24.252
3	2.803	7.007	41.692	4.059	10.147	34.400
4	2.033	5.083	46.775	3.415	8.537	42.937
5	1.782	4.455	51.231	1.985	4.963	47.900
6	1.528	3.821	55.051	1.730	4.325	52.224
7	1.277	3.194	58.245	1.603	4.007	56.232
8	1.139	2.848	61.093	1.404	3.511	59.742
9	1.114	2.786	63.879	1.391	3.477	63.219
10	1.002	2.504	66.383	1.266	3.164	66.383
Extraction Method: Principal Component Analysis						

Scree plots were used to help extract components from the PCA results. A scree plot is a line plot that shows the eigenvalue for each principal component. One common method of interpreting a scree plot is to use the elbow rule, which is about looking for the inflection point or the “elbow” shape on the curve as the break and retaining all components above this break. In figure 10 of the 2012 survey there was an elbow near component 5 or 6 so 6 components should be extracted. Extracting 6 components would account for 51.715% of variation in the dataset.

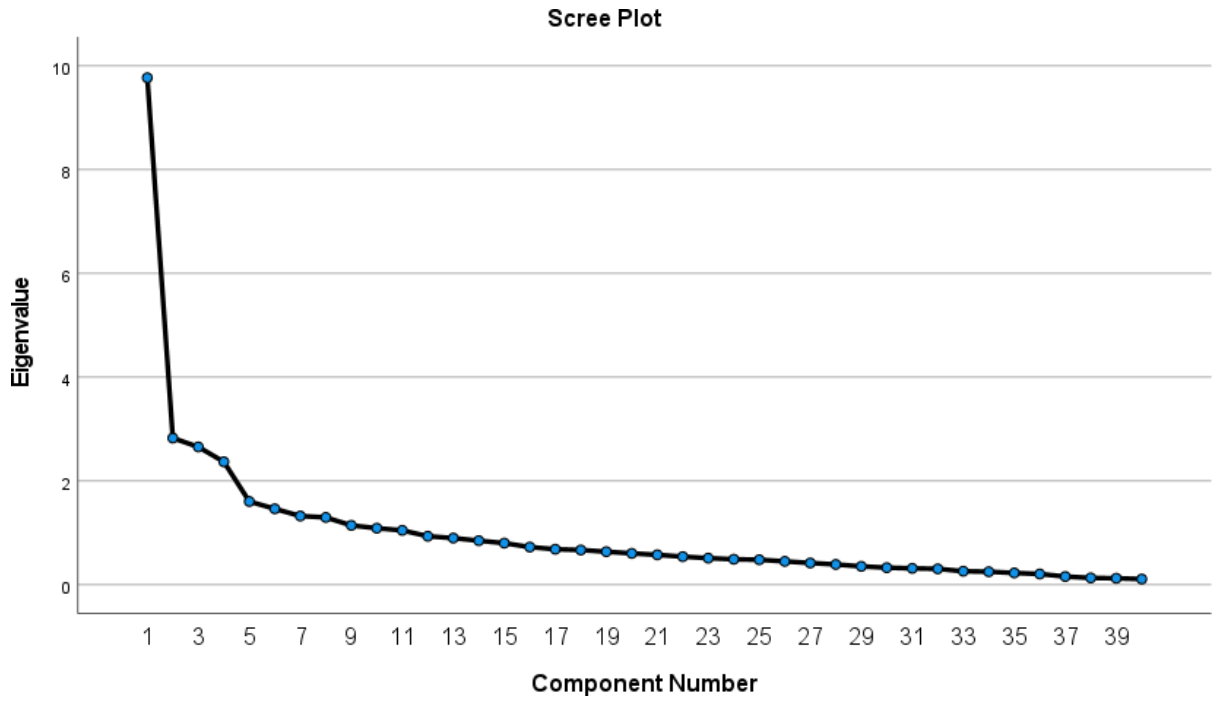

Figure 10: PCA Scree Plot of 2012 Survey

Figure 11 shows a scree plot of the 2020 survey. An elbow was much less apparent in this scree plot. The line graph starts to show smaller and smaller decreases after component 6. This indicates an explanation of less variance in the dataset. Six components will be extracted which accounts for 55.051% of variance in the dataset.

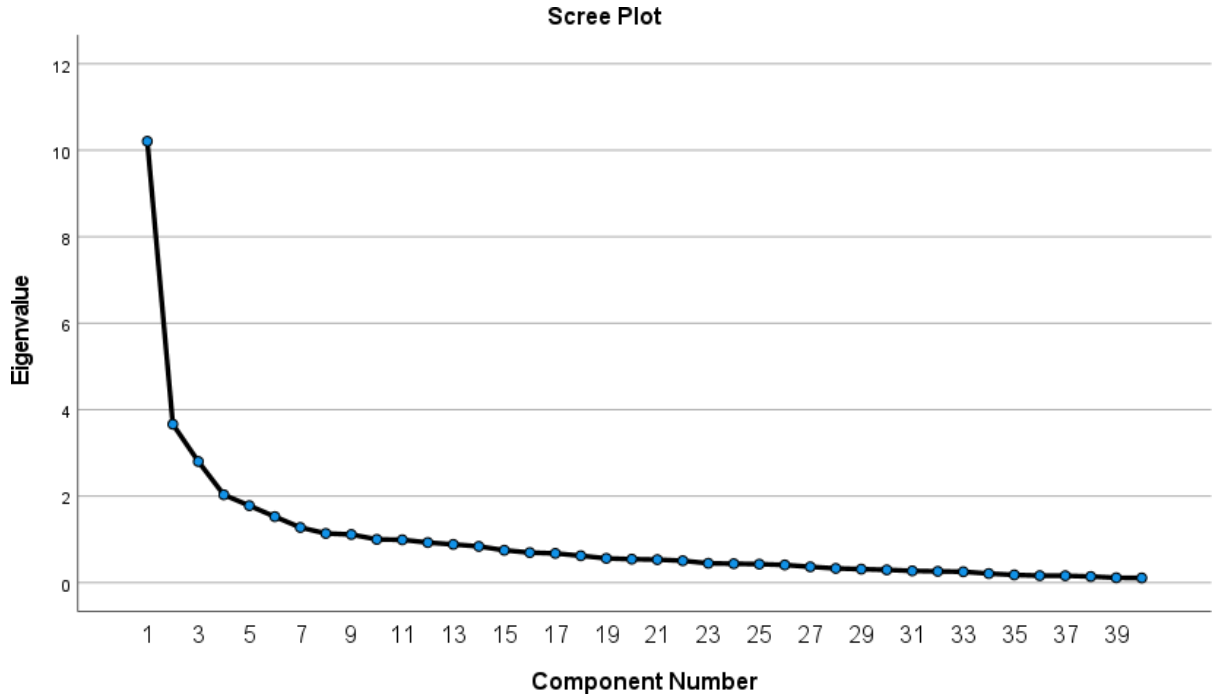

Figure 11: PCA Scree Plot of 2020 Survey

4.5.2 Component Matrix and Rotated Correlation Matrix

The component matrix showed the correlation each indicator has within their respective components. Indicators with an absolute value greater than 0.3 were the only ones included in each component. The first component often contains many of the indicators and as the component number increases the number of indicators with significant correlation decreases. Appendix B shows the 2012 results and appendix C shows the 2020 results. The number of components shown in each table shows the number of components the software extracted but does not indicate the number of the components used in the results.

Results can be derived from the component matrixes, but a rotated component matrix filters out the lower correlated indicators. This creates a group of indicators with each component that highly correlate with each other. Appendix D is the rotated component matrix for 2012 and appendix E is the rotated component matrix for 2020.

4.5.3 PCA Final Results

The results in Tables 12 and 13 were derived from the rotated component matrix. The factor loadings within each component show which indicators were most crucial to that component. The mean scores show whether the indicators were positive or negative for QoL in western North Dakota boomtowns. The higher the score the more positive it was for QoL while the lower the score the worse this indicator was for QoL. Only the indicators that represented the most variance in each component were included. Indicators with a factor loading of under 0.5 were omitted from the component because some components had two of the same indicators within them with small variance. The word "components" was switched to dimensions to represent QoL jargon. Names for each dimension encapsulated all the indicators within that certain dimension.

Each dimension represents a group of indicators that correlate well with each other. In Table 12 of 2012 survey, for example, environmental health had indicators all related to different aspects of the natural environment. Table 13 of the 2020 survey had a similar first component except an indicator of environmental laws was included. The indicators in dimension 1 of Tables 12 and 13 all negatively affected QoL according to their mean values. The second component in Table 12 and 13 were political satisfaction or trust in leadership. The indicators related to the perception of those in public office in their community. 2012 political satisfaction indicators all negatively affected QoL while in 2020 they improved and most of them positively affected QoL. The third dimension in Table 12 for 2012 and was work/economy which had indicators related to financially benefiting from the oil boom. Work/economy was the fourth dimension in Table 13

of 2020. 2012 work/economy indicators were all positive while 2020 indicators were even more positive.

Dimension 4 in Table 12 of 2012 was safety and security which included crime and law enforcement indicators. Dimension 3 (quality of community and social life) in Table 13 of 2020 included these crime indicators but also included sense of community indicators. These sense of community indicators in 2012 were included in dimension 5 of Table 12 of 2012. Crime indicators negatively affected QoL in 2012 and 2020. The social disruption indicators were negative in 2012 and 2020 but improved in 2020. Social disruption indicators show perceptions of newcomers and the social traffic they brought. Dimension 5 in Table 13 of 2020 was community preparedness which included two indicators related to community services and how prepared they were to handle oil boom problems. These indicators negatively affected QoL. Dimension 6 in Table 12 of 2012 was noise which had two different indicators related to overcrowding and traffic, both were negative. Dimension 6 in Table 13 of 2020 represented transportation safety which included negative QoL indicators related to road conditions and accidents.

Table 12 2012 Survey Components

Dimension 1: Environmental Health	**Factor Loading**	**Mean Value**
E6- Soils were more polluted than before the oil boom.	0.836	2.47
E5- Our air was more polluted than before the oil boom	0.804	2.42
E12- Plant and animal communities were endangered.	0.801	2.52
E9- Water pollution was a problem.	0.766	2.72
E13- We need better state environmental laws.	0.714	2.73
E4- My community became a less environmentally sound place.	0.668	2.15
Dimension 2: Political Satisfaction	Factor Loading	Mean Value
D6- My city mayor/councilors are keeping on top of all problems.	0.829	2.53
D5- My community commissioners are keeping on top of all problems.	0.811	2.45
D7- We have a good land use plane for the county.	0.708	2.24
D8- Our planning officials have sufficient training to address local housing problems.	0.704	2.21
D9- Our law enforcement officials are able to handle problems that arise.	0.691	2.53
Dimension 3: Work/Economy	Factor Loading	Mean Value
B4- Financially, the oil boom was good for my family.	0.829	3.33
B5- I financially benefitted from the oil boom.	0.800	3.41
B6- I had relatives or friends who have benefitted from the oil boom.	0.677	4.06
B3- Financially, the oil boom was good for my community.	0.640	3.35
C13- My quality of life improved.	0.591	2.43
Dimension 4: Safety and Security	Factor Loading	Mean Value
C12- Drugs & alcohol were becoming more serious problems.	0.805	1.80
C10- There were more criminal activities.	0.768	1.57
C11- Lack of law enforcement was a major problem.	0.688	1.94
Dimension 5: Social Disruption	Factor Loading	Mean Value
C2- There were too many newcomers.	0.778	1.99
C3- There were too many out-of-state cars.	0.758	1.95
Dimension 6: Crowdedness	Factor Loading	Mean Value
C8- Stores were overcrowded.	0.540	1.87
C9- Roads and highways became less safe with more traffic and machinery.	0.534	1.24

Table 13 2020 Survey Components

Dimension 1: Environmental Health and Awareness	**Factor Loading**	**Mean Value**
E13- We need better state environmental laws.	0.761	2.54
E4- My community became a less environmentally sound place.	0.759	2.29
E5- Our air was more polluted than before the oil boom.	0.756	2.66
E9- Water pollution was a problem.	0.753	2.81
E6- Soils were more polluted than before the oil boom.	0.751	2.43
E12- Plant and animal communities were endangered.	0.708	2.46
E8- There was too much trash and litter.	0.505	1.71
Dimension 2: Political Satisfaction	Factor Loading	Mean Value
D8- Our planning officials have sufficient training to address local housing problems.	0.846	2.84
D5- My community commissioners are keeping on top of all problems.	0.831	3.11
D6- My city mayor/councilors are keeping on top of all problems.	0.820	3.19
D7- We have a good land use plane for the county.	0.777	2.95
D12- Our state representatives are representing local interests well.	0.722	3.07
D10- Our local representatives in the North Dakota legislature are aware of local problems.	0.660	3.28
D9- Our law enforcement officials are able to handle problems that arise.	0.626	3.49
Dimension 3 – Quality of Community and Social Life	Factor Loading	Mean Value
C2- There were too many newcomers.	0.802	2.21
C3- There were too many out-of-state cars.	0.780	2.20
C10- There were more criminal activities.	0.636	1.45
C8- Stores were overcrowded.	0.625	2.23
C6- My community became less safe to live.	0.619	1.91
C12- Drugs & alcohol were becoming more serious problems.	0.574	1.54
Dimension 4 – Work/Economy	Factor Loading	Mean Value
B4- Financially, the oil boom was good for my family.	0.866	4.10
B5- I financially benefitted from the oil boom.	0.826	3.92
B6- I had relatives or friends who have benefitted from the oil boom	0.749	4.42
B3- Financially, the oil boom was good for my community.	0.631	4.26
C13- My quality of life improved.	0.570	3.24
Dimension 5 – Community Preparedness	Factor Loading	Mean Value
D4- My community was prepared for the influx of oil workers and companies.	0.806	1.92
C7- City services could handle increasing population.	0.698	2.54
Dimension 6 - Transportation Safety	Factor Loading	Mean Value
E11- Road conditions became worse than before the oil boom.	0.806	1.57
E10- There were many more heavy vehicle accidents.	0.576	1.57

4.6 Interviews

The interviews conducted were divided into different sections. The first two questions were on basic information about the interviewee like time spent in their community and their profession. The next section delt with the economic effects of the oil boom followed by a section on the community effects. Another section on some environmental effects along with various other questions on local government, traffic, etc. The last few questions focused on quality of life (QoL) in an oil boom but also what QoL meant to the interviewee. Only numbers were used in this section instead of names to protect the identity of the interviewees.

The first question delt with their personal economic situation in Williston, North Dakota. Here were the first questions: “Did the oil industry influence your economic situation?” I followed this up with other questions on unemployment and the economic situation during the oil slowdowns. Each of the interviewees answered in their own unique way. Interviewees 1 and 2 said the only way they were affected was by a higher wage, but interviewee 2 mentioned how this was just to combat the higher cost of living. Interviewee 3 mentioned how his salary was not affected by the oil boom, but he owned land with mineral rights which provided him wealth. Interviewee 4 did not indicate how the oil boom affected her career but mentioned that she owned a business and saw a lot of money coming in and out of it which improved her wealth. Interviewee 5 came back to Williston at the start of the oil field because she got a job in higher education. She said it was a high paying job and since Williston was having a hard time finding professionals, she was allowed to move up quickly and take positions that were usually for more experienced employees. The follow-up questions I asked allowed the interviewees to talk more about the economic situation in Williston.

I noticed a pattern of response between the interviewees about the economic situation of younger people, especially those who were professionals. Interviewee 1 summarized it by saying there were two different economies: those who worked in the oil industry and those who did not. The people who did not work in the oil industry had a tougher time during this boom according to interviewee 1. He mentioned young professionals like teachers and government workers struggled with the cost of living. Some of the interviewees like interviewee 3 and interviewee 5 mentioned the great amount of money coming into the community. This could support new projects and help bring in needed professionals. I also asked about the "busts" or when oil prices tank. I was corrected by at least 3 of the interviewees because they did not like the use of the word bust. Interviewee 3 described it as more of a slowdown since oil production in barrels dipped slightly. North Dakota was still producing massive amounts of oil. Another key aspect of the community economic situation in Williston was housing costs.

I asked each interviewee this question about the housing situation in Williston: "Could you explain the housing situation in your community and how that evolved?" I followed it up with this question: "Do you know anyone personally who was pushed out of your community by rising housing costs?" A few of the interviewees mentioned how their houses had increased dramatically in price compared to when they bought them. One of the interviewees mentioned they bought their house for $80,000 before the boom and sold it during the boom for $320,000. Two of the interviewees mentioned apartment rents also skyrocketing. This led them to talk about different federal and local programs to help service workers or professionals with housing costs. Four of the five participants expressed their concern for young professionals like doctors, police officers and teachers. They all mentioned the problem Williston had with attracting young professionals. They knew housing costs were too steep for workers and interviewee 5 talked

about the lack of quality of health care from this issue. Four of the five interviewees mentioned makeshift housing. The city of Williston allowed oil workers to live in a city park for a summer and use the YMCA showers to bathe. Interviewee 3 explained how many people had to live in motor homes or even their cars for extended periods of time. Interviewee 1 explained how the oil man camps helped alleviate the stress on the housing market in Williston. Another way people afforded housing was by moving back in with their parents according to interviewee 5. She mentioned that her and her brother's family had to move back in with their parents because of extreme housing costs. Housing costs influence a community's outside perception and create a difficult situation for many in the community. Just from this one question one could visualize the unique community and social situation the oil boom created.

Questions five and six asked about this unique social situation in Williston. I asked the interviewees if newcomers were welcomed into the community and how they made new acquaintances. Interviewees 1 and 2 indicated that newcomers needed to take initiative by starting families and going to church to fully integrate into the community. Interviewee 3 stated that Williston has always been an open armed community, but long-term residents were completely overwhelmed by the sheer population coming in. Interviewee 4 thought many children and their parents did not want to get involved at school since many only stayed for a short period of time. Interviewee 5 was the youngest person I interviewed and closest in age to most workers coming to Williston. She indicated that Facebook groups helped bring people together in Williston along with the new recreation center called the ARC. Every single interviewee indicated that they made many new acquaintances over the boom, but interviewees 3 and 5 agreed that Williston went from a town where everyone knew everyone to a bustling community filled with outsiders.

All these new people coming in raised the crime rate of Williston drastically and many people felt unsafe. I asked my interviewees what they felt about their own safety along with the crime situation in Williston. Here were the questions I asked: "Do you think your community was less safe to live in during the oil boom? Explain." Along with these series of questions: "Could you describe the crime situation during the boom? Drugs? Domestic violence? How did local law enforcement keep up with the increase in population?" Every single respondent tied crime to drugs and alcohol. They indicated that drug usage and selling had gone up in the area. Interviewee 3 indicated that he only saw crime rise with population and it was not drastic in any way. The other four respondents felt more uneasy about the situation unfolding in Williston. Four of the five interviewees brought up the closing of two strip clubs in Williston. Each interviewee who mentioned these strip clubs indicated that violence and crimes related to drugs and alcohol were high at these clubs along with other large bars. Interviewees 1, 2, and 4 mentioned the struggle local police had to control these strip clubs and bars since they needed constant surveillance. Interviewee 1 stated that Williston was "like the wild west," since he saw murders and other violent crime increase in the area. Interviewee 5 was the only person to mention sex crimes like prostitution and trafficking. She mentioned that some hotels were known for prostitution. Interviewee 3 indicated that many women felt unsafe to be outside in the evening. Sex crimes like this corroborate with the population coming into Williston which was 20–30-year-old men who wanted to spend money according to interviewee 3.

Local community services struggled throughout the boom. Keeping up with crime, road traffic, and infrastructure. The questions I asked related to local community services included: "Could city services handle the increase in population and traffic? Explain." and "Did local government handle the boom well in your opinion? Any suggestions for other communities

going through this?" The survey respondents all mentioned the improvement to the roads and the construction of the bypass when asked about city services. Interviewees 1 and 5 brought up the police force and how understaffed they were at times. Interviewee 5 also mentioned the fire department struggled to keep up with emergencies. Interviewees 1 and 4 discussed the schooling situation in Williston. Interviewee 4 was and still is a teacher in Williston and she discussed how the public school system struggled to handle the number of new kids. When asked about the local government and their performance every respondent applauded the local government. Interviewee 5 summarized their feelings well by saying, "they did their best and got us through it." Interviewee 3 commented on the government by saying it was reactive and Williston had to react quickly with few mistakes. Some suggestions were made by interviewees 2 and 3. Interviewee 2 suggested that future boomtowns must establish a good tax plan. He explained that Williston is a town built on sales tax because property taxes were difficult to collect due to many people renting or living in their RV. Interviewee 3 discussed how cities need to track their municipal assets like water, electricity, and materials to build roads or infrastructure. He also mentioned the importance of a solid land use plan when confronted with the situation of an oil boom of this magnitude. Interviewee 5 discussed a solution the City of Williston had for inexperienced professionals. According to her, Williston used tax money to fly in approved professionals in different areas like planning, education, and government. These professionals hosted workshops for Williston's workers and helped develop their skills. Local government also had to deal with environmental problems in Williston and the surrounding area.

I chose to only ask one question on an environmental indicator and that was trash and litter. I asked the interviewees this question: "Was there too much trash and litter?" I did this in part because it's difficult for respondents to talk about environmental indicators they cannot see

like air and water quality. They also cannot see the spills because they all lived in the city and mostly farmers saw the extent of oil and salt brine spills. Trash or litter was a visual way of understanding how residents treat their community. The respondents all indicated that trash and litter were worse during the start of the oil boom but they also all indicated that it has gotten better over time. All the respondents besides interviewee 2 mentioned community days where oil companies would host large scale trash pickup. Churches also held similar events. They discussed how this helped foster social interactions in the community and kept the community clean. Interviewee 3 even stated, "The problem of trash disappeared." Williston residents took pride in keeping their city clean.

The final part of my interviews involved questions on QoL. The first question asked, "Was your quality of life better during a bust or worse compared to a boom? Compare and explain." I received pushback from a view of the interviewees about the phrase oil bust because they thought of it as more of an oil slowdown. Interviewee 3 knew production was not going to cease but profits for oil companies would decline and people would get laid off. For the sake of my interviewees, I will call it a slowdown period instead of a bust. Interviewees 1 and 4 both thought their QoL was higher during the slowdown period since life was quieter. Interviewees 2 and 5 thought their QoL was higher in the height of the boom. Interviewee 2 liked the new variety of businesses in town, and he thought the boom kept younger people in the community. Interviewee 5 said her QoL was higher during the boom because of the amount of money she made, and the opportunities she was given in the job market. Interviewee 3 thought his QoL stayed the same throughout.

The other questions I asked the interviewees was, "What does having a good QoL to you mean in western North Dakota?" Each person answered in their own unique way. Interviewee 1

thought community interaction was important to his QoL, but he wants to know everyone in his community. He also thought environmental activities were important to his QoL like camping, fishing, and hunting. He ended the interview by showing his support for his community and said, "I still love Williston and never want to leave." Interviewee 3 had a similar philosophy on QoL except he liked the new people in the community. He said having outdoor activities was also important to his QoL. Interviewee 2 had a different mindset regarding QoL. He thought a great economy and having financial success was most important to QoL. Interviewee 5 had a similar philosophy to interviewee 2. She thought her career opportunities helped raise her QoL. She also thought the oil boom helped keep her in Williston and close to her family. She discussed how family and friends are the most important thing to her for improving her QoL. She also agreed with interviewee 3 and thought having new people and more things to do helped foster more community engagement. Interviewee 4 had a short and sweet way of describing what good QoL meant to her and that was, "Happy, healthy, and safe." These responses show five different attitudes towards QoL. They validate different results from the two surveys and contribute to the literature on oil boomtowns in North Dakota.

Chapter 5.

Discussion

5.1 Dimension and Indicator Comparison

A comparison between the two PCA results in 2012 and 2020 showed an improvement in perception of quality of life (QoL) in 2020 compared to the height of the boom in 2012. The conditions in 2012 were frantic and new boomtowns were reacting to the changes in their communities. Six dimensions were taken from each survey that reveal different areas of life that are affected by an oil boom. Each dimension was given a name that summarized the indicators within it. 2012 revealed six key dimensions of QoL including natural environment, political satisfaction, work/economy, safety/security, social disruption, and crowdedness. Social disruption included a resident's overall feeling of belonging within their community and how they feel toward newcomers in their community. 2020 had similar dimensions including environmental health/awareness, political satisfaction, quality of community and social life, work/economy, community preparedness, and transportation safety. Some indicators were included in different dimensions with different indicators. Other indicators were included in one year and left out of the other year indicating a greater perceived impact on QoL. A select number of dimensions were chosen from the PCA results which limits the number of indicators included, some indicators like housing costs were not included because it did not correlate well with the indicators included in the first six components. A discussion of each dimension and a comparison of similar dimensions between years was necessary to answer my research questions.

When limiting my component results in QoL dimensions, only indicators with a factor loading greater than 0.5 were included. This guarantees that each indicator within the dimensions

had a high correlation with that dimension and represents a part of a long-term community member's life. It also guaranteed that an indicator did not show up in two different dimensions.

The first dimension from both surveys covered different environmental effects. 2020 showed improved perception of environmental quality with slightly better mean values compared to 2020. People in 2012 were concerned about specific aspects of the environment. Water, air, soil, plants, and animal communities were a concern for long-term community members. This addresses two different key aspects of life in western North Dakota: agriculture and outdoor recreation. Before the oil boom in 2008, agriculture acted as the main economic driver in this region. Soil health is essential to farmers in the region and the impact of oil/salt brine spills has impacted the productivity of many farmers in western North Dakota. Salt brine is a specific new waste byproduct of fracking and brine spills and were often larger than oil spills in North Dakota and just as toxic to soil health (Lauer, 2016). These spills can also seep into the water supply and affect fish health. Many long-term community members like interviewee 1 embrace activities like fishing and hunting. Community members see the level of industry it takes to support oil extraction and know the environmental health and quality was not the same as before the boom. Improvements have been made over time from the height of the boom in 2012 and my interviewees mentioned a clean-up day in the springtime every year that has decreased the amount of trash and litter. The 2020 PCA analysis had environmental laws as the highest indicator and overall environmental soundness as the second highest according to the factor loading within the dimension. Many environmental regulations were passed in the 2010s including limiting well flaring (Office of Oil and Natural Gas, 2020). This suggests that overarching environmental indicators represent this dimension of QoL compared to singular aspects of the environment in 2012.

The second dimension for each survey represented long-term community members political satisfaction. This dimension represented perceived impact of authority figures in the region. Confidence with those in charge is important in oil boomtowns because of the planning involved to address larger needs in the community. Trustworthy local leaders can create a sense of community along with creating a sense of comfort for long-term community members who have seen their town change so much over a short period of time. Community members in western North Dakota like to see the physical changes that come from political leadership including roads, housing, tax distribution, safety, and education. Finding appropriate funding for each area of the community was up to these local political leaders as their community grew significantly. Indicators that ask about local leaders and their responsibilities could probably be combined into one singular indicator for future research.

Indicators in 2012 had a much lower QoL mean compared to 2020 in the political satisfaction dimension. Community leaders were dealing with the initial boom effects in 2012 and were most likely completely overwhelmed. QoL averages increased in 2020 partly because many long-term residents knew the situation was incredibly difficult for local leaders. When I asked the interviewees about local government many of them suggested that they did the best they could and reacted quickly to different problems in their community. The 2020 survey results indicate a good relationship between community members and their local politicians, city employees, and local land-use planners with positive QoL scores. Law enforcement capability (D9) improved significantly from 2012 to 2020. According to my interviews, new police officers were difficulty to find at the start of the boom because of high cost of living. This situation obviously improved because the 2020 respondents were much more satisfied with their local police and the security they provide.

The third dimension in 2012 was completely related to work and the economy of western North Dakota. Fernando and Cooley (2016) indicate that stakeholders working in the oil industry have a better QoL economically in oil boomtowns. Most of the participants in this study were not involved in the oil industry so this study provided a key insight into non-stakeholder perception. The third dimension in 2020 mostly had community and social QoL indicators but the fourth dimension in 2020 was completely related to work and the economy. This just means that work/economy took up more variance in the data set in 2012 compared to 2020. For the sake of consistency, the third dimension from 2012 was compared to the fourth dimension in 2020. The indicators within the work/economy dimension were the same in 2012 compared to 2020 and in the exact same order according to factor loading. 2012 mean scores were above average in this dimension but they improved even more in 2020. One of the interesting indicators included in the PCA was C13: My QoL improved. This indicator was most closely associated with work and the economy. This shows how QoL overall correlated highly with financial success. This indicator was still negatively perceived in 2012 at only 2.43 but improved in 2020 to 3.24. Long-term community members most likely struggled through the first portion of the boom as the cost of living skyrocketed. But those who stuck through it often saw new opportunities throughout the community including interviewee 4 who opened a successful business or interviewee 5 who was allowed to move up positions quickly in her career. The oil boom did not only bring oil jobs but also brought in new businesses with job opportunities not related to the oil field. This dimension summarizes how an oil boom can transform a small town into a city with many economic opportunities. Overall, the oil boom made western North Dakota a powerhouse economically and this benefitted many groups including some long-term community members.

A large part of this QoL research revolves around the quality of community and social life. As seen from figure 5 the population has significantly increased in the study area, especially in Williams and McKenzie counties. Referring to table 1, the average age of the population in the study has also been decreasing. The population also skewed towards male because of the intense physical demands of oil work. This is indicative to many boomtowns and to the original boomtown model. Long-term community members in both surveys felt like QoL in many community aspects had declined. Dimension 4, 5, and 6 in 2012, which represent safety/security, social disruption, and crowdedness respectively, all focus on different community issues. Dimension 4 was safety and security which deals with crime and the appropriate response to crime. Referring to figure 9, crime has increased tremendously, especially alcohol and drug-based crime. Obviously, a population increase will bring crime, but many long-term community members associate newcomers with crime. Dimension 5 in 2012 including two indicators that show a disdain toward the increasing population and a disdain toward the number of outsiders. Dimension 6 was another effect this new population brought to their community which was a lack of space or comfort. Long-term community members no longer saw someone they knew while shopping but instead saw outsiders crowd their stores. They were not used to intense bumper to bumper traffic.

Dimension 3 of the 2020 PCA results directly grouped crime related indicators with the overcrowding indictors, including “there were too many newcomers”, “there were too many out-of-state cars”, and “stores were overcrowded”. This indicates that long-term community members do associate crime with this new population. Crime-related indicators received negative mean scores in 2020 compared to 2012 while indicators related to population increase received better mean scores in 2020. Dimension 5 of 2020 included two indictors related to community

services' capability to handle the increasing population. Both indicators were not included in the 2012 PCA results. The below average mean scores indicate a negative reaction to the way their community handled this population. Dimension 6 of 2020 summarized traffic and safety on the road. Every single one of my interviewees described the traffic situation as horrifying or scary. Personal transportation is the preferred method of travel in North Dakota and road conditions can be scary as it is with extreme winter weather. Indicators related to traffic and road conditions had some of the lowest mean scores out of all the indicators.

The most important indicator held out of both PCA results was C1: Housing costs increased significantly. This directly impacted QoL in western North Dakota Boomtowns and this indicator had the lowest mean score in both surveys. It directly influences the cost of living and the ability to live in the community. Figure 6 shows the increase in median housing price in the study area. Williams and McKenzie Counties increased the most from just under 100 thousand in 2010 to over 250 thousand in 2020. Figure 7 shows how cost of living for renters in the study area increased dramatically from 2010 to 2020. High housing prices and an increased cost of living made it an easy decision to sell your house if you were a retired long-term community member. My interviewees indicated that younger professionals were scarce because of this increased cost of living. Attracting the appropriate medical professionals for the increasing population or number of teachers for the increasing student population or the number of police officers for increasing crime rates was difficult. An article back in 2012 in the Williston Herald highlighted the lack of health care professionals in Williston (Rapkalvis, 2012). New patients had to wait almost 3 months to be seen at the Craven-Hagen Clinic in Williston. Housing costs did not correlate well with other variables because they did not have much variance. Almost all respondents negatively rated the housing situation in their community in

both surveys. The housing costs indicator fell into component 10 for both PCA analyses. In 2012 housing costs increasing correlated most with schools being negatively affected by the oil boom. Both these conditions make it difficult to start a family in oil boomtowns. It is difficult to buy a house in oil boomtowns and your children go to a crowded school struggling to hire teachers. Ferando (2015) found that family experience was important to many western North Dakotans and quality schools was an important indicator for family experience. You must include a dimension of cost of living when analyzing QoL in an oil boomtown and housing costs would be a major indictor under cost of living.

The perception of QoL in western North Dakota has evolved significantly from 2012 to 2020. As communities adapt to the changes an oil boom brings, perceived QoL tends to improve economically and politically as community services caught up with demand and certain social indicators. Economic QoL was expected to improve because those who stayed until 2020 most likely saw the benefits of the oil boom whether it was in their life or someone else's. Politically, I expected many people to be more upset with those in charge, but it seemed to be the opposite in the surveys and in the interviews conducted. Many people knew it was a challenging scenario and they respected the work put in by government employees. The social indicators that improved from 2012 to 2020 were associated with social cohesion. North Dakotans who stayed in their community through the boom were more used to the new people the oil boom brings while people in 2012 were overwhelmed by the population and traffic increase.

Areas of QoL that tend to not improve or stay the same were safety/security and environmental health. All indicators related to crime and community safety decreased from 2012 to 2020. Some indicators related to crime were not included in either PCA results. Crime increased drastically during the oil boom, especially crimes related to drugs and alcohol if you

refer to figure 9. Long-term community members seem to have a worse reception of their community when it comes to safety and security that developed over the boom. Perceived environmental quality stayed stagnant from 2012 to 2020. Some indicators improved slightly while other indicators deteriorated slightly. Long-term community members perceive their community was negatively affected in 2012 and in some respects even more negatively affected in 2020.

Interviews in late 2022 revealed a more relaxed view toward changes brought about by unconventional oil extraction. Interviewees had adjusted to the change of pace and community services had caught with the demands oil extraction brought. The perception of environmental QoL improved and all interviewees mentioned a community day to pick up trash in Williston, ND. Most interviewees economically benefited from the oil boom in some way whether it be a new job opportunity, opening a business or an increase in pay. Their opinion of local leadership was favorable, and they all believed the City of Williston did their best to solve large problems due to unconventional oil extraction. Safety and security were important to interviewees and the increase in traffic and crime affected many long-term residents. Most interviewees thought Williston was a welcoming city, but it was hard to trust a transient workforce. For example, interviewee 4 explained how children and parents did not want to get involved with school events. Most long-term community members wanted new workers to assimilate into the community and start families. QoL values, or what they perceive as valuable to their life, of interviewees matched those of rural small communities (Fernando, 2015). Values included knowing everyone in the community, outdoor activities, going to community events, safety, a positive economic situation, and most importantly family and friends.

5.2 Contextualizing the Results

When contextualizing the results compared to other quality of life (QoL) research in oil boomtowns, my research fits a pattern for long-term community members. Fernando and Cooley (2016) investigated different clusters of society including oil workers, non-oil industry workers, senior citizens, and homeowners compared to renters. All these groups formed a community. Fernando and Cooley (2016) found that non-oil industry workers struggled financially but more high paying jobs were available across the community. Their findings correlated well with the results of this study because almost all agreed that housing costs were too high, but economic opportunities were plentiful. They also found that the social structure in place from before the boom had deteriorated. Long-term residents in this study felt like there were too many newcomers and this population increase coupled with an increasing crime rate fractured the community trust level. This study finds similar results to Fernando and Cooley's (2016) study on QoL: positive impacts toward economic QoL but negative impacts to social QoL like community cohesion and family-based values. This study added to their study by looking into more environmental indicators and more local political indicators.

Raycraft (2017) investigated attitudes and perceptions of residents in the Bakken and found significant QoL stressors related to traffic, infrastructure, and social cohesion. This study found low scores and attitudes towards these stressors as well. Long-term community members were not used to these fast-paced changes and the degradation of community social ties and infrastructure. Ruddell and Ortiz (2014) looked directly at crime and disorder in North Dakota boomtowns and their effect on QoL. Many of their indictors delt with safety and security and they found lower than average feelings of safety compared to Canadian statistics. They also found that citizens were most concerned about drugs and reckless/drunk driving (Ruddell and

Ortiz, 2014). The results of this study were similar because safety and security indictors in this study were extremely negative, and interviewees were mostly concerned about drugs and alcohol. Indictors related to crime in my study had a worse impact on QoL in 2020 compared to 2012 indicating a long-lasting effect toward community perception. This study connected a lot of social indicators and how they evolved over time. Newcomers became associated with "riff raff" because many long-term community members knew they were only there for short time and felt like they did not respect the community. The population spike and increased crime rate lowered the fragile sense of community safety within Bakken communities. My interviewees pointed out that those who did stay and raise families in the Bakken were accepted by community members. It seems like those who were transient were not trusted and those who participated in community events and committed to a family lifestyle became a trusted part of the community.

These shifts in community values and culture seem to have created a place-based identity issue. Most of my interviewees valued family experiences. The oil boom shifted the demographics toward more male individuals and a younger population. Many oil workers were transient meaning they usually left their family in another area of the country, or they were not looking to settle down and start a family in North Dakota. Along with the tremendous number of newcomers a wave of increasing crime came to western North Dakota. Crime has rarely been a large issue historically in North Dakota and long-term community members were forced to adjust. All these social changes affect place-based values for worse but also sometimes for the better. Interviewee 1 thought newcomers would be better accepted if they started a family, integrated their kids in school and participated in community events. He mentioned that at the start of the boom many people were only there for the money, but many people also stuck around because they realized North Dakota was a great place to start a family. Even though a lot of

things changed socially many long-term community members adjusted to the new socioeconomic system of the oil boomtown described by Fernando and Cooley (2016). Adam Mayer (2017) summarized how community bonds can be formed over time in boomtown communities through knowledge of how important the resource creating the boom is to economic success and betterment of QoL. A new social structure between long-term community members and newcomers was created around the economic success of oil extraction.

Environmental QoL and its connection to oil boomtowns with unconventional oil extraction has little to no literature. This study analyzed long-term community members' perceptions of how their community and the surrounding environment were affected. Residents were affected negatively by environmental variables, but improvements were made over time in Bakken communities. An oil boom brings stresses unto infrastructure and often the environment is taken for granted during the beginning of the boom. This contribution to oil boomtown literature will hopefully help future researchers craft new QoL indexes using the indicators in this study.

Negative results in certain social/community indicators along with negative results in environmental indicators contribute to a better understanding of the social disruption theory. The lack of a conceptual framework when referring to the social disruption hypothesis or boomtown impact model was glaring. It was difficult to guide this study without a conceptual framework for evaluating QoL perceptions in oil boomtowns. The social disruption hypothesis predicted a breakdown in social cohesion within a community along with stresses on community services for the sake of expansive economic growth due to energy extraction. The community loses its sense of cultural identity and informal social ties break down (Jacquet, 2014). A large part of western North Dakotans' identity lies within the outdoors and agriculture. Negative results for

environmental serenity and quality indicate another breakdown in long-term community members' attachment to western North Dakota. Many people in the 2012 survey were concerned about the increasing crime rate, increased cost of living, and environmental quality which led to poor results in political satisfaction.

Initially my results correspond with the social disruption hypothesis. Over time long-term residents become accustomed to these changes and their attitudes do change. A new form of social cohesion seems to emerge, but the perception of crime sticks. People in the boomtown communities may form a new sense of community with incoming workers. The population became younger and new cultures were introduced to the community. Still long-term community members were concerned about crime in their community. Environmental quality and road conditions started to get better, but accidents still happen. The interviews conducted in this study reveal that many people still love their hometown of Williston and some like seeing new faces and businesses. Social disruption hypothesis focuses heavily on the breakdown of social cohesion and the environment. The hypothesis also focuses on energy busts and how towns suffer immensely from a halt in extraction. The Bakken has oil reserves that will last years into the future and a culture has emerged in western North Dakota around the reliance on oil extraction. Slowdowns in extractions will come and go. It was local government's job to find new ways to expand economically and diversify their economic future.

Political satisfaction and its effect on QoL is a rarely researched topic. The improvements in political indicators from 2012 to 2020 were significant. People did not trust their local politicians and city officials in 2012 but local officials seemed to gain back some of this trust as infrastructure demands were slowly managed over time. This change in perception over the span of an oil boom is significant to the literature since it showed a distrust in local leadership, but an

eventual understanding of the situation policymakers were presented with. My interview data backed up the survey data. My interviewees felt bad for local officials, and a few summed up the situation by stating, “they did the best they could.” Long-term residents might also distrust local leadership because of the past boom in the 80s that led to an eventual bust. Political satisfaction and its effect on residents during an oil boom is an under-researched topic. Changes in political stance over an oil boom would be an interesting topic for future researchers.

5.3 Policy and Real-world Implications

Public policymakers in western North Dakota should evaluate these results when determining the future of their community plans. The North Dakota Legacy Fund was created in 2010 to tax the extraction of oil and natural gas. The fund was designed to preserve the legacy of North Dakota (North Dakota Retirement and Investing, 2019). The use of these funds could help retain cultural value in western North Dakota including investments in natural resources or cultural heritage sites. The North Dakota State government finally dove into the Legacy Fund dollars by beginning the construction of the Theodore Roosevelt presidential library. While this is in western North Dakota, it does not help preserve the cultural heritage of boomtown communities. Investment in social and community events could also attract tourism and help diversify the economics of western North Dakota past its reliance on agriculture and oil.

Community planners in new energy boomtowns should consider the trends found in this study. The stress put on local infrastructure and community services was a lot for western North Dakota. Interviewee 3, a civil engineer, provided some key feedback for city officials and planners. He thought new boomtowns had to investigate available municipal assets like water, construction materials, and electricity, as well as constraints. This makes road construction smoother, and helps planners implement a quick land use plan for industrial expansion. Planners

and civil engineers were burdened with handling tremendous city expansion. This study provided a change in perception over time for communities in western North Dakota. Other rural areas affected by unconventional oil extraction in the future will need these results when considering future community plans.

5.4 Limitations

The largest limitation to this study was the lack of ability to create a QoL index for oil boomtowns. A large majority of respondents were from Williston and there were not enough responses to rank different cities within North Dakota. Another limitation was the lack of models surrounding boomtowns and QoL. The social disruption hypothesis provided unconventional oil extraction effects on a community and how they change in a boom-bust cycle. Other researchers like Fernando and Cooley (2015) summarized QoL for different clusters of people in western North Dakota. This provided background on western North Dakotan's QoL values. Research around QoL and tourist destinations provided a few different indexes for places affected by influxes of people that disrupt the local culture and social cohesion. Future researchers should look to construct QoL indexes surrounding unconventional oil extraction.

Another limitation was the difference in surveys from 2012 to 2020. While each survey encompassed the perceptions of long-term community members at the time, the surveys were not the same people. A change over time with the same people in each survey would be great but the random sampling methods taken by the researchers should create an accurate array of perceptions for both surveys. The 2012 survey included people only from Williston, Watford City, and Stanley. The 2020 survey included more towns like New Town, Tioga, Killdeer, Alexander, etc. The first survey also had a large majority of men while the 2020 survey had a more even split between men and women. Some of these differences between surveys could be

up to random sampling while others like location of respondents was chosen by the researchers. The 2020 survey encompasses smaller agricultural communities but still focuses on the largest boomtowns like Williston and Watford City.

The number of interviews done in this study may be considered a limitation, but the interviews were designed to complement the survey data. The interviews complimented the PCA results by indicating which dimensions were most important to them and indicators were most important to them. The interviews were also designed to extract a narrative of experiences from the interviewee. Twenty to thirty interviews would have been necessary for a dissertation on oil boomtowns. The strength of the interviews conducted in this study was the interviewees themselves. All of them were respected community members who spent at least 20 years in the community. They also encompassed a wide range of careers that were not orientated with the oil field including electrics, higher education, elementary teacher, and an engineer.

Chapter 6

Conclusions

The first research question was, “How has quality of life changed over the oil production cycle of the last 15 years in western North Dakota boomtowns?” This question was answered. Certain dimensions improved like economic/work, social cohesion indicators, and political satisfaction. Other dimensions stayed stagnant like environmental and traffic indicators. The only dimension to deteriorate over time was safety and security. This dimension included crime indicators associated with drugs and alcohol, police force capability, and overall safety in the community. The PCA analysis placed important indicators into different dimensions of QoL. One of the most important results of this study was the way indicators were grouped together and which indictors correlated highly with each other. Changing correlations from 2012 to 2020 indicated different dimensions of concern in 2020. Indicators related to safety and security were now grouped in with community and social cohesion indicators. Transportation safety was a new dimension in 2020 that was only partly addressed with one indicator in 2012.

The second research question was, “Which dimensions of quality of life do long-term residents perceive as being most impacted by the oil boom in western North Dakota?” This question was also answered. Indicators that correlated most within each dimension typically represent that component/dimension the most. Interviewees also contributed to answering this research question. Interviewees valued safety, family, serenity, community activities, and a positive economic situation the most. Work and economic indicators counteract housing costs because of the overall positive scores those indicators received. Political satisfaction indicators correlated surprisingly well within dimensions 2 for both 2012 and 2020. Trust in leadership to handle the number of problems unconventional oil extraction can bring was significantly

important to long-term community members. Safety and security may have been one of the most important dimensions or group of indicators right next to economics/work. Many long-term community members like how quiet western North Dakota was before the boom and unconventional oil extraction brought a lot of noise to their city. Traffic was dangerous, drugs and alcohol crimes were skyrocketing, and the number of new people was disorientating for most North Dakotans. The combination of these conditions heightened safety and security concerns. Many of the community or social indicators included in this study in some way relate to community safety and security. Some dimensions included in the results represent different types of safety whether it be from crime or increased accidents on the road.

Overall, this study was a case study of QoL for long-term community members living in an oil boom. Western North Dakota was a rural place before the boom focused on agriculture and now it is a powerhouse in unconventional oil extraction. Long-term community members have seen the positive and the negative sides of the oil boom in western North Dakota. Other researchers have looked at the community as a whole or in different clusters but my research focused on change over time in QoL and only long-term community members know what it was like before the boom. The interviews conducted in this study contributed to the understanding of perceptions in current times after the COVID-19 pandemic. They also filled in gaps like how certain problems were fixed over time and what their community did to combat QoL issues. Results from the PCA analysis made more sense after conducting these interviews. All these results indicate that this study was significant in tracking QoL values over an oil boom in western North Dakota.

Bibliography

Anderson, Peggy A. 2014. Preserving Place: Williston, ND and The Use of the Community Capitals Framework for Boomtown Community Development. *Housing and Society* 41, no.2: 297-314.

Barkdull, Carenlee, Bret A. Weber, and Julia C. Geigle. 2016. Extractive Industries and Temporary Housing Policies: Man Camps in North Dakota's Oil Patch in *The Bakken Goes Boom: Oil and the Changing Geographies of Western North Dakota.* Edited by William R. Caraher, and Kyle Conway. University of North Dakota: The Digital Press. 199-224.

Becker, Karin L. 2016. The Paradox of Plenty: Blessings and Curses in the Oil Patch in *The Bakken Goes Boom: Oil and the Changing Geographies of Western North Dakota.* Edited by William R. Caraher, and Kyle Conway. University of North Dakota: The Digital Press.

Burin, Nikki Berg. 2016. Public Discourse on the Rise and Regulation of the Illicit Sex Trade During North Dakota's Economic Booms in *The Bakken Goes Boom: Oil and the Changing Geographies of Western North Dakota.* Edited by William R. Caraher, and Kyle Conway. University of North Dakota: The Digital Press. 117-128.

Caraher, William R. 2016. The Archaeology of Man Camps: Contingency, Periphery, and Late Capitalism in *The Bakken Goes Boom: Oil and the Changing Geographies of Western North Dakota.* Edited by William R. Caraher, and Kyle Conway. University of North Dakota: The Digital Press. 181-197.

Caraher, William R., and Kyle Conway. 2016. *The Bakken Goes Boom: Oil and the Changing Geographies of Western North Dakota*. University of North Dakota: The Digital Press.

Carlson, Alexander, and Enru Wang. 2020. *Life in Boomtowns: A Survey of Long-Term Residents' Perceptions of Oil Boom and Bust in Western North Dakota.* University of North Dakota: Department of Geography.

Centers for Disease Control and Prevention. 2021. *Health-Related Quality of Life.* https://www.cdc.gov/hrqol/index.htm?msclkid=354cb0b1b6ea11eca4cb9b7167180a81.

Chapman, Rachel, Paul Plummer, and Matthew Tonts. 2015. The Resource Boom and Socio-Economic Well-Being in Australian Resource Towns: A Temporal and Spatial Analysis. *Urban Geography* 36, no. 5: 629-53.

Conway, Kyle. 2016. Notes from the Global Hinterlands: What It Feels Like To Be Global In North Dakota in *The Bakken Goes Boom: Oil and the Changing Geographies of Western North Dakota.* Edited by William R. Caraher, and Kyle Conway. University of North Dakota: The Digital Press. 31-49.

Kyle Conway. 2020. Sixty Years of Boom and Bust: The Impact of Oil in North Dakota, 1958-2018. University of North Dakota: The Digital Press.

Ellis, Colter, Gene L. Theodori, Peggy Petrzelka, Douglas Jackson-Smith, and A.E. Luloff. 2016. Unconventional risks: The experience of acute energy development in the Eagle Ford Shale. *Energy Research and Social Science* 20: 91-98.

Fernando, Felix N. 2015. An Oil Boom's Effect on Quality of Life (Qol): Lessons from Western North Dakota. *Applied Research Quality of Life*: 1-33.

Fernando, Felix N., and Dennis R. Cooley. 2016. Attitudes toward Shale Oil Development in Western North Dakota: The Role of Place Based Community Values in Attitude Formation. *Journal of Rural Studies* 46: 132-46.

Fernando, Felix N., and Dennis R. Cooley. 2016. Socioeconomic System of the Oil Boom and

Rural Community Development in Western North Dakota. *Rural Sociology* 81, no. 3: 407-44.

Gilmore, John S. 1976. Boom Towns May Hinder Energy Resource Development. *Science* 191, no. 4227: 535-540.

Grubert, Emily. 2018. The Eagle Ford and Bakken Shale Regions of the United States: A Comparative Case Study. *The Extractive Industries and Society* 5: 570-80.

Hague, Cliff, and Paul Jenkins. 2005. *Place Identity, Participation, and Planning.* London: Routledge.

Hay, Iain, and Meghan Cope. 2021. *Qualitative Research Methods in Human Geography*.

Jacobsen, Grant D., and Dominic P. Parker. 2016. The Economic Aftermath of Resource Booms: Evidence from Boomtowns in the American West. *The Economic Journal* 126, 1092-1128.

Laerd Statistics. How to Perform a Principal Component Analysis (PCA) in SPSS Statistics. 2018. https://statistics.laerd.com/spss-tutorials/principal-components-analysis-pca-using-spss-statistic.php.

Jacquet, Jeffrey B., and David L. Kay. 2014. The Unconventional Boomtown: Updating the Impact Model to Fit New Spatial and Temporal Scales. *Journal of Rural and Community Development* 9, no. 1: 1-23.

Jayasundara, Dheeshana, Elizabeth Legerski, and Fran Danis. 2018. The Impact of Oil Development on Sexual Assault in the Bakken." *Family & Intimate Partner Violence Quarterly* 10(4): 63-72.

Jeon, M. M., Kang, M. M., & Desmarais, E. (2016). Residents' perceived quality of life in a cultural-heritage tourism destination. *Applied Research in Quality of life, 11*(1), 105-

123.

Junod, Anne N., Jeffrey B. Jacquet, Felix Fernando, and Lynette Flage. 2017. Life in the Goldilocks Zone: Perceptions of Place Disruption on the Periphery of the Bakken Shale. *Society and Natural Resources*: 1-18.

Keles, Rusen. 2012. The Quality of Life and the Environment. *Social and Behavioral Sciences* 25: 23-32.

Khan, Muhammed Imran. 2017. Falling Oil Prices: Causes, Consequences and Policy Implications. *Journal of Petroleum Science and Engineering* 149: 409-27.

Langton, Marcia, and Odette Mazel. 2008. Poverty in the Midst of Plenty: Aboriginal People, the "Resource Curse" and Australia's Mining Boom. *Journal of Energy and Natural Resources* 26: 31-65.

Lauer, Nancy E., Jennifer S. Harkness, and Avner Vengosh. 2016. Brine Spills Associated with Unconventional Oil Development in North Dakota. *Environmental Science and Technology* 50: 5389-5397.

Legerski, Elizabeth M., and Laura C. Hand. 2020. "We're keeping everything together with Band-Aids": A Case Study of Care Work and Family Violence During a US Oil Boom. *International Journal of Care and Caring* 4(3): 395-411.

Liang, Z. X., & Hui, T. K. (2016). Residents' quality of life and attitudes toward tourism development in China. *Tourism Management*, *57*, 56-67.

Liburd, J. J., Benckendorff, P., and Carlsen, J. (2012). Tourism and quality-of-life: how does tourism measure up?. *Handbook of tourism and quality-of-life research*, 105-132.

Mason, James. 2012. Oil Production Potential of the North Dakota Bakken. *Oil and Gas*: 1-12.

Mayer, Adam. 2017. Quality of Life and Unconventional Oil and Gas Development: Towards A Comprehensive Impact Model for Host Communities. *The Extractive Industries and Society* 4: 923-30.

McCollum, John. 2020. Extraction, class, and consciousness: A case study of unionization in the Bakken oil shale region. *Journal of Labor and Society* 23: 531-549.

Measham, Thomas G., Andrea Walton, Paul Graham, and David A. Fleming-Muños. 2019. Living with Resource Booms and Busts: Employment Scenarios and Resilience to Unconventional Gas Cyclical Effects in Australia. *Energy and Social Science* 56:1-11.

North Dakota Department of Mineral Resources. 2020. Annual Oil and Gas Production. https://www.dmr.nd.gov/oilgas/stats/annualprod.pdf.

North Dakota Retirement and Investing. 2019. Legacy Fund. https://www.rio.nd.gov/legacy-fund.

North Dakota State Government. 2022. North Dakota Crime Statistics. https://crimestats.nd.gov/tops.

O'Connor, Christopher D. 2017. Oil, Crime, and Disorder: A Methodological Examination of the Oil Boom's Impact in North Dakota. *Deviant Behavior* 38, no. 4: 477-91.

Peterson, Del, and Ali Rahim Taleqani. 2018. The Impact of Oil Boom and Bust Cycles on Western North Dakota: 1-23.

Rahman, Tauhidur, Ron C. Mittelhammer, and Philip Wandscheider. 2005. Measuring the Quality of Life across Countries: A Sensitivity Analysis of Well-Being Indices. *World Institute for Development Economics Research*: 1-32.

Raycroft, Mary D. 2017. Boomtown Attitudes and Perceptions Non-Renewable Energy Extraction Regions: North Dakota, U.S.A., Oil Shale and Alberta, Canada, Oil Sands."

University of Cincinnati.

Reed, Ann. 2016. Unpackaging Boomtown Tropes: Insider/Outsider Dynamics in North Dakota's Oil Patch in in *The Bakken Goes Boom: Oil and the Changing Geographies of Western North Dakota.* Edited by William R. Caraher, and Kyle Conway. University of North Dakota: The Digital Press.

Ruddell, Rick, and Natalie R. Ortiz. 2014. Boomtown Blues: Long-Term Community Perceptions of Crime and Disorder. *Southern Criminal Justice Association*: 1-18.

Ruddell, Rick. 2017. *Oil, Gas, and Crime: The Darkside of the Boomtown.* New York: Palgrave Macmillan.

Rundquist, Bradley C., Devon A. Hansen, Enru Wang, and Stanley D. Brunn. 2012. Perceptions of the recent oil boom among long-term residents of Williston, Stanley, and Watford City, North Dakota. University of North Dakota: Department of Geography.

Rundquist, Bradley C., and Gregory Vandeberg. 2018. The Geographic Setting of the Bakken Oil Shale Play in *Sixty Year of Boom and Bust: The Impact of Oil in North Dakota. 1958-2018.* Edited by Kyle Conway. University of North Dakota: The Digital Press. 67-100.

Rupkalvis, David. 2012. Shortage of Doctors could be ND Crisis. *The Williston Herald.* https://www.willistonherald.com/news/shortage-of-doctors-could-be-nd-crisis/article_b95ba570-3d63-11e2-9ef8-0019bb2963f4.html.

Schafft, Kai A., Kathryn Brasier, and Arielle Hesse. 2019. Reconceptualizing Rapid Energy Resource Development and Its Impacts: Thinking Regionally, Spatially and Intersectionally. *Journal of Rural Studies* 68: 296-305.

Tan, Huimin, Jianhua Xu, and Gabrielle Wong-Parodi. 2019. The Politics of Asian Fracking: Public Risk Perceptions Towards Shale Gas development in China. *Research & Social*

Science 54: 46-55.

U.S. Census Bureau. 2000. Profile of General Demographic Characteristics: 2000 (DP1). https://data.census.gov/table?q=All+Counties+within+North+Dakota+2000&tid=DECENNIALDPSF42000.DP1.

U.S. Census Bureau. 2019. Annual Estimates of Resident Population: April 1, 2010, to July 1, 2019. https://data.census.gov/table?q=All+Counties+within+North+Dakota&tid=PEPPOP2019.PEPANNRES.

U.S. Census Bureau. 2020. ACS Age and Sex (S0101). https://data.census.gov/table?q=age+north+dakota+counties&tid=ACSST5Y2018.S0101.

U.S. Census Bureau. 2020. ACS Demographic and Housing Estimate (DP05). https://data.census.gov/table?q=All+Counties+within+North+Dakota&tid=ACSDP5Y2020.DP05.

U.S. Census Bureau. 2020. ACS Financial Characteristics (S2503). https://data.census.gov/table?q=north+dakota+counties+housing&tid=ACSST5Y2020.S2503.

U.S. Census Bureau. 2020. ACS Median Value (B25077). https://data.census.gov/table?q=median+housing+north+dakota+counties&tid=ACSDT5Y2020.B25077.

U.S. Department of Energy: Office of Oil and Natural Gas. 2020. North Dakota Natural Gas Flaring and Venting Regulations. fossil.energy.gov.

U.S. Energy Information Administration. 2022. U.S. Crude Oil First Purchase Price. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=f000000__3&f=m.

Weber, Bret A., Julia Geigle, and Carenlee Barkdull. 2014. Rural North Dakota's Oil Boom and Its Impact on Social Services." *National Association of Social Workers*: 62-71.

Wilkinson, Kenneth P., James G. Thompson, Robert R. Reynolds, Jr., and Lawrence M. Ostresh. 1982. Local Social Disruption and Western Energy Development: A Critical Review. *The Pacific Sociological Review* 25 (3): 275-296.

Woo, E., Uysal, M., & Sirgy, M. J. (2018). Tourism impact and stakeholders' quality of life. *Journal of Hospitality & Tourism Research*, *42*(2), 260-286.

Woodworth, Max D. 2018. Finding a Place for Boomtowns in Energy Geographies. *Area* 59: 307-14.

Wright, Rosemary, Richard D. Muma, and Teresa S. Radebaugh. 2016. Perceptions of Risk and Reward of Rapid Energy Exploration in Rural Kansas: Are Older Adults Different? *Journal of Rural Social Sciences* 31, no. 2: 107-29.

Appendices

Appendices

A. Interview Questions

Number	Question
1	What is your occupation and the city you reside in?
2	How long have you been a member of your community?
3	Did the oil industry influence your economic situation? Was unemployment a problem in your community during the oil boom? How about the bust?
4	Could you explain the housing situation in your community and how that evolved? Do you know anyone personally who was pushed out of your community by rising housing costs?
5	Were the newcomers welcomed in your community? How?
6	Did you make any new acquaintance with new community members?
7	Do you think your community was less safe to live in during the oil boom? Explain.
8	Could city services handle the increase in population and traffic? Explain.
9	Roads and highways became dangerous to travel on. Do you think accidents increased?
10	Could you describe the crime situation during the boom? Drugs? Domestic violence? How did local law enforcement keep up with the increase in population?
11	Was there too much trash and litter?
12	Did local government handle the boom well in your opinion? Any suggestions for other communities going through this?
13	Was your quality of life better during a bust or worse compared to a boom? Compare and explain.
14	What does having a good quality of life to you mean in western North Dakota? For example - community, social experiences, family experience, environmental satisfaction like clean air, parks, and outdoor activities, work and career satisfaction, and political and government satisfaction.

B. 2012 PCA Component Matrix

	Component										
	1	2	3	4	5	6	7	8	9	10	11
E6	.666		-.492								
E5	.659		-.435								
E12	.636		-.485								
C2	.631				.345	-.377					
D6	.629			-.530							
D9	.629			-.317							
B3	.629	-.311		.310							
D7	.606			-.393							
C3	.594		.313		.325	-.356					
D5	.572			-.496							
C13	.567										
C6	.565										
E4	.563	.302									
D12	.559			-.357							
D8	.557			-.368							
E9	.554		-.533								
D10	.552			-.372							
C7	.550										
C11	.532		.415								
B4	.529	-.472		.362							
C10	.498	.339	.441						-.350		
E8	.483				-.405	.385					
C8	.470									.312	
E13	.469		-.425								
E11	.436				-.309	.378			.410		
D13	.433									.390	
C12	.433		.422				-.325		-.405		
E10	.380	.369									
C17		.570						.312			
B6		-.523		.334							
B5	.395	-.477		.419							
C9	.418	.459	.330								.323
D1		.434					.374				
C5	.317				.437						
C4	.352	-.320			.403						.332

B7					.325	.446		.371		.359	
C1		.358					.483	.309		-.405	
D4	.388						.422				
C16	.458						-.308	.546			
C15	.307					-.362		.403	.390		
Extraction Method: Principal Component Analysis.											
a. 11 components extracted.											

C. 2020 PCA Component Matrix

	Component									
	1	2	3	4	5	6	7	8	9	10
E4	.754									
E9	.726			-.350						
E12	.689									
C3	.658						-.368			
E6	.649			-.381						
E5	.640			-.347						
C10	.622		.318							
C2	.614						-.440			
E13	.608		-.320							
E8	.588									
C11	.561						.389			
C6	.561									
C13	.559		-.336		.358					
C12	.536	-.364							-.325	
C16	.528									
C9	.517		.355							
B3	.510		-.317							
E10	.510						.315			
D1	.499					-.376		.340		
C17	.489							-.341		
E11	.423								.381	-.414
C15	.418				-.389					
C8	.382			.308						
D8	.452	.629	.377							
D12	.409	.622								
D10	.369	.590								.311
D6	.489	.589	.314							
D7	.484	.566	.320							
D5	.548	.558	.321							
D9	.453	.475								
B4	.491		-.559	.401						
B5	.434		-.533	.374						
B6	.407		-.486	.306						
D4	.318				.645					
C7	.398				.562					

C4						.530		.457		
C5				-.329		.523				
D13	.404					-.494		.347		
B7								-.350	.324	
C1			.358							.429
Extraction Method: Principal Component Analysis.										
a. 10 components extracted.										

D. 2012 PCA Rotated Component Matrix

	Component										
	1	2	3	4	5	6	7	8	9	10	11
E6	.836										
E5	.804										
E12	.801										
E9	.766										
E13	.714									.313	
E4	.668										
D6		.829									
D5		.811									
D7		.708									
D8		.704									
D9		.691									
D12		.499						.463			
D10		.482						.478			
B4			.829								
B5			.800								
B6			.677						-.319		
B3			.640		.333						
C13			.591								
C12				.805							
C10				.768							
C11		.340		.668							
C2					.778						
C3					.758						
C5					.424					-.330	
C8						.540					
C9				.343		.534			.344		
E10	.300					.480					
C7		.434				.466					
C6				.326		.432					
C4						.426		.329		-.312	
E11							.812				
E8							.757				
B7								.816			
C1									.787		
C17									.689		

D1										.623	
D13								.338		.500	
D4		.313								.461	
C15											.737
C16											.624
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]											
a. Rotation converged in 17 iterations.											

E. 2020 PCA Rotated Component Matrix

	Component									
	1	2	3	4	5	6	7	8	9	10
E13	.761									
E4	.759									
E5	.756									
E9	.753									
E6	.751									
E12	.708									
E8	.505									
C16	.434		.321	.338						
D8		.846								
D5		.831								
D6		.820								
D7		.777								
D12		.722								
D10		.660								
D9		.626								
C2			.802							
C3			.780							
C10			.636							
C8			.625							
C6			.619			.319				
C12	.385		.574							
C9			.477		.342	.316				
C17	.335		.389			.302				.316
C15			.354							
B4				.866						
B5				.826						
B6				.749						
B3				.631						
C13				.570	.321					
D4					.806					
C7					.698					
E11						.806				
E10	.385					.576				
D13							.727			
D1	.350						.612			

C4								.839		
C5							-.351	.468		
B7									.652	
C11	.388		.310						-.466	
C1										.675
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]										
a. Rotation converged in 9 iterations.										