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The "Boom" and "Bust" Patterns of Communities within the Energy Rich Region of West Virginia: A Case Study of Moundsville

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The "Boom" and "Bust" Patterns of Communities within the Energy Rich Region of West Virginia: A Case Study of Moundsville

Brandon S. Kiger

Thesis submitted to the
Davis College of Agriculture, Natural Resources, and Design
at West Virginia University
in partial fulfillment of the requirements
for the degree of

Master of Science
in
Design and Merchandising

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School of Design and Community Development

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Abstract

The "Boom" and "Bust" Patterns of Communities within the Energy Rich Region of West Virginia: A Case Study of Moundsville

Brandon S. Kiger

The increasing worldwide demand for energy will provide Energy Rich Regions (ERRs) the opportunity to increase their wealth and quality of living. However, a reoccurring pattern of boom and bust cycles in ERRs suggests the need for more sustainable development strategies.

A mixed methods approach (case study) is employed to explore the "wicked human problems" occurring in one community, Moundsville, WV and to discover development patterns that might inform sustainable development strategies for the future.

This study explores briefly the distant past development patterns, and in greater detail the pre-boom and most current boom in natural gas. First, data will be derived from a conceptual "Energy Rich Region Template" that explores the sustainability of development from the inclusive wealth forms of natural, human, and physical capital. The qualitative data analysis software (MAXQDA) is used to systematically collect and organize data and information into a community-wide knowledge base (specifically seven years of city council minutes).

This framework can assist future research dedicated to similar cases. Furthermore, this case may support communities and or policymakers in the development of a programming guide for converting the natural capital into other reproducible capital forms, thus avoiding the development cycle of boom and bust.

Dedication

I would like to dedicate my thesis to first and foremost my wife, Deepa. Additionally, I would especially like to thank my mom and family who have been my 'cheering squad' throughout my life. This has been a long journey and my wife and family have been a source of encouragement all along the way. There have been so many opportunities where I could have given up. There were many challenges throughout my younger years beginning with the loss of my dad at age three. I know my dad would be proud of me. More recently, it would have been easy to walk away from this research process while moving out-of-state to Colorado, starting a new job, and helping my wife start her own business. I am extremely grateful for having a loving and supportive wife and family, and a Mom who raised me well! Overcoming these challenges has made life more fulfilling and has in turn made me a stronger person with the help from friends and family.

Acknowledgements

I am profoundly grateful for the guidance, expertise, and 'push' from my lead chair Dr. Ghadimi. He has been there for me from the very beginning and I will never forget one of his first lectures where he introduced this concept of "Boom and Bust" and allowed me to explore sustainable development differently. Furthermore, he has given me opportunities and challenges that have greatly enhanced my research skills which ultimately led to my current job at the National Renewable Energy Laboratory. Thank you!

And because this has been a long process, there have been other committee members who I know wish they could have seen my thesis to the end, but did assist me at the beginning of my research and gave me opportunities to increase my desire for learning and taught me to remain curious—thank you Dr. Mcfall and Dr. Burnett.

More recently, Dr. Haddox joined the committee who has always been a source of inspiration and support. I admire his willingness to help others and his love and skill for teaching. I'll never forget that it was he who went out of his way to meet with me and discuss my potential future academic career and interests. Thank you for opening that door.

Finally, I would like to thank Dr. Odell for reaching out to Dr. Blythe to become a part of my committee. I am extremely grateful for her to fill in at the last minute and provide me with helpful comments and feedback. Dr. Odell kept the ball moving. He is a great leader and listener, and has always gone out of his way to meet with grad students. In my opinion, he has seemingly managed the change and transformation of our department with ease. I think the School of Design and Community Development has an even brighter future because of him.

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Chapter I

Introduction

Problem Statement

With the demand for energy to increase, Energy Rich Regions (ERRs) worldwide have the opportunity to increase their wealth and improve the quality of life of their residents. However, a reoccurring pattern of boom and bust in these regions suggests the need for more sustainable development at the regional and community levels. This study examines one such region to discover patterns that might inform more sustainable development strategies for the future.

The Appalachia region is the birthplace of the first oil boom in the United States. Waples (2005) describes this boom, stating "the population of Titusville, Pennsylvania shot up almost overnight to approximately 10,000 people and land prices skyrocketed" (p. 16), after Col. Edwin Drake's success in drilling for oil on August 28, 1859. Sadly, fast growth is often not sustainable. Literature suggests resource abundant economies, particularly those endowed with exhaustible resources, tend to have comparatively slower economic growth and have poor outcomes of development (Sachs & Warner, 1995; Auty, 1993). This phenomenon is referred to as the 'natural resource curse' by many economists. Nobel Prize winning economist Joseph Stiglitz observed, "resource-rich countries often do not pursue sustainable growth strategies. They fail to recognize that if they do not reinvest their resource wealth into productive investments above ground, they are actually becoming poorer" (Charleston Gazette, 2012).

The West Virginia Center on Budget and Policy (2012), suggests a path by enacting an economic diversification trust fund, (West Virginia Future Fund—SB 461), for turning the finite natural capital into a sustainable wealth for West Virginia. This would take a portion of the

severance taxes from the extraction of resources and place money into a permanent trust fund.

This solution seems simple; however, the support for such change does not seem sufficient.

Although the Governor, Earl Ray Tomblin, finally signed SB 461 on March 20th, 2014 into law,

it took several years of fortitude and leadership by the state's Senate President Jeff Kessler (D-

Marshall) to promulgate the final law which had been greatly weakened by the house (Figure 1).
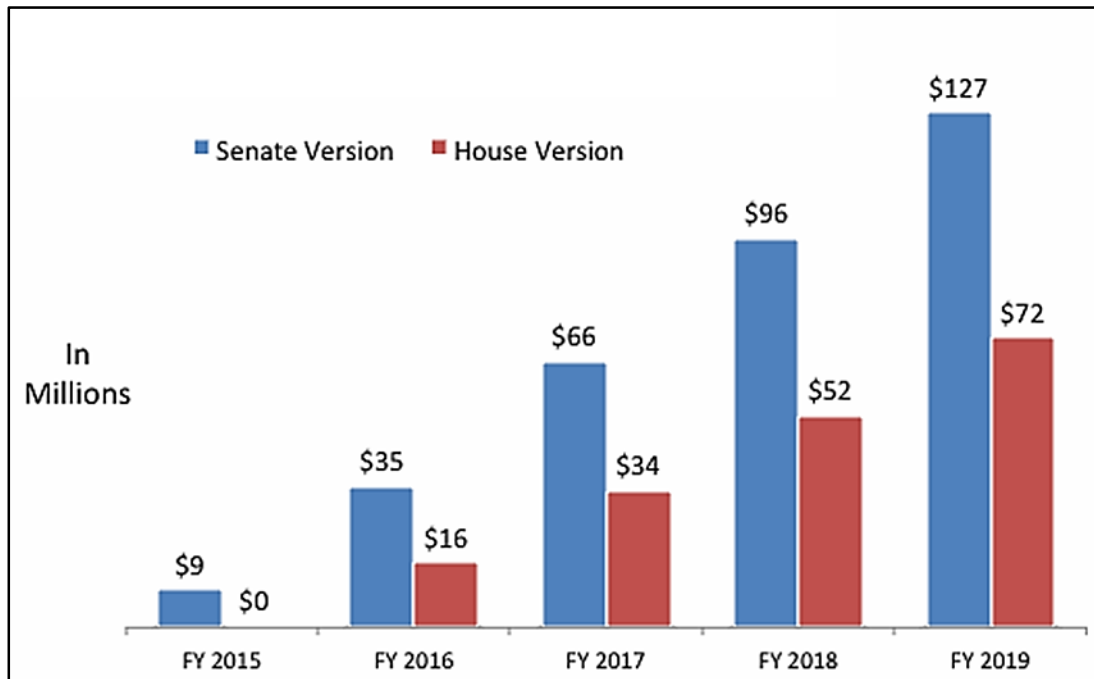
Figure 1. Estimated Difference in West Virginia Future Fund Versions by the West Virginia
Department of Revenue. Note: Assumes 7.5% annual investment rate of return. Retrieved from
http://www.wvpolicy.org/what-did-the-house-do-to-the-future-fund.

Perhaps this recent change in policy is the result of increasing pressure on politicians to

see more actions and protections for future generations in the aftermath of the January 9th, 2014

Elk River chemical spill—where an estimated 10,000 gallons of the coal cleaning chemical

MCHM contaminated the water supply for approximately 300,000 residents. Although this

tragedy is not necessarily the direct result of choosing an energy system dependent primarily on

finite resources, it is but one example illustrating the indirect or unforeseen externalities

associated with this type of developmental pattern. Nevertheless, the problem of the natural

resource curse could not be more important and addressing such challenges may involve a 'bottom-up' response from the human-will to intervene at these community and regional scales.

The ERR of West Virginia exhibit a diverse and extensive prior pattern of boom and bust in timber, coal, oil, and natural gas. The effects from previous busts manifest in a decaying environment, a diminished quality of life, and a stagnant economy in the region today. Usually, money and politics drive all decisions, and energy is no exception. However, other contributing factors driving this rapid development of resources are increasing globalization, population, and technology. The latter really applies to the increasing mechanization of natural resource extraction, specifically coal, during the 1970's, and more recently in the case of Moundsville, the ability to extract unconventional shale oil and gas. What makes the most recent boom noteworthy are the technologies of hydraulic fracturing and horizontal drilling. "Although these technologies are not new, they have recently initiated the rapid production of the unconventional deposits of oil and gas in shale formations with little or no recent presence of the oil and/or gas" (Court, Jackson, & White, p. 99, 2012).

Many stakeholders claim that the emerging gas industry will be great for everyone, resulting in increasing job growth, higher wages, cheaper energy bills, increasing energy independence, increasing wealth for property owners, and a less carbon intensive energy source (Considine, Watson, & Blumsack, 2010; American Gas Association, 2013; HIS Global Insight, 2009; NPR, 2013; & PBS Montana, 2012). However, other key players decry the externalities associated with the current boom in natural gas, i.e., unplanned growth resulting in increased pressure on infrastructure and the built environment; water, soil, and air contamination; increasing rent; increasing crime rates; increasing alcohol and drug use; increasing prostitution; increasing drop-out rates, and even more recently an increasing frequency of earthquakes (White,

2012; Court, Jackson, & White, 2012; Kinnaman, 2011; PBS Montana, 2012; Weinstein & Partridge, 2011; USGS, 2011). These contrasting perspectives reveal only a fraction of the 'wicked problems' existing at the community and national levels alike.

The idea of 'wicked problems' as defined by Rittel & Webber (1973), are the opposite of the linear 'tame problems' which most scientists and engineers focus. Tame problems are "definable and separable and may have solutions that are findable" (p. 160). With tame problems, cause and effect relationships may be generalized. "The problems (wicked problems) of governmental planning—and especially those of social or policy planning—are ill-defined; and they rely upon elusive political judgment for resolution" (Rittel & Webber, p.160). Indeed, researchers widely agree there is no existing panacea for solving a wicked problem, nor could there ever be. "Here the aim is not to find the truth, but to improve some characteristics of the world where people live" (Rittel & Webber, 1973, p.167). For change to occur, greater understanding must inform the human-will of the stakeholders. Only then might self-interests align in a mutual consensus between all parties.

The natural wealth flowing from the region today may or may not yield enhanced quality of living for the communities involved in the extraction of these finite resources. If previous patterns of coal production in the region are any indicator of what the future may hold for the current natural gas boom, the conclusion to this story has been written, and we may assume the development pattern of boom and bust will continue. For positive change to occur, human-will must be engaged in exercising many possible solutions for improving human well-being. There remains an option to break this vicious boom and bust cycle, and convert the natural capital into other reproducible capital forms that could produce a stream of income in the future if community leaders can summon the will to do so.

Objectives of the Study

   The purpose of this study is to explore historical choices that might be altered in some

way in future designs to vanquish the natural resource curse. Currently, Moundsville (Marshall

County) and the Appalachia region are in the "take off" stage (Figure 2). Before development of

the finite resource begins in the 'pre-resource stage', a more proactive response to this energy

system should consider this stage as a priority. A community that recognizes and integrates these

different resource development stages into the planning process is more likely to have a positive

post-resource outcome.
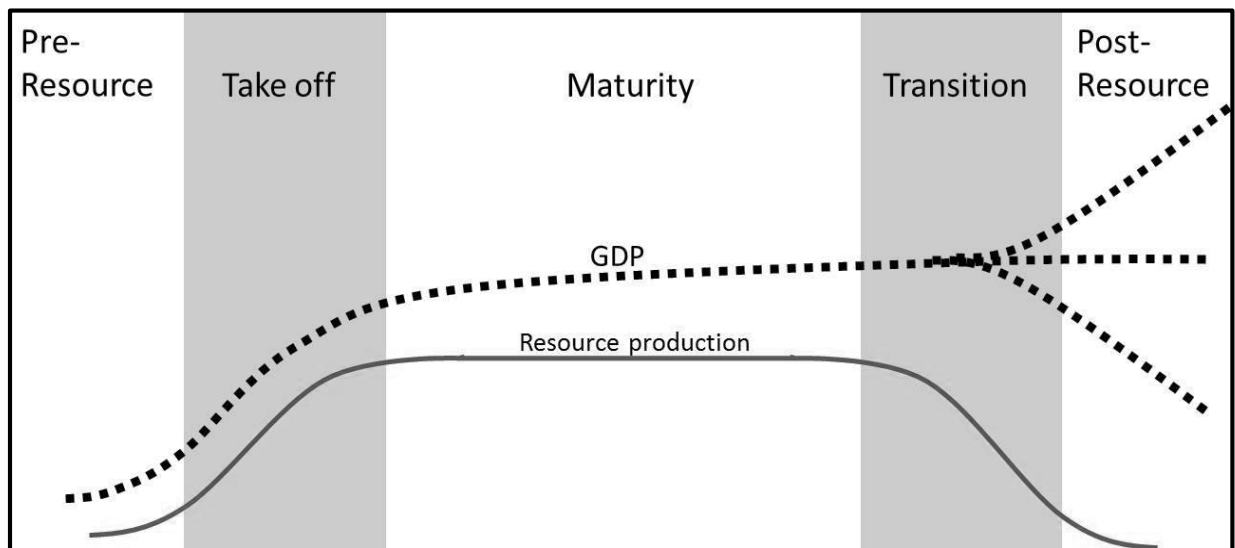
Figure 2. Stages of Resource Depletion Model. Retrieved from Ghadimi (2010).

   A path to a more positive post-resource outcome is presented in Figure 3, which presents

a conceptual model for engaging the planning process to extract the resources responsibly, where

(N) represents the finite resources (natural capital), and (K and H) represents the reproducible

capital forms of human capital and physical capital. "The most important development challenge

for ERRs is to convert valuable, but exhaustible natural capital into reproducible capital in

pursuit of sustainable economic development that is also environmentally sustainable" (Ghadimi,

2010).
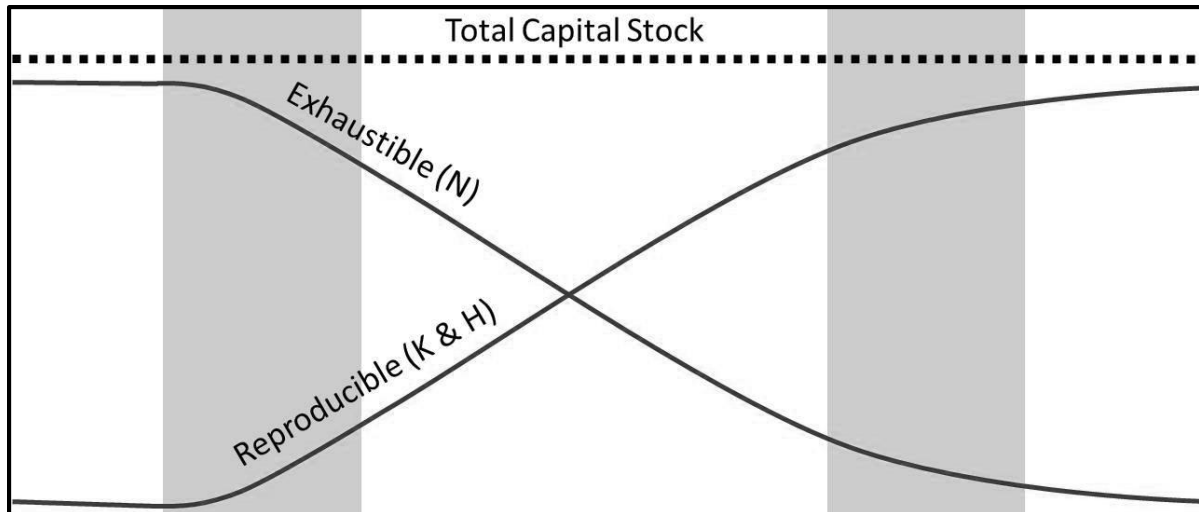
Figure 3.Total Capital Stock Conversion Model. Retrieved from Ghadimi (2010).

People living inside an ERR often feel powerless or neglected while decisions are made by people with vested interests who fail to consider what is best for a region as a whole. However, stakeholders need to engage in the design process and question how a community should transition to a sustainable economy while maintaining the environment and quality of life. This long-term thinking process is difficult for most communities which experience vast amounts of change and often lack the appropriate resources for planning and managing this growth responsibly. This can lead to rushed and negligent decisions by all stakeholders, including city, state, federal officials, as well as citizens, and producers.

Due to the lack of consistent data, indicators, and varying energy policy structures at the local level, prior research has typically analyzed development patterns at a macro scale instead of a micro scale, (community level). Perhaps a change is in order for analyzing development patterns from a more community or regional level. The West Virginia University Regional Research Institute (2013) defines an Energy Rich Region (ERR) as a type of homogeneous natural resource region located geographically in an administratively defined area containing a large endowment of energy reserves.

The case of Moundsville inductively explores both qualitative and quantitative data, thus identifying the theoretical constructs existing when designing for sustainable development at the community level within an ERR. This is accomplished by (1) exploring sustainability through the inclusive wealth—embodied by forms of natural, physical, and human capital assets (informed via Energy Rich Region Template) and (2) linking these forms of wealth to the historical choices made at the community level (mainly from exploring seven years of city council minutes). Ultimately, this process may assist in the formation of a programming guide for communities historically dependent on natural capital. The programming guide may be a decision making tool for converting the natural capital to the more reproducible forms of human and physical capital, thus providing a more sustainable prosperous future.

Case Study Background

This phenomenon of booming gas in West Virginia is not an isolated event. Figure 4 displays the current shale plays across the United States. This boom is grabbing the attention of media and popular publications, highlighting the growing pains occurring in small rural communities as a result of the energy boom. Communities reporting such growing pains include Williston, North Dakota; communities throughout Uintah County, Utah; Lackawanna, Luzerne, Wyoming, and Wayne counties in Pennsylvania; Rock Springs and Gillette, Wyoming; Denton County, Texas; and many more.

Typically when discussing the size of a resource, the oil and natural gas industry measures natural gas by volume in cubic feet or cubic meters. The Energy Information Administration (EIA) estimates 1,161 trillion cubic feet (Tcf) of technically recoverable shale gas resources (wet and dry gas) exists in the United States. The largest portion of the US shale

gas resources are found in the Marcellus and Utica shale formations containing 509 Tcf (44%)

throughout the Appalachia Region (EIA, June 13, 2013).

Figure 4. Shale Gas Plays, Lower 48 States. Retrieved from http://www.eia.gov/.

Currently, forty-seven out of fifty-five counties in West Virginia are seeing some type of

natural gas activity in terms of permitting and completed wells. As of June 2013, there have been

2,109 completed wells and 1,360 permitted wells statewide (Figure 5). It is important to note that

having a well permitted does not necessarily mean drilling will occur. In fact, with a sharp

decrease in natural gas prices over the last few years (Figure 6), several companies are

abandoning less profitable locations to allocate their resources to more lucrative fields further

north in West Virginia. Natural gas in the northern part of the state tends to be 'wet gas' as

opposed to 'dry gas'. Wet gas can be found at the same strata as oil thus providing additional

petrol vapors including propane, butane, pentane, and heptane (Waples, 2010). These extra petrol

products incentivize companies to concentrate their operations in locations rich in wet gas,

especially in times of decreasing natural gas prices.
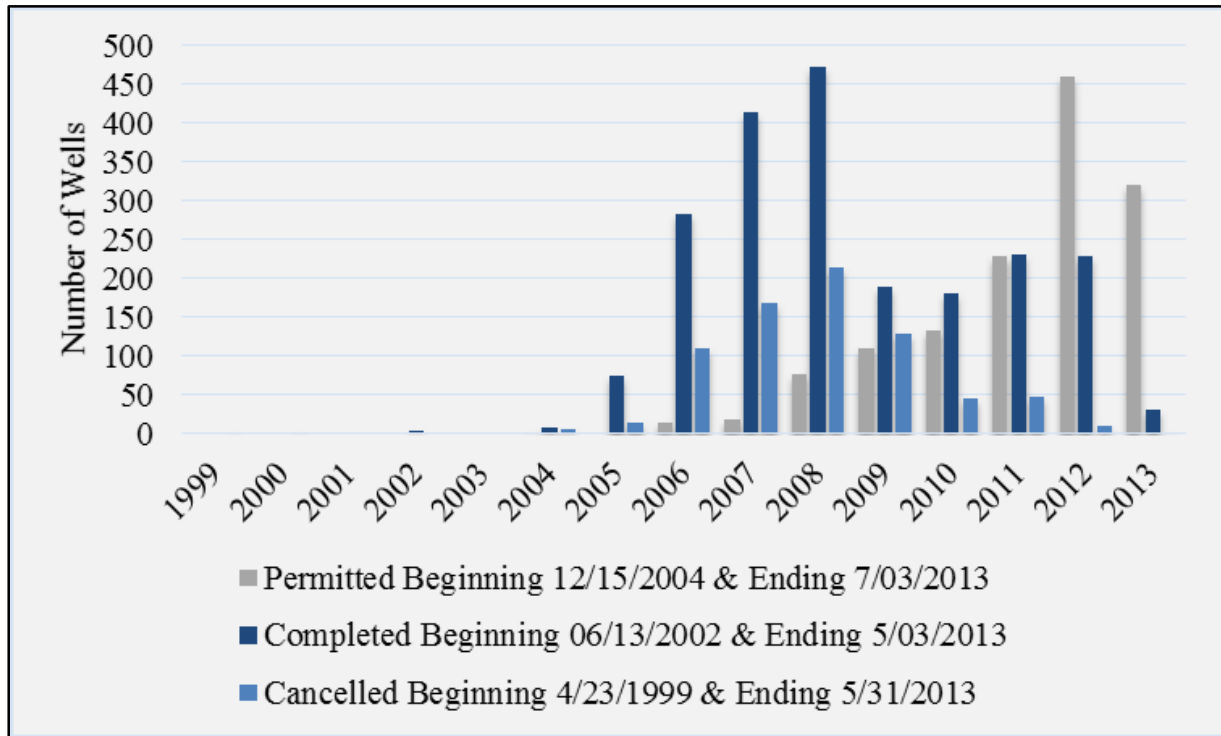
Figure 5. Historical Natural Gas Activity in West Virginia. Data retrieved from
http://www.wvges.wvnet.edu.
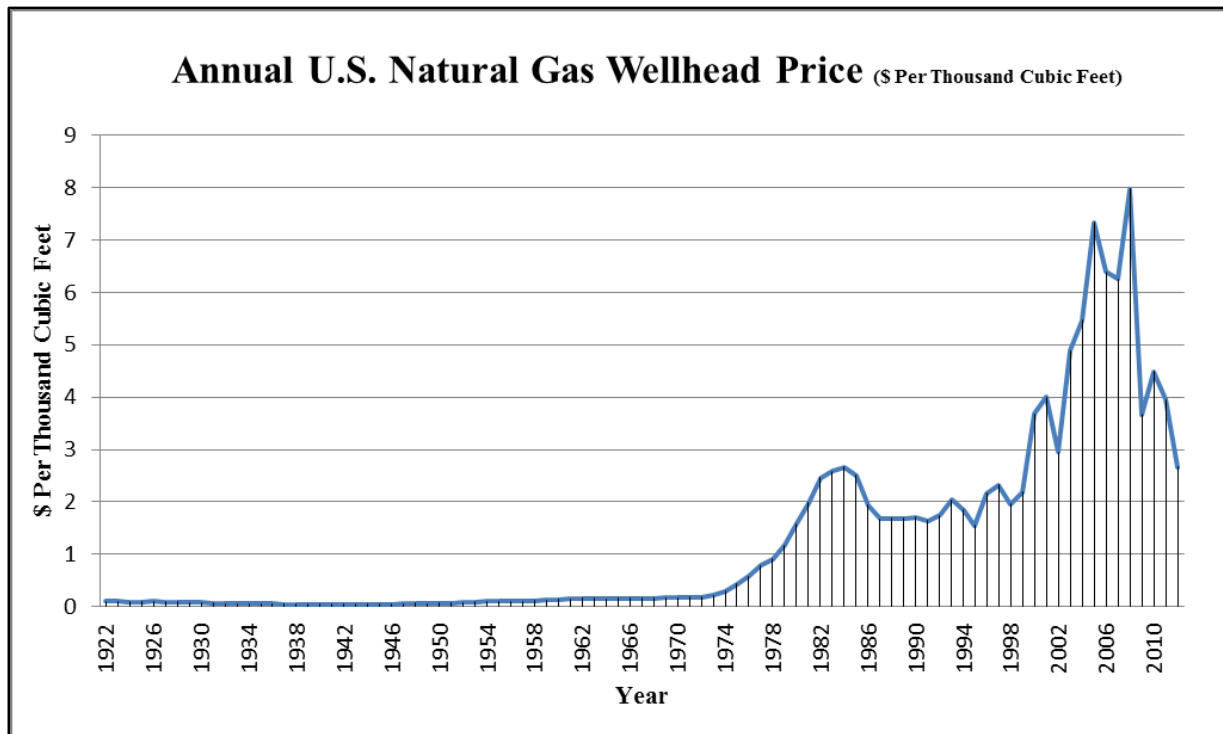
Figure 6. Annual U.S. Natural Gas Wellhead Price. Data retrieved from http://www.eia.gov/.

Although the state is booming in natural gas, as of 2012 this region at the state level had a

median household income of $40,196 (49th lowest nationally) while the nation's median

household income was $51,371. This points to a seemingly common reality seen in ERRs such

as West Virginia, where having high wealth in natural capital, does not necessarily translate to an

increase in quality of life. This again calls for an argument to transcend from an energy systems

model of boom and bust towards a more sustainable model to maintain 'total capital stock' from

decreasing as previously illustrated in Figure 3.

As of 2010, Moundsville had a population of 9,318 and a median household income of

only $28,496. The poverty rate is high (21.3%). In the case of Moundsville, this might be

partially attributed to the early stages of natural resource development, prior to realization of

related economic benefits. Figure 7 illustrates the amount of natural gas activity occurring

throughout West Virginia as of September 2012, but focuses on Moundsville located in Marshall

County. As of September 2012 in Marshall County, there were a total of 196 permitted and

completed wells. This number increased to 242 wells in less than a year. The increase in natural

gas activity will place pressure on the built environment and infrastructure such as roads,

sewage, and bridges. With a potential vast increase in population, finding homes or renting

apartments may become a focus by Moundsville stakeholders. If Moundsville decides to build,

they could be building for a short-lived boom resulting in numerous empty structures or even

incomplete development projects. This boom may be good for the short term, but the long-term

implications in choosing this path is unsustainable.
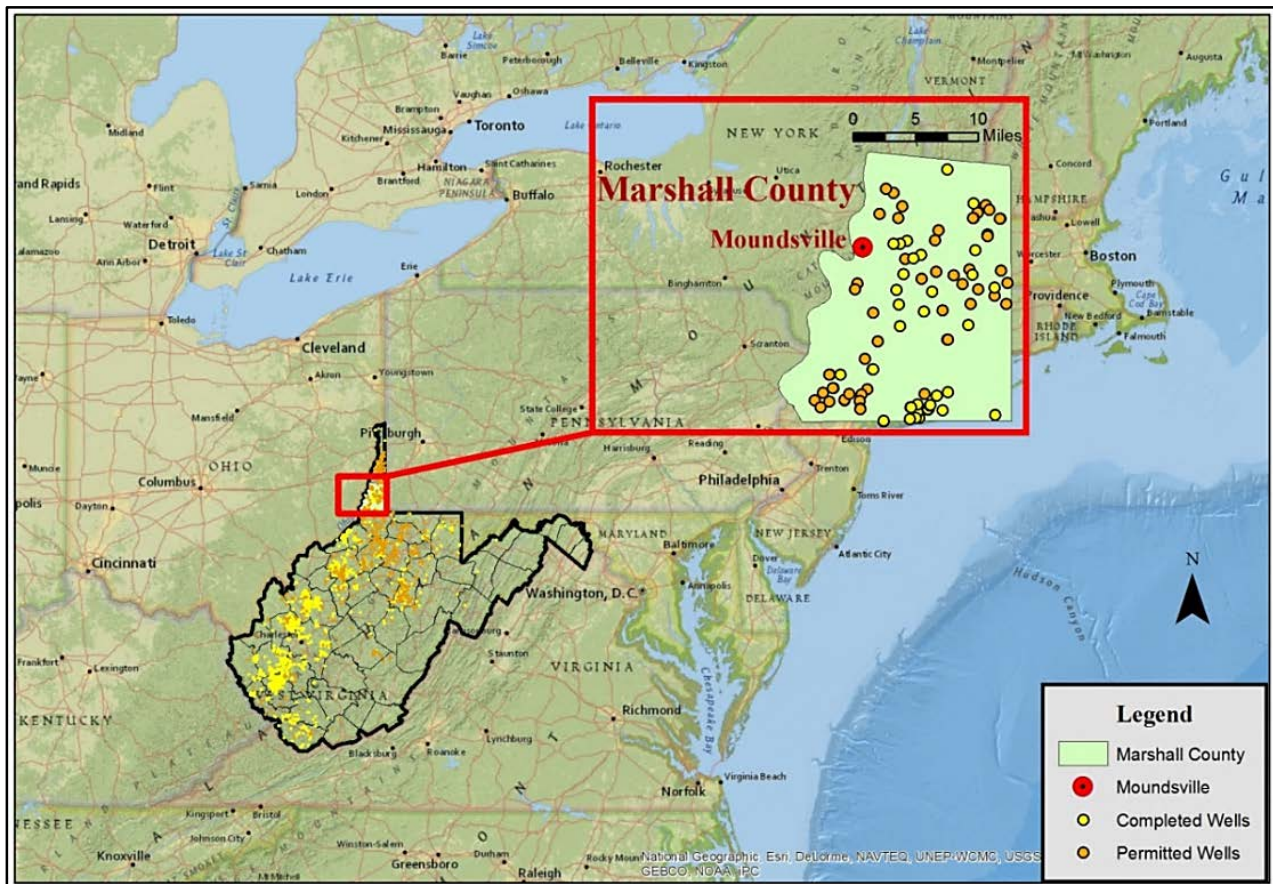
Figure 7. Natural Gas Activity in Marshall County, by Completed and Permitted Wells, Sept.
2012. Data retrieved from http://www.wvgs.wvnet.edu/.

Table 1

Snapshot of Moundsville

	US	West Virginia	Moundsville
Population (2010)	308,745,538	1,852,994	9,318
Population Growth (2000 - 2010)			
Total Change	27,323,632	44,650	-680
Percent Change	9.7%	2.5%	-6.8%
2006 - 2010 ACS Five Year Estimates			
Percent of Population 65 years +	12.7%	15.80%	21.90%
Percent of Population Non-White	23.9%	4.3%	1.9%
Percent of Population Hispanic or Latino	15.7%	1.1%	1.0%
Median Household Income	$51,914	$38,380	$28,496
Poverty Rate (All People)	13.8%	17.4%	21.3%
Population 25+ with high school degree or greater	85.0%	81.9%	80.3%
Population 25+ with bachelor's degree or greater	27.9%	17.3%	9.7%
Unemployment Rate (2006 - 2010 avg.)	7.9%	7.1%	12.1%

Data retrieved from the U.S. Census Bureau. 2006-2010 American Community Survey 5 Year Estimates. Accessed from American Fact Finder.

This region has been largely influenced by its industrial past. The impacts resulting from structural changes in the United States' economy including the loss of traditional manufacturing jobs and prominent regional employers such as Fostoria Glass (Figure 8) and the Louis Marx Toy Company, visibly exist even today. Ironically, the Appalachia region has continuously experienced a development cycle of booms and busts since the early 19th century including those from natural gas. A recent article in the Charleston Gazette stated, "Fostoria Glass began operations in Fostoria, Ohio, on Dec. 15, 1887, because the area was rich with cheap natural gas. But supplies dwindled quickly, and Fostoria moved operations to Moundsville in 1891 to take

advantage of the state's gas and coal supplies (June, 2013)." Fostoria closed its doors after

increasing foreign competition in 1986, and until recently has remained as a brownfield

consisting of lead, asbestos, and other harmful contaminants. When discussing the boom and

bust from natural resources, it is important to include the lingering impacts left for the

government and ultimately the taxpayer's responsibility to clean up from the bust. Although, the

final nail in the coffin for Fostoria Glass Company may have been increasing foreign

competition, Fostoria's initial purpose for relocating in Moundsville was due to a bust in

resources in Ohio and a boom in natural gas and coal in West Virginia.
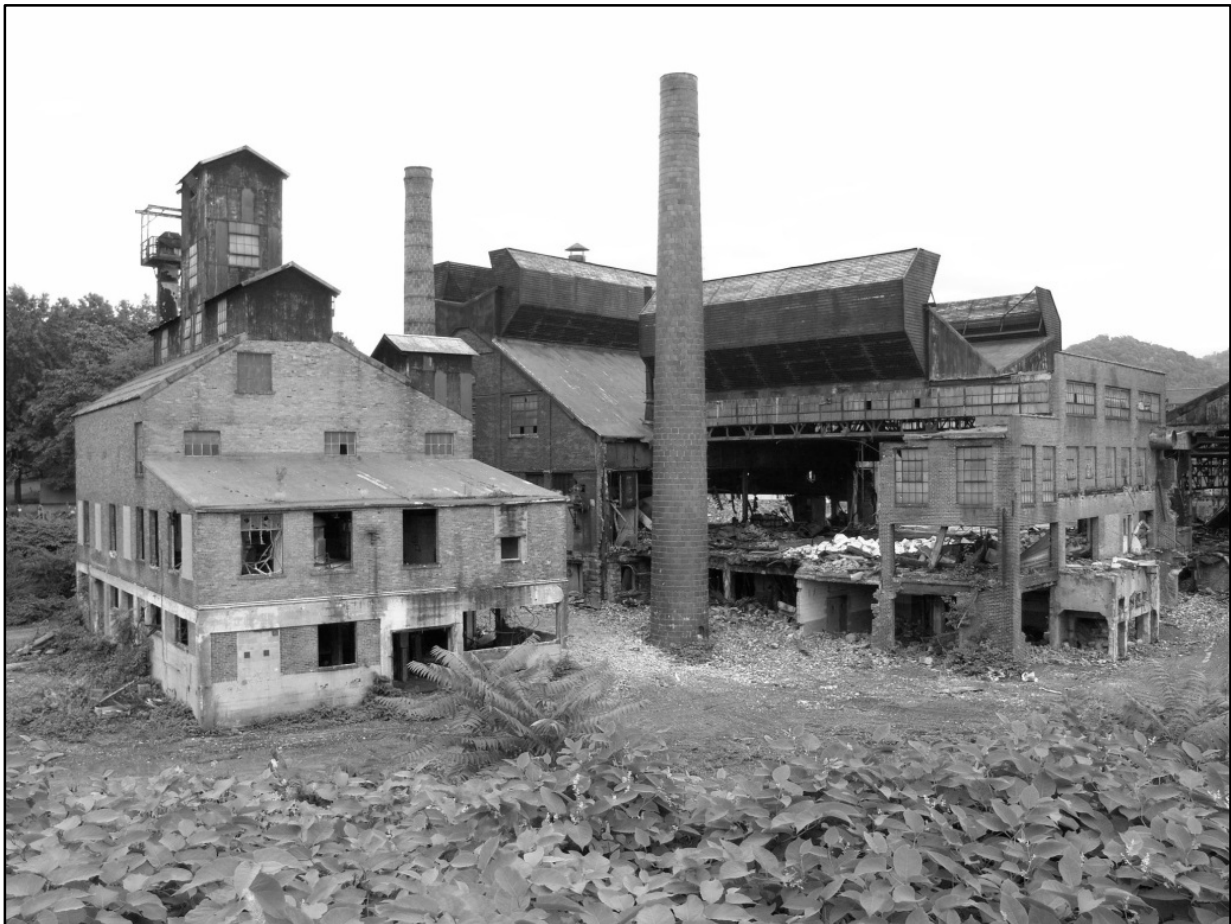
Figure 8. Fostoria Glass Company Brownfield, Moundsville, WV, July, 2006. Adapted from
http://www.flickr.com/photos/14559376@N03/1569992016.

Organization of the Study

The following is a brief description of what the reader can expect in the subsequent chapters. Chapter II reviews the literature; however, given the breadth of the related literature—an approach utilizing a delimitation process to narrow down and focus on the relevant concepts is employed. This process (Figure 9) provides the necessary knowledge and background for implementing the remainder of the case, and furthermore assists the researcher in clearly defining the case and unit of analysis (Yin, 2003). There are four main topics identified; (1) Energy Rich Regions; (2) Sustainable Development; (3) The Natural Resource Curse; and finally (4) Wicked Human Problems. Under each of these overarching topics are reviews of relevant constructs for these headings.
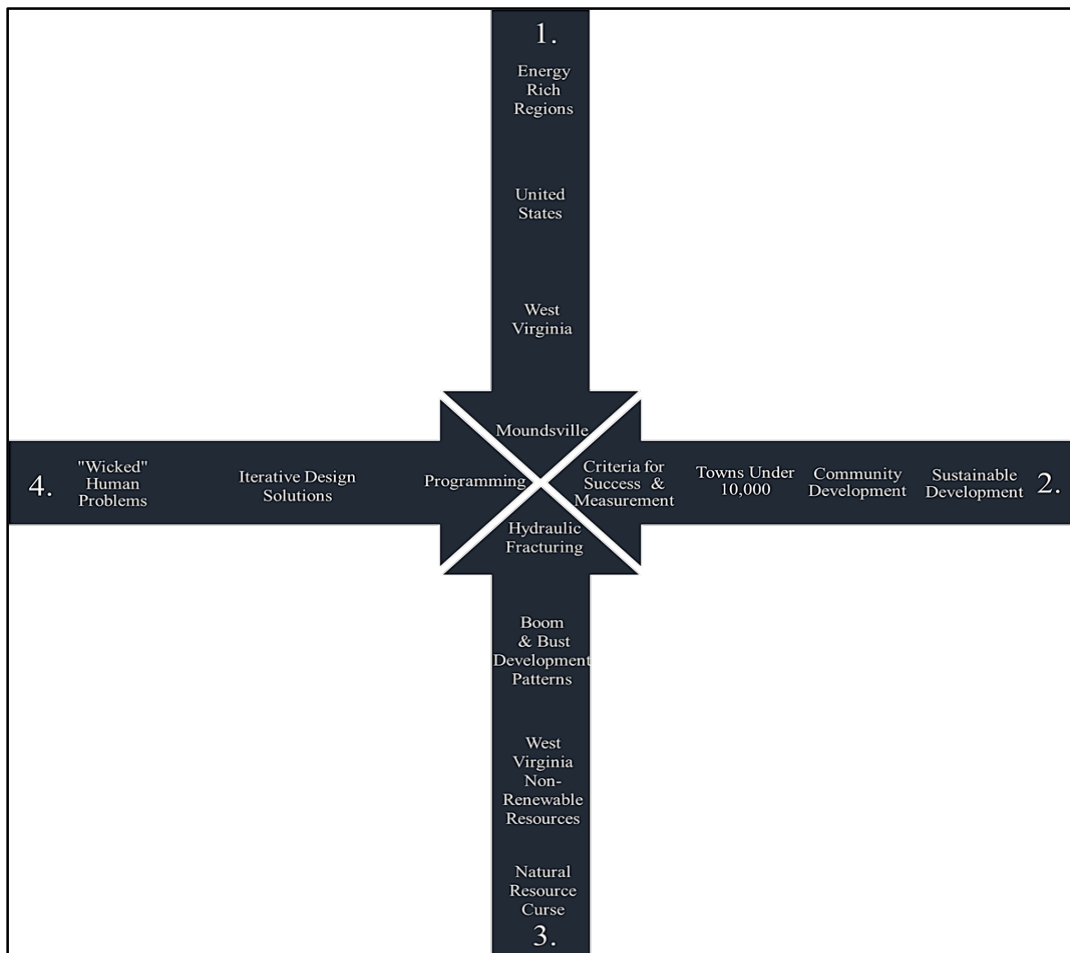
Figure 9. Delimitations Process for Case of Moundsville Literature Review.

The following chapter, presents the methodology implemented for conducting the case which includes a case study design using a mixed methods approach. Furthermore, this chapter discusses the main tools for applying the theory at hand which are the "Energy Rich Regions Template", the "Moundsville Knowledge Base", and the qualitative data/coding software program MAXQDA.

The results of this coding process and analysis are found in chapter IV. Furthermore, the aggregate results from the coding process are categorized into the inclusive wealth forms of natural, physical, and human capital for linking local decision making and discussions revolving around these three capital forms. Other significant qualitative and quantitative results from knowledge base tools, e.g., ArcGis, StatsAmerica, and U.S. Census data; are also presented.

In chapter V, the findings from conducting this case study are summarized. In addition, the implications in conducting this case and recommendations for future research are needed for providing communities practical steps forward in transforming a region to a more sustainable future.

Finally, an appendix can be found at the end which presents the open coding system utilized for analyzing the city council minutes, the Energy Rich Region Template, and photographs taken while a participant observer with the Community Design Team.

Chapter II

Review of Literature

The following literature represents the constructs in considering sustainable development as it pertains to the Case of Moundsville. As previously introduced, a delimitations process is employed which allows the researcher to link the analysis portion of this case study back to the referenced literature. This process sets the stage for understanding the problems holistically, beginning with defining (1) Energy Rich Regions (ERRs) and briefly exploring the ERRs within the United States and in further depth—local community scales. Next, (2) sustainable development is defined from an evolving historical perspective and the criteria for successful sustainable development implementation at the community level is explored. Then a discussion on (3) the 'natural resource curse' is needed for exploring the historical constructs leading up to the current boom in natural gas. Finally, this delimitation process defines (4) 'wicked human problems' and iterative design solutions that may inform future programming recommendations for resource dependent communities in ERRs. This last topic of wicked human problems is relevant and necessary for connecting theory to action—and how theory may inform the transformation of boom and bust to a future of sustainability.

Energy Rich Regions

"An Energy Rich Region (ERR) can be thought of as a type of homogeneous natural resource region located geographically in an administratively defined area containing large endowments of energy reserves"(Regional Research Institute, 2013). Typically when discussing an ERR, one is exploring the finite resources of oil, natural gas, and coal. Ghadimi (2010) lists the advantages of using a regional approach including; (1) spatial organization of production, (2) spatial distribution of capital, (3) spatial disparities, and (4) regions are a flexible unit of analysis

("bottom-up regional approach to development"). The spatial unit for analyzing an ERR could be a state or province within a country or in this example, the case study examines one community within a county located in the ERR of West Virginia.

Often, the region under analysis is highly dependent on the exhaustible natural capital, although, this may not always be the case. Such regions that seem to be effectively diversifying their natural capital into more sustainable forms of capital are the states of Texas, Colorado, and California. Ghadimi (2010) states, "The most important development challenge for ERRs is to convert their valuable but exhaustible natural capital into reproducible capital in pursuit of sustainable economic development that is also environmentally sustainable."

United States. As a whole, the United States is blessed with vast amounts of resources. In comparing internationally, the U.S. ranks 12th in proved oil reserves, but 2nd in oil production; 4th in proved natural gas reserves while 1st in production; and finally, 2nd in coal energy production (EIA, 2013). Furthermore, the total share of natural gas production in the world is 39% from the US, 15% Canada, and less than 1% from China (EIA, 2013). Unfortunately, the vast amounts of reserves and consumption of these fossil fuels comes a high output of carbon dioxide emissions where the U.S. ranks #2 only to China as of 2013. In fact, as of 2010, the US total energy per capita was 315.9 million British Thermal Units (Btu). Compare this to the world's average total energy per capita of 74 million Btu in 2010. The EIA (2013) states the U.S. fuel mix of petroleum, natural gas, and coal has provided 87% of this nation's primary energy (Figure 10).
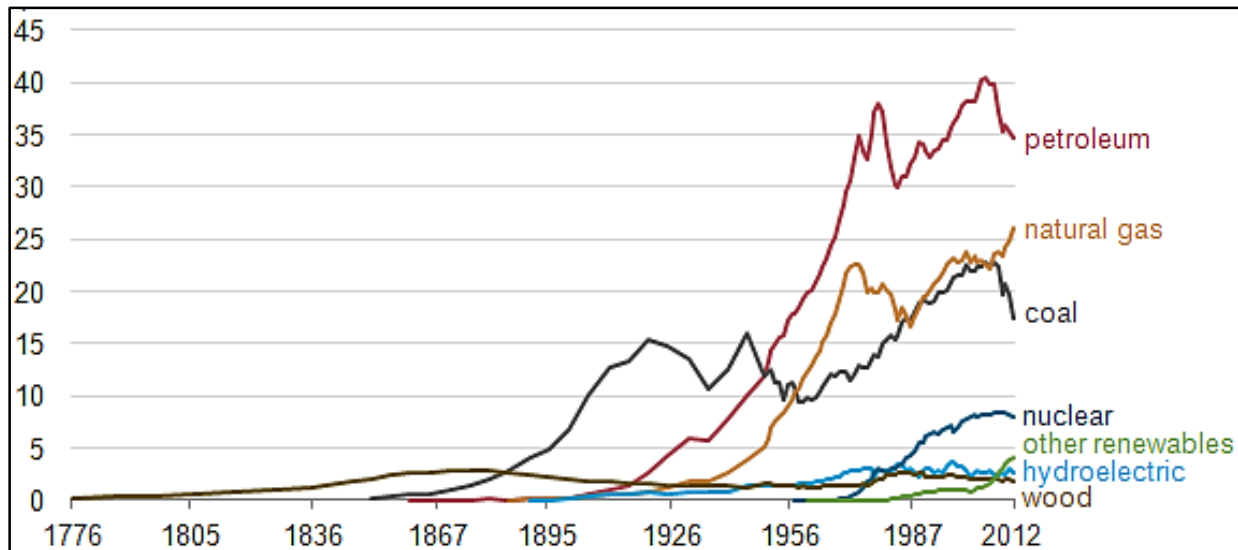
Figure 10. History of Energy Consumption in the U.S. (1776-2012). Retrieved from http://www.eia.gov/todayinenergy/.

Traditionally, when one thinks of an ERR in the U.S., the state of Texas might come to mind; however, the first oil boom began in the Appalachia state of Pennsylvania in 1859. More recently, with technological changes with horizontal drilling and hydraulic fracturing, the ERR states of Appalachia—such as Pennsylvania and West Virginia, are once again changing the energy landscape nationally and abroad. In addition, the Marcellus Shale Play, located primarily in Pennsylvania and West Virginia, became the largest proven natural gas reserves in the U.S., surpassing the Barnett Shale Play located in Texas. An EIA (2013) report stated, Pennsylvania and West Virginia alone are "expected to provide 18% of total U.S. natural gas production for this month" (December 9, 2013). Clearly these ERR states are increasingly feeling the pressure from the nation and world to extract, transport, and provide affordable energy to the marketplace.

West Virginia. As of 2011, EIA data shows the ERR of West Virginia ranks 5th in total energy production, 2nd in coal energy production, and 10th in natural gas production within the United States. West Virginia typically generates more electricity than it consumes. In 2010, 56% of its net electricity generation was consumed outside the state and approximately 80% of total

energy production is exported (EIA, 2013). Currently, with the vast expansion of drilling in the

Marcellus Shale, West Virginia's position in energy production may change as long as the

current boom is implemented responsibly and coal energy production remains stable. However,

due to the combination of regulating mercury emissions, and most recently the potential EPA

111(d) ruling on carbon emissions regulation, the cleaner alternative energy source—natural

gas, will indeed greatly impact coal's production share of energy.

Table 2

U.S. State Total Energy Production and Consumption Rankings, as of 2011

State	Production, U.S. Share	Production Rank	Consumption per Capita, Million Btu	Consumption per Capita, Rank
TX	16.2	1	476	6
WY	13.3	2	975	1
LA	5.1	3	886	2
PA	5	4	292	32
WV	4.9	5	390	16
KY	3.6	6	438	10
CO	3.5	7	289	34
OK	3.5	8	421	11
CA	3.4	9	209	47
NM	2.9	10	331	23

Data retrieved from http://www.eia.gov/state/.

Moundsville—Small Town Rural West Virginia. As we work through the various

scales of an ERR, the complexity increases. From a more abstract perspective, the choices made

at the higher regional levels manifests into a more tangible real effect at the local level.

Moundsville, West Virginia is a small rural town located in the ERR of West Virginia,

experiencing the top down effects of this global energy system. The community has historical

significance. Due to the fertile soil and its proximity to water (Ohio River), early frontiers

settled this plot of land in approximately 1771, although it was not officially incorporated until

1832. "In the center of the town is the largest conical burial mound in the Western Hemisphere—

and one of the largest in the world" (Schramm, 2004, p.9). In explaining the historical

significance, Schramm (2004) states, "It was constructed in stages between 250 and 150 B.C.E

until around 1 C.E. While the Adena People were constructing the mound, Hannibal was

crossing the Alps, the Great Wall of China was being built, and the Roman Empire was starting

its campaign for world domination"(p. 9).

Moundsville was even a popular spot on the political trail, Schramm (2004) notes that,

"Former U.S. President Harry Truman addressed attendees at the Democratic fund-raising dinner

in 1956" (p.99) and the community held parades to support "Republican candidates, including

Arch Moore for Congress and Cecil Underwood for governor" (Schramm, 2004, p. 98).

It had been rumored by historian Peter Boyd when Moundsville was given the choice to

host the state's university, West Virginia University—or the state's penitentiary, it opted for the

state's penitentiary to be built in their community (Boyd, 1927). However, more recently, an

author professes, "no such historical documentation exists to support the claim, and the

community chose the penitentiary "because Moundsville was in close proximity to Wheeling, the

state's capital at the time" (Clemins, p. 8). In addition to the state's penitentiary being located in

Moundsville, the community was home to "four nationally prominent industries"(Schramm,

2004); Fostoria Glass Company, United States Stamping Company, Fokker Aircraft Factory

(actually located in neighboring Glen Dale), and the Louis Marx Toy Factory (also located in

neighboring Glen Dale). Schramm (2004) states, "these industries are of special interest, because

three of them manufactured products that were not only unique, but which became so popular

that they could be found in almost every household in America and, to some extent, worldwide.

The fourth of these companies (Fokker Aircraft Company), produced a product that significantly

changed the world's travel industry" (p.33). It is important to note the historical industrial past of

Moundsville because these industries located in this community and region due to "the

abundance of energy in the form of coal and gas and access to riverboats and the railroad"

(Schramm, 2004, p. 61). Schramm (2004) notes that, "There were several mines being operated

in the vicinity of Moundsville" (p. 66). As one can see (Figure 11), the interplay between the

natural resources found throughout this community and region alike has manifested an 'energy

culture' as their chosen way of life.

Figure 11. Miners from the First Street Mine, Approximately 1890. Retrieved from Schramm
(2004).

Literature suggests Moundsville was no small town, but seemingly on its way to

becoming a thriving metropolis. The following literature proposes a community's success is built

on the understanding of long-term sustainable development patterns of which were seemingly

not employed in the case of Moundsville.

Sustainable Development: Concepts, Theory and in Practice

Buckminster Fuller, visionary and architect, perhaps provides the broadest definition of sustainability when he invented a game designed to promote world peace ("The World Peace Game"). The game posed this question: "How can we make the world work for 100 percent of humanity in the shortest possible time through spontaneous cooperation without ecological damage or the disadvantage of anyone?" (*as cited in* Meredith, 2009, p. 1). In essence, Fuller's vision for this game is the very breath of sustainability.

Arguably, the most recognized definition of sustainable development was conceived through the Brundtland Report 1987, which states, "sustainable development meets the needs of the present without compromising the ability for future generations to meet their own needs." Understanding this broad definition, a vast amount of literature has emerged attempting to explain sustainability, however with greater complexity and focus. Many fields of academia have presented their version of the topic using a variety of examples. The most common theme used by social scientists explores sustainability through the 'three pillars scheme' of environment, economy, and society. Peering into this scheme, we find a system interdependently complex and imploring the question whether sustainability is even possible.

McDonough and Braungart (2002) defined the scope of 'sustainable design' across cultures and over time in their best-selling manifesto Cradle to Cradle: Remaking the Way We Make Things. Their approach to sustainable design uses a 'cradle to cradle' systems design. Furthermore, they state the current production system is largely built from a 'cradle to grave' systems design. In brief, when imagining an "assignment of designing the Industrial Revolution retrospectively", McDonough and Braungart (2002) state, "design a system of production that creates prosperity by digging up or cutting down natural resources and then burying or burning

them" (p.18). To this day, although there is progress in changing the production system of cradle

to grave towards a system of cradle to cradle—the world still widely uses the paradigm of cradle

to grave.

> Human beings don't have a pollution problem; they have a design problem. If
> humans were to devise products, tools, furniture, homes, factories, and cities more
> intelligently from the start, they wouldn't even need to think in terms of waste, or
> contamination, or scarcity. (McDonough & Braungart, 2013, p. 7)

Behind much of McDonough and Braungart's research is their defining of the 'The Hannover

Principles' which was publically presented in 1992. The principles state:

> 1. Insist on the right of humanity and nature to coexist in a healthy, supportive,
> diverse, and sustainable condition.
> 2. Recognize interdependence.
> 3. Respect relationships between spirit and matter.
> 4. Accept responsibility for the consequences of design decisions upon human
> well-being, the viability of natural systems, and their right to co-exist.
> 5. Create safe objects of long-term value.
> 6. Eliminate the concept of waste.
> 7. Rely on natural energy flows.
> 8. Understand the limitations of design.
> 9. Seek constant improvement by the sharing of knowledge. (p. 10)

Although, this code may describe a utopian vision for the future, reversing a system

designed primarily dependent on fossil fuels is assuming a human civilization that is thinking

long-term progress and prosperity, i.e. intergenerational equity, versus a civilization based on

money and politics or short-term gains.

Within these overarching frameworks, researchers have examined issues of weak and

strong sustainability as well as social dimensions and capital forms. Gowdy (1999) addresses the

environmental and economic debates over the concepts of 'weak' and 'strong' sustainability.

"Weak sustainability assumes substitution is possible. If one species is driven to extinction, we

can use another. Strong sustainability recognizes that species are irreplaceable but implies that

they have value only in an economic context" (p. 177). In addition, "strong sustainability

recognizes the finiteness of the natural world and that there may be limits to substitution"
(Gowdy, 1999, p. 169). At first glance, it may seem like strong sustainability is the approach for
sustainable development; however, it only recognizes the finiteness of the natural world in the
context of economics, not social or biological contexts. As an example, Gowdy recognizes, "A
complex ecosystem could be reduced to a monoculture tree farm, and as long as those trees are
harvested at a low enough rate, this would be strongly sustainable in the economic sense"
(Gowdy, 1999, p. 167). Gowdy suggests an alternative proposed by other economists such as
Georgescu-Roegen called viability. Gowdy (1999) observes, the concept of viability recognizes
that human activity and its effects on the natural world are characterized by uncertainty,
irreversibility, and long-term unforeseen consequences.

Sachs (1999) discusses the social aspects of sustainability referred to as social
sustainability. For such conditions to exist, it is suggested a criteria of pre-conditions must be
met for sustainable development. "This becomes clear when one addresses the central question
as to why so many people's needs are not being met today; moving to the analysis of economic,
social, and political causes of unemployment, poverty, and social exclusion" (Sachs, p. 25).

Finally, through researching these broad perspectives White (2012) explores
sustainability through capital forms, concluding:

> Growth does not necessarily improve the standard of living if it compromises the
> quality of life and does not lead to sustainable development. This view of
> development includes valuing all capital that is used in producing income and
> calls for locally based indicators that can be used to evaluate changes in capital
> stocks and quality of life factors, where capital includes physical capital, public
> capital, natural resources, human capital, and social capital. (White, 2012, p. 114)

It is evident that defining sustainability is not without its flaws and the debate continues
even today. However, the nuances of perspectives and definitions all recognize the current
system is not working for humanity. The problem of living unsustainably and not considering

future generations is man-made. To begin addressing a seemingly insurmountable paradigm, one

must first design a future of balance by positioning sustainability at the fulcrum.

Sustainable Development (UN Agenda 21). A new form of governance was presented

at the Rio Earth Summit in 1992 where a plan created by the United Nations was signed by 178

world leaders. The U.N. saw this as a "new form of global government known as Sustainable

Development" or otherwise known as UN Agenda 21(Monolith Press, 2012).

An important element that deserves much attention for the successful implementation of

sustainable development in America is found in the term 'regionalism'. In the manuscript,

U.N.Agenda 21: Sustainable Development in the U.S.A. defines regionalism as:

> A term used to describe cities, counties, or geographical areas that create
> unelected official consortiums, which often by-pass the local governments' stage
> of development in global economic reform and creates forces of change that affect
> how we might live as a society. (p. i.1, 2012)

Such an approach would require a 'bottom-up' response from local governments. Furthermore,

NGOs and nonprofits such as the Local Governments for Sustainability (ICLEI) would become

an important piece in connecting local governments voluntarily worldwide for advocating and

pursuing sustainable development policies. Their mission "is to build and serve a worldwide

movement of the local governments to achieve tangible improvements in global sustainability

with specific focus on environmental conditions through cumulative local actions" (ICLEI,

2013).

Although sustainable development may seem on the surface as an appropriate technique

for governing in America, there is much debate and even conspiracy in this new philosophy of

governance. "Everything we do in our daily lives must come under increasing governmental

control in order to protect the planet and maintain sustainability" including "how we build our

homes, the products we use, the foods we eat, and the methods of transportation we choose"

(Monolith Press, p. i.2, 2012). Following this observation, it is critical for government to strike a balance between protective freedoms and rights of the people in implementing such policies.

President's Council for Sustainable Development (1993-1999). In response to a seemingly positive new trend in the world's view of sustainable development, on June 29, 1993, President Clinton under Executive Order 12852 established the President's Council on Sustainable Development (PCSD). This council presented their case in a report entitled "Sustainable America: A New Consensus for the Prosperity, Opportunity and a Healthy Environment for the Future." Here, the PCSD suggests "Building a New Framework for a New Century," where the federal government would provide "greater flexibility and expanding the roles played by states, counties, and local communities in implementing policies and programs to address national goals" (PCSD, Ch. 4). Included in this vision, "local governments will play a key role in creating stronger communities from planning and facilitating development, to creating community partnerships, and providing leadership" (PCSD, Ch. 4).

Community Development. The biological definition of a community is: "an association of organisms of different species living together in a defined habitat with some degree of mutual interdependence" (Rocky Mountain Institute, 1998). It is important to understand community from this perspective for relating to the interdependencies, diversity (or lack of), and other constructs observed at the community scale. Realizing the previous PCSD vision for communities will require a 'bottom-up' response from local governments and leaders. However, dwindling human capital (population and talent) and diversity may be preventing a community from engaging in sustainable development practices.

Calthorpe (2011) discusses the idea of community using the words of famed Harvard sociologist Robert Putnam who coined the term 'social capital' back in the early 1990's. "Social

capital consists of civic engagement, healthy community institutions, norms of mutual

reciprocity, and trust" (*as cited in* Calthorpe, 2011). "Social capital broadens people's sense of

self from 'I' to 'we' and encourages them to work together on community problems" (Calthorpe,

p. 65, 2011). Calthorpe, among many other urban designers and planners, profess that a

community without social capital will fail. This could lend support for why communities through

time, especially with the advent of the internet, have increasingly diminished American

community's social capital (Putnam, 2000).

Understanding how community development has changed in the U.S. through the last

century reveals how isolated such places were at one time; however, this is not the case anymore.

Many communities were 'truly local' in the sense "places were shielded from the full force of

external influence and thus were able to sustain their more or less self-contained existence"

(Chen, Orum, & Paulsen, 2012). However, since WWII, such communities experienced a "boom

like no other" and received a physical connection from government subsidies in the form of

expanded infrastructure and the interstate highway system (Calthorpe, 2011). Through this

transition, we chose the "suburban" model where "our national identity and international cachet

were inextricably tied to cars, suburbs, and all things new" (Calthorpe, p. 26, 2011).

Unfortunately, this new model calls for increasing energy-use and seemingly counterintuitive—

communities that are fragmented and disconnected.

Towns under 10,000. Knox and Mayer (2013) state, "In the United States, the fastest-

growing places in the country over the past two decades have been towns between 10,000 and

50,000 inhabitants, which together account for just over ten percent of the U.S. population"(p.

11). This massive outmigration of populations to larger cities will certainly have a long-term

effect for the communities under a population of 10,000—even more apparent for those communities located in an ERR.

In observing the interplay between populations and the current energy system, it is important to discern between rural and urban populations and/or land because the potential effects from the energy system greatly depends on location and population size. The US Census defines 'rural' as, "a territory, population, and housing unit located outside an urban area (UA) and an urban cluster (UC)" (U.S. Census, 2013). The criterion for defining a UA is a "contiguous area consisting of densely developed territory that contains 50,000 or more people" and for a UC as a "densely developed contiguous territory that has at least 2,500 people but fewer than 50,000 people. Applying these definitions, the 2010 US Census found 19.3% of the population is rural with 80.7% being described as an urban population—and yet, over 95% of the land area is still classified as rural in the United States. Furthermore, adding even greater complexity to defining a small rural town, the Office of Management and Budget (OMB) delineates between metropolitan and micropolitan statistical area which states, "A metro area contains a core urban area of 50,000 or more population, and a micro area contains an urban core of at least 10,000 (but less than 50,000) population".

In observing these definitions, the state of West Virginia contains 401 populated places recognized by the U.S. Census with only one city having a population over 50,000 (Charleston City). This leaves 64 places with a population greater than 2,500, but fewer than 50,000. If this study is interested in communities of less than 10,000 and greater than 2,500—this leaves 50 places in West Virginia meeting this criteria. However, these numbers although helpful in defining a rural community—the number misses the additional social dimensions such as the "interaction between land and place that is integral to understanding rural development patterns

or the challenges associated with growth and development facing rural communities" (ICMA, p. 1 2010). One major challenge that these small communities face is not only maintaining a population, but a population that effectively commits its talents to the long-term success and vision of that community. Winkler et al. (2011) posit, "Although aging and natural decrease are certainly important issues affecting rural communities, these problems are ultimately driven by migration patterns" (Winkler, Golding, Cheng, p. 349). "Different types of natural resource dependence produce distinctive migration patterns that ultimately shape the assets that localities can engage for community development" (Winkler et al., p. 349). Additional research has shown this outmigration from these small rural towns, as described by Knox and Mayer (2013), manifests into "decades of economic and demographic stagnation" (p. 12). "Outmigration has typically accounted for a disproportionate share of the brightest, most energetic, and best-educated young people, leaving aging populations that tend to become provincial and parochial in outlook, lacking in vision and leadership" (Knox & Mayer, 2013, p. 12). As a result, many of these communities face a rather vulnerable tipping point of decline. This phenomenon is not necessarily indicative of communities highly dependent on the energy or agricultural industries, but it also observable for small rural communities that rely solely on any named industry therefore effectively leading to a less resilient community.

  Criteria for success and measurement. The PCSD profess "it is not possible today to point to a list and say, 'these communities are sustainable'". However, in general these communities all have certain 'characteristics in common' for moving towards a more resilient community. These common characteristics include:

> (1) All people have access to educational opportunities that prepare them for jobs to support themselves and their families in a dynamic local economy that is prepared to cope with changes in the national and global economy;
> (2) People are involved in making decisions that affect their lives;

(3) Businesses, households, and government make efficient use of land, energy
and other resources, allowing the area to achieve a high quality of life with
minimal waste and environmental damage;
(4) These communities are healthy and secure, and provide people with clean air
to breathe and safe water to drink". (PCSD, May, 1999)

An alternative perspective on the criteria for successfully implementing sustainable

development may be revealed in Flora & Flora (2008) method called the "Community Capitals

Framework" which assists in analyzing how communities work. They observe, "communities

most successful in supporting healthy sustainable community and economic development paid

attention to all seven types of capital: natural, cultural, human, social, political, financial and

built."

Measuring sustainability. Considering the criteria for measuring the success (or lack) of

sustainability, five tools are commonly used: benefit-cost analysis; environmental assessment;

risk assessment; life cycle assessment (LCA); and ecological 'footprint' analysis (Allenby, B.,

1999; Costanza, R., 1991; Stavins, R., 2005; Paehlke, 1999). These measurements although

helpful, tend to focus mostly on the environmental and economic dimensions of sustainability

and omit the social dimensions. Stigletz et al. (2008) stated, "There is no single indicator that can

capture something as complex as our society"—thus, a comprehensive measurement is needed.

One possible consideration for measuring the sustainability of a society may be in using the

inclusive wealth framework of human, physical, and natural capital. This was presented earlier in

the capital stock conversion model which is primarily derived from the World Bank. The World

Bank utilizes these capital forms framework for measuring the wealth of nations although at the

country level.

Adding greater depth to this framework—Ghadimi, Harris, and Warner (2014) explore

the need for measuring wealth of regions and sub-regional scales using a geospatial approach

conceived through the inclusive wealth forms of physical, natural, and human capital.

Furthermore, Ghadimi et al. (2014) provide potential indicators for measuring each of these

capital forms, but also admit their list of indicators is not necessarily comprehensive or

exhaustive.

There are a variety of reasons for using a capital form framework. (1) Capital forms can

be comprehended as stocks of wealth and can be estimated. (2) Capital forms have the

opportunity to provide a more full-cost or true-cost accounting measure. As an example, indices

like GDP, do not currently fully account the depletion of natural capital or the distribution of this

wealth, and yet society places great weight on using this metric for measuring economic

progress. (3) Finally, the capital forms framework is more comprehensive. As previously

mentioned, there is no single indicator that can capture the complexity of society, thus multiple

methods, metrics, and indices should be employed. Furthermore, it should be noted there are

many ancillary or more granular forms of capital that may fall into these three primary forms,

e.g., creative capital and political capital would fall under human capital.

Development patterns of human capital. Human capital, broadly defined, consists of a

society's education, skills, diversity, freedoms, competence, quality of institutions, innovation

etc…—much of which is, in the World Bank's rubrics, 'intangible capital' and difficult to

measure. Ghadimi et al. (2014) describe other potential indicators of human capital such as

demographic structure (population and labor force), educational attainment, and talent

(occupations in the creative economy).

There has been a growing trend by leading economists, urban planners, and even

politicians towards agreement that human capital is the key to success of a society. Leading

researchers include economist Paul Romer and urban planner Richard Florida. Romer's 'New

Growth Theory' or 'Endogenous Growth' focuses on a model centering on human capital,

innovation, and ideas. Romer clarifies this concept of an 'object vs. idea' using a coffee cup

design as an example:

> The paper that makes up the cup in the coffee shop is a thing. The insight that you
> could design small, medium, and large cups so that they all use the same size
> lid—that's an idea. The critical difference is that only one person can use a given
> amount of paper. Ideas can be used by many people at the same time. (Bailey,
> 2001)

Bringing further meaning to 'human capital', Florida (2011) expounds the idea of

'creative class' and states it is largely compiled of occupations from architecture, engineering,

social science, computer science and programming, and arts and entertainment among many

other occupations. "It has grown from roughly 5-10% of the workforce at the turn of the century

to roughly a third or more of the workforce in the advanced economies by the early 21st century"

(Florida et al., 2011).

Development patterns of physical capital. Physical capital generally, is anything man-

made, i.e. roads, buildings, infrastructure etc... Emery & Flora (2006) refer to physical capital as

'built capital' and define it as the infrastructure supporting the six capital forms presented in their

'community capital framework' (natural, financial, political, social, human, & cultural). Ghadimi

et al. (2014) examine potential indicators for measuring physical capital including residential and

non-residential *buildings* (housing, commercial buildings, schools and colleges, churches,

bridges, correctional institutions, and state government buildings), and *infrastructure*

(transportation and communication structures, urban and regional sewer and utility networks,

etc.).

The PCSD (1999) state, "Society's investments should aim to create places that people

want and can sustain. The built environment is a critical factor in shaping the quality of life,

accessibility, environmental burden, and unique character of a community, which contributes to a sense of place" (Ch. 4). Thus if the priority for sustainable development is to "create places that people want and can sustain", then sustainable design should inform the development patterns of physical capital. Ultimately, what shapes the physical capital are the local building codes and zoning ordinances. If a community is to be resilient, then "making efficient use of existing infrastructure, energy, materials, and land" through important components of sustainable design such as 'location efficiency' (PCSD, 1999, Ch. 4). "Zoning ordinances that allow for mixed-use development, such as having a store, apartment building, and school on the same block, can give people easy access to a range of facilities and the ability to walk to obtain goods and services" (PCSD, 1999, Ch. 4). Furthermore, this reduces the need for motorized vehicles, thus decreasing traffic congestion and pollution from mobile sources.

The importance of physical capital cannot be underestimated because the built environment improves the quality of life with access to amenities like electricity and shelter, and is the tool and vessel for connecting human capital.

Development patterns of natural capital. Finally, we come to understand the vital role that all life depends—natural capital. Hardin (1968) uses the example of a herdsmen's decision to add an additional cow to a pasture that can be shared by all in explaining the concept 'Tragedy of the Commons'. "Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom of the commons brings ruin to all" (Hardin, 1968). To Hardin's point, it is rational for every herdsman to continue adding more cows to this pasture in order to increase their individual incomes (self-interests). Eventually this pasture reaches its carrying capacity and everyone loses. Similar to this story, the

'Tragedy of the Commons' has and is occurring in present day when extracting natural resources

such as natural gas and oil (Figures 12 &13).

Figure 12. Rapid and Uncontrolled Oil Production in the Past, Spindletop, TX, 1903. Retrieved from Bosselman, Eisen, Rossi, Spence, & Weaver (2010).

Figure 13. Rapid and Uncontrolled Gas Production Present Day, Public Land, Western Wyoming, 2011. Retrieved from The Wilderness Society (2012).

Adding greater breadth and focus to defining natural capital can be revealed by other leading researchers. "Any resource or environmental asset is a form of 'natural capital,' whose value to society is by definition equal to the amortized value of future benefits that can be derived from use of the asset" (Clark, 1991). Emery & C. Flora (2006) define natural capital from a less economic perspective as "those assets that abide in a particular location, including weather, geographic isolation, natural resources, amenities, and natural beauty" (p.20). Ghadimi et al. (2014) add potential indicators for natural capital in referencing their case of West Virginia —fossil fuel energy resources such as coal stock and ecosystem services. Arif (2012), compares the natural capital assets and amenities between Vermont and West Virginia and observes, "Policy-makers must fully account for the economic benefits of natural landscapes—including those that stem from intangible use and enjoyment, and include this as a central part of the economic development equation" (Arif, p. 2). These natural and recreational amenities have shown to affect a region's ability to attract the talented and innovative thinkers of tomorrow. For this reason, one may consider the long-term effects the energy industry has on the landscape. Once the decision is made to transform the natural capital into either human or physical capital forms—a debt is left for future generations which cannot be reversed but must be compensated by sufficient increases in physical or human capital.

The Natural Resource Curse

Weinstein & Partridge (2011) state, "Generally, economists find that energy development is associated with small or even negative long-run impacts" (p. 1). Moreover, Weinstein & Partridge, give several examples of ERR's that are plagued by the 'natural resource curse' including Louisiana and West Virginia, and countries like Venezuela and Nigeria. Literature suggests resource abundant economies have comparatively slower economic growth and have

poor outcomes of development (Sachs & Warner, 1995; Auty, 1993). Other researchers have explored the relationships and suggested reasons for slow economic growth among natural resource abundant countries; e.g., corruption (Ades & Di Tella, 1999), "natural resource abundant countries overshooting their steady-state in terms of consumption and production" (Rodriguez & Sachs, 1999), the lack of human capital (Gylfason et. al, 1999), "resource abundance renders the export sectors uncompetitive and that as a consequence never pursued export-led growth" (Sachs & Warner 2001), and finally political and institutional driven explanations (Mehlum et. al., 2006). Much of the literature on the natural resource curse is based on economic models and lacks the insight needed to explore the additional dimensions seen impacting people and their communities resulting from the natural resource curse. There is more behind the natural resource curse than economics which cannot simply be explained by economic models. By digging deeper, the constructs of the natural resource curse may be revealed, e.g., culture, historical decision-making, and lack of human capital etc...

West Virginia's history of non-renewable resources. West Virginia and its counterparts of Appalachia have a rich historical 'energy culture'. However, as indicated by Ghadimi et al. (2014), "West Virginia reveals the irony of 'a rich region with poor people' typical of many rural energy rich regions" (Ch. 8, p. 116). Traditionally, West Virginia is seen as a 'coal state' and has remained an integral part of the West Virginia economy since its discovery in Boone County in 1742 (WVGES, 2013). In fact, from 1920 to 1950 the coal mining industry employed more people and invested more capital than any other industries in the state combined (Casto, 2004). Waples (2005) states, "West Virginia historians assert that the 'Little Mountain State' may have initiated the domestic petroleum industry months earlier in 1859 when the Rathbone Brothers began boring a salt well at Burning Springs Run near Little Kanawha" (p.

110). Salt water wells (for tanning leather) were dug by hand as early as 1779 in West Virginia and these brine wells would often lead to the ignition of natural gas during this time period. However, natural gas was seen as a waste product resulting from this process and was not considered to be a potential nor viable resource. Human innovation, technology, and the marketplace would need to evolve before natural gas could be considered a practical resource.

In referencing Figure 14, a few notable historical natural gas achievements in West Virginia include; (1) the discovery of oil and gas by salt well drillers in 1806, (2) new drilling methods invented by William Morris in Kanawha County in 1831, (3) the discovery of the Big Moses well in 1894 which was the first 100 million cubic foot well in the U.S., (4) the formation of Hope Natural Gas Company by Standard Oil interests in 1898, and (5) the discovery of 1930 Oriskany sand natural gas play which leads to a boom in West Virginia, central Pennsylvania, and New York. More recently, the increasing abundance of natural gas could be added to this historical energy continuum due to the expansion of hydraulic fracturing throughout the Marcellus and Utica shale formations.
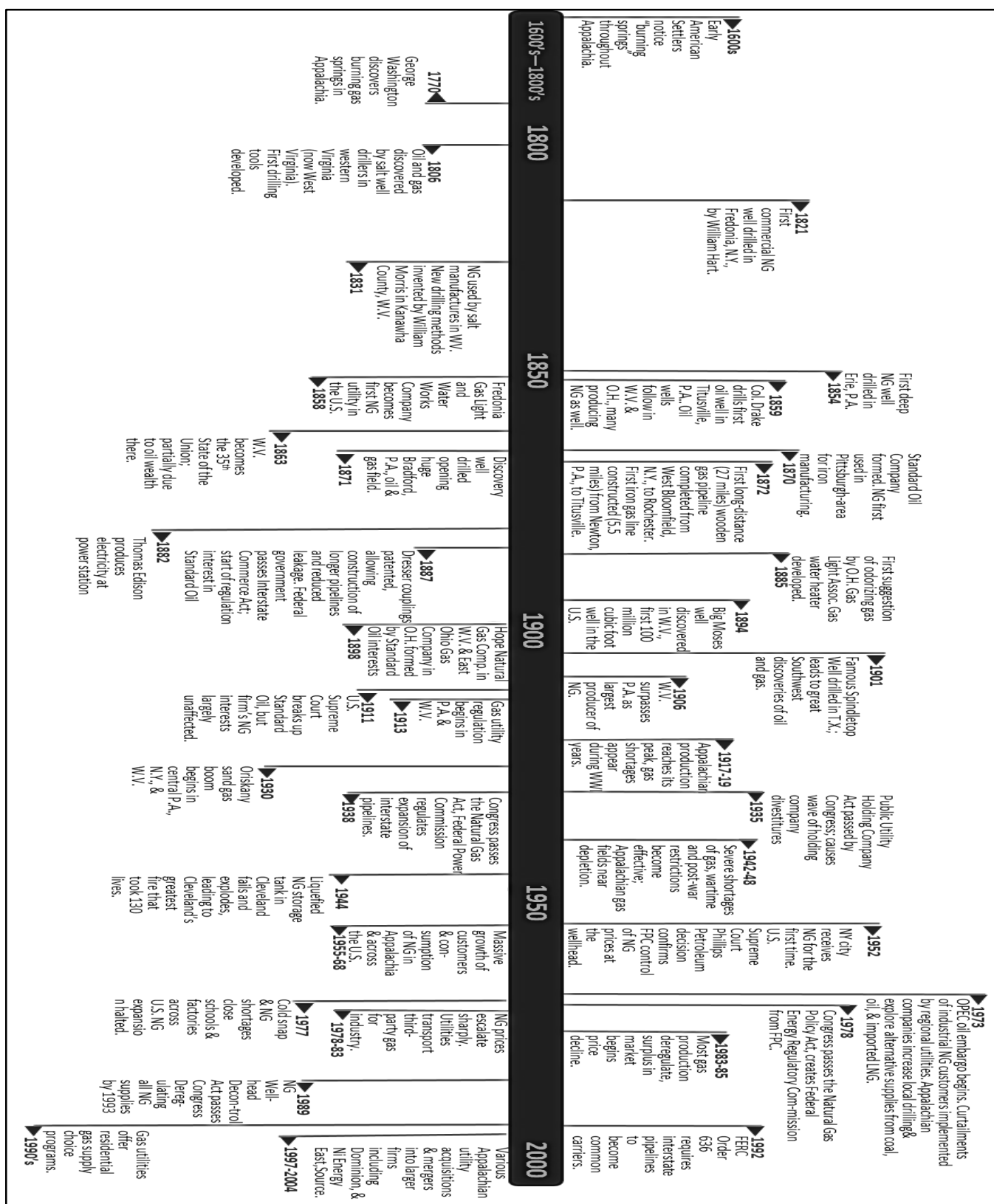
Figure 14. Appalachian Natural Gas History Timeline. Altered and adapted from Waples (2005).

Linking Moundsville's boom and bust development patterns to theory. Generally, typing the key words 'boom and bust' into a search field results with voluminous amounts of literature dedicated to market bubbles and or the economy. This play on words is typically for understanding the dynamics of neo-classical economics, which is essentially modern day economics where supply and demand are based on the assumptions that people will make rational choices to maximize utility and profit. Perhaps a change is in order for exploring boom and bust patterns in the context of sustainable development. Currently, the topic of boom and bust lacks the qualitative data needed to understand the wicked problems concerning the interplay of energy and sustainable development at the local level. A few alternative theories of boom and bust are professed in the following:

One such alternative theory of boom and bust development patterns can be traced back in readings examining ancient civilizations that collapsed such as the Western Roman Empire, Mayan, and Chacoan civilizations. Well known anthropologists Joseph Tainter (1988) explores such civilizations connecting the overwhelming evidence and the common principal concepts leading towards collapse:

> Human societies are problem-solving organizations; sociopolitical systems require energy for their maintenance; increased complexity carries with it increased costs per capita; and finally, investment in sociopolitical complexity as a problem-solving response often reaches a point of declining marginal returns. (Tainter, p. 194)

This theory of diminishing returns as it relates to the underpinnings of society raises many issues concerning sustainability. Society reaches a point where increasing complexity calls for increasing investments. This adds a perspective to this idea of a boom and bust pattern, although occurring over a period of centuries, where Tainter states, "What is perhaps most intriguing in the evolution of human societies is the regularity with which the pattern of increasing complexity

is interrupted by collapse—by episodes when societies change rapidly to a lower level of complexity". Tainter's idea of diminishing returns as it applies to society may relate to what we are observing in a short-term boom and bust development pattern. To clarify, the social phenomena of 'increasing complexity' over time is a type of 'boom' and the 'collapse' may be considered a type of 'bust'.

Another alternative theory of boom and bust may be revealed in the social phenomena of 'efficacy-performance spirals' (Lindsley, Brass, & Thomas, 1995). These spirals are defined as, "deviation-amplifying loops in which the positive, cyclic relationship between perceived efficacy and performance builds upon itself" (Lindsley et al., 1995). Lindsley et al. (1995) apply this concept through multilevel perspectives including individuals, groups, and organizations. "The advantage of a multilevel perspective lies in the recognition that individuals, groups, and organizations are not separate conceptual categories, but parts of a whole, each affecting and being affected by the other" (p. 647). "When considered over time, the cyclical nature of the efficacy-performance relationship suggests three possible patterns: (1) self-correcting cycle, (2) upward spiral, and finally, (3) downward spiral" (p. 650). Lindsley et al. (1995) suggest fifteen propositions for guiding future research by identifying the "factors affecting the occurrence, continuation, and stopping of spiral". Linsley et al. (1995) posit the results from an upward spiral ending (*bust*), is "more problematic" than halting an upward spiral (*boom*) stating:

> Because the causes of success during an upward spiral may not be well understood, actors are left without the tools to correct for the initial failure once the spiral is stopped. Thus, it is likely that the initial failure after stopping an upward spiral will be followed by another failure. Without the ability to self-correct, upward spirals are more likely to be followed by downward spirals than by self-correcting cycles. (pp. 661-662)

Concluding, Linsley et al. (1995) theorize, "The cyclic nature of the efficacy-performance relationship may be a critical link to understanding and managing the factors that have an impact

on the performance of individuals, groups, and organizations, and thus, their self-regulation" (p.

672).

 The last alternative theory in exploring boom and bust seems the most relevant in

exploring Moundsville in the context of natural resource dependent communities and the socio-

economic influences typically associated in such communities. Malamud (1984) explores this

perspective in his thesis and later in his book called "Boomtown Communities". Malamud builds

upon previous boomtown research, and provides a comprehensive perspective on the rise and fall

of communities throughout the world dependent on mining especially in gold, coal, and oil.

Malamud (1984) calls this rise and fall phenomenon, 'boomtown syndrome'. Much of

Malamud's work is built upon the work of Gilmore (1976) who created the "Gilmore's Problem

Triangle" which represents the boomtown model seen in Figure 15.

> Gilmore's boomtown model includes the local services (public) and the basic
> (private) sectors. They are in equilibrium before the boom. The community's
> residents determine the extent to which they are willing to pay for local services
> and therefore, the quality of those services. When the energy boom suddenly
> begins to pump vast sums of money into the basic service sector, the town's
> population must increase in order to fill the new jobs and the local service sector
> must expand as rapidly to keep the town's quality of life intact. (Malamud, 1984,
> p. 6)
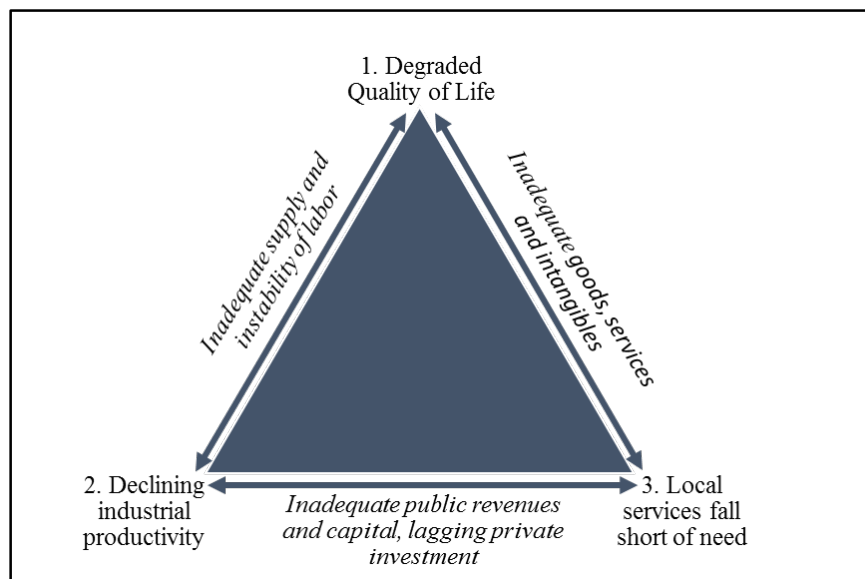
Figure 15. Gilmore's Problem Triangle. Adapted from Gilmore (1976).

Gilmore (1976) and other researchers consider an impacted community a boomtown if it experiences a population growth rate exceeding 15% annually. In addition, Gilmore states there are four main phases of attitudes for the local elected officials and citizens of the community dealing with the effects of boomtown growth; (1) enthusiasm, (2) uncertainty, (3) near panic, and (4) adaptation. Unlike Gilmore, Malamud believes towns, states, and industry should play the major role in managing boomtown communities instead of the federal government.

Freudenberg (1992), discusses the social impacts on resource dependent communities in over specializing or what he calls 'overadaptation'. Freudenberg states, "While overadaptation may happen in response to virtually any activity, the potential is particularly evident for rural communities that become heavily dependent on, or too closely adapted to, large scale extractive industries" (p. 10). Furthermore, Freudenberg lists four 'noteworthy' factors leading to overadaptation which are (1) anticipation of duration of development; (2) ongoing duration of prosperity; (3) level of prosperity; and (4) rate of evolution and specialization. The interplay of these factors results in "industries effectively taking over local economies—absorbing and committing local resources and potentially reshaping the entire physical and social environment of the area, in a fashion that can leave it less able to adapt to other opportunities in the future" (p.16).

Hydraulic fracturing. To be more informed of the constructs occurring in the previous described theories, it is important have a general understanding of latest technological phenomenon and hydraulic fracturing processes taking place throughout Moundsville and Marshall County. In referencing Freudenberg's theory of "overadapting", it is understandable how this theory may be conceived when observing the vast resources and investments needed for hydraulic fracturing. The investments added to the finite energy system are not only made by

private oil and gas companies; but by community, county, and state decision makers—which

sends ripples of impacts throughout the environment, society, and the economy.

The EIA defines hydraulic fracturing as, "a technique in which water, chemicals, and

sand are pumped into a well to unlock the hydrocarbons trapped in shale formations by opening

cracks in the rock and allowing natural gas to flow from the shale into the well" (EIA, 2012).

This process is commonly used in conjunction with horizontal drilling allowing access to

deposits that were once not possible. Although the technology of hydraulic fracturing has been

around commercially since the 1940's, it was not until recently at the beginning of the 21st

century that horizontal drilling combined with hydraulic fracturing became prevalent and

economically viable.
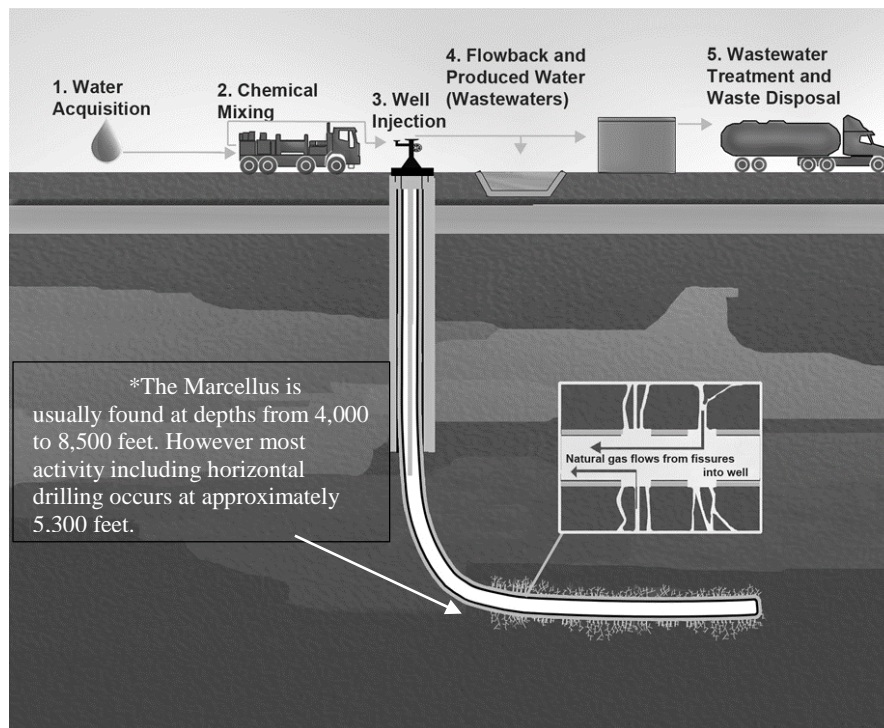
Figure 16. The Process of Hydraulic Fracturing. Altered image with caption and arrow. Adapted
from http://www2.epa.gov/hfstudy/hydraulic-fracturing-water-cycle.

In the West Virginia Department of Environmental Protection (WVDEP) report entitled

State of the Environment 4th edition, the agency states, "Since January 1, 2006, the Department

of Environmental Protection has issued over 1,200 permits for Marcellus drilling" (2011). The earliest documented natural gas well drilled into the Marcellus shale play was in Roane County permitted in November, 2001 and completed in June, 2002 (WVGES).

Before any drilling begins, a gas lease is signed between the landowner and the energy company granting exploration and development rights to subsurface oil and gas deposits. Landowners are encouraged to have these contracts reviewed before signing over both surface access and mineral rights.

The regulation of oil and gas wells are primarily overseen by the state and therefore rules, taxing/fee schemes, setbacks etc… vary from state to state. The Department of Environmental Protection (DEP) Office of Oil and Gas are responsible for establishing rules and regulating the construction of every well in West Virginia. The DEP reviews all gas well permit applications and conduct inspections before, during, and post construction. Furthermore, gas companies are required to post a bond with DEP to guarantee plugging and or reclamation of the site. Although these rules and regulations primarily focus on protecting water quality and preventing pollution, drilling companies currently are not subject to the same environmental standards, such as the Clean Water Act, or the Safe Drinking Water Act since the Energy Bill of 2005 was passed by Congress—commonly referred to as the 'Halliburton Loophole'.

The process for drilling a gas well can range from 2-8 weeks, but can be even longer. During this time, depending on the well size and location, a substantial amount of land may be disturbed. If the well is productive, the well head, meters, and tanks will remain on site. If it is not productive, the well will need to be plugged in accordance with state regulations.

Although there may be many economical and even environmental benefits proclaimed by the oil and gas industry, there is a movement of concerned citizens decrying some of the

externalities associated with choosing this path, which highlights the concept of "wicked
problems".

"Wicked" Human Problems

Rittel and Webber remain the most influential in exploring wicked problems. Through
their work they have characterized such problems as 'ill-defined' or 'unstructured' in contrast to
'tame' or 'well-structured' problems that engineers and scientists typically encounter. Rittel and
Webber (1973) state, "There is no definitive formulation of a wicked problem" and "the
information needed to understand the problem depends upon one's idea for solving it" (p. 161).
Therefore, "The formulation of the wicked problem is the problem" (p. 161). "Because there are
no criteria for sufficient understanding and because there are no ends to the causal chains that
link interacting open systems," the designer can only try to find a better solution.

Ritchey (2013) builds upon the work of Rittel & Webber's definition states, "Above all,
wicked problems won't keep still: they are sets of complex, interacting issues evolving in a
dynamic social context. Often, new forms of wicked problems emerge as a result of trying to
understand and treat one of them" (p. 2).

Banathy (1996) claims, "In the design world of wicked problems, the aim is not to find
the truth but to design systems that enhance human betterment and improve human quality" (p.
31). As cited in Banathy (1996), Rittel and Webber state, "Solutions to design problems are good
or bad. They are not true or false. Judgments of 'goodness of fit' of the solution may vary
depending on people's interest, values, and perspectives" (p. 31).

Cherry (1999), discusses the wicked problems from the context of an architectural
programmer stating, "While we may not be able to solve them, the awareness can make our
activities more effective." Furthermore, Cherry professes that a wicked problem is dependent on

the value system of the individual. "Wicked problems have a right solution only from one point

of view. When an individual is in a decision-making role, the solution that seems right to that

individual will be the one that supports his or her value system."

      Iterative design solutions. One such solution for designers in exploring wicked

problems is through the 'systemic' (Banathy, 1996) approach. Contrast this from the 'systematic'

approach that is linear or one-directional, the systemic approach "relates to the dynamic

interaction of parts from which the integrity of wholeness of the system emerges" but it also

"recognizes the unique nature of each and every system" (Banathy, 1996, p. 57). Academia

points out society continually tries to solve wicked problems using the same technique they

apply to linear problems or tame problems and expect one right and one wrong answer. Banathy

(1996), states, "This paradigm is not applicable to open social systems. They often approach

problems in social systems the way scientists do their tame problems" (p. 30).

      Banathy (1996) states, "Design is a creative, disciplined, and decision-oriented inquiry,

carried out in iterative cycles" (p. 16).

> The design process is not linear, sequential, or systematic. Design manifests
> dynamic interaction between feedback and feed forward, reflection and creation,
> and divergence and convergence. This dynamic process goes on until we develop
> confidence in the viability of one of the solution alternatives. (Banathy, 1996, p.
> 17)

Banathy (1996) states from a systems perspective there are two general solutions when we

realize that something is not working and we need to engage in the design process. (1) A solution

that focuses on "changing within the system, which are accomplished by adjustment or

improvement". (2) In the case where "our purposes are not viable anymore and our system is out

of sync with the environment in which it is embedded" then there is the option to change the

whole system. In this case, the feedback received calls for change to the system as a whole.

When changing a system, an iterative design solution process is employed that is "guided by self-regulation" (Banathy, 1996, p. 49).

     Programming. "Programming is the systematic search involving gathering, organizing, and interpreting information that is relevant to a project" (Dickinson & Marsden, 2009, p. 12-13). Pena & Focke (1969) present a five step format for programmers in the context of these determinants which includes; (1) establish goals, (2) collect and analyze, (3) uncover and test concepts, (4) determine needs, and (5) state the problem. This systematic format is in wide use even today and may be provide direction for communities looking to change their community from a boom and bust development pattern towards a more sustainable development pattern.

     The results in conducting this literature review process, reveals a broad range of theories, definitions, and potential constructs that should be considered for improving an energy system based on finite resources towards a system of regional diversity. Although the constructs discussed here may not be an exhaustive list of topics, it does reveal the complexity involved in considering the theory of sustaining total capital stock by converting natural capital to the more sustainable forms of human and physical capital. Furthermore, although this conversion model is an ideal option for reaching a more sustainable system, it is not without its limitations which is revealed under the overarching topic of wicked problems. To this point, before a community may even consider moving towards a more sustainable system, the human-will to change must be informed by an iterative design process which may improve post-resource outcomes. Finally, in linking theory to action, a first practical step may be the development of a programming guide for communities ready for change.

Chapter III

Methodology and Procedure

The following presents the research design chosen for the case study of Moundsville. This case study design utilizes the recommended practices for case study design by Yin (2003). Furthermore, to add a greater consistency to the case study design, a mixed methods approach is employed combining both qualitative and quantitative data for enabling a more comprehensive and systematic case study. One such tool for supporting the analysis process includes the ERR Template—which not only informs the relevant theory at hand, but also informs the open coding process of the city council minutes and exploring the Moundsville Knowledge Base with the support of the qualitative data software program MAXQDA. The participant observation activities involving the Community Design Team are discussed which enhances the researcher's ability to gain first-hand accounts of the community's sense of place, challenges they are facing, and to observe any effects the oil and natural gas industry may be having on the community. Finally, the researcher addresses strategies for maintaining reliability and credibility throughout the case.

Case Study Design

Yin (2003) defines a case study as "an empirical inquiry that investigates a contemporary phenomenon within a real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 13), where: "(1) how or why questions are being posed and (2) the investigator has little control over events" (p. 1). It is common to conduct a case study in the fields of psychology, sociology, political science, social work, business, and community planning.

Yin (2003) suggests five components in conducting a case study. These components include (1) research questions, (2) propositions, (3) unit of analysis, (4) logic linking the data to the propositions, and (5) criteria for interpreting the findings. The following is a brief definition of these components and their descriptions as applicable to the case study of Moundsville.

Study questions. The case study strategy is most likely to be appropriate for how and why questions, so the initial task is to clarify precisely the nature of the researcher's study questions in this regard. Initially, case study questions are deductively produced. The main overarching question—is the natural capital (natural gas) being converted effectively to the reproducible forms of human and physical capitals to avoid the boom and bust cycles of the past? If not, then what are the barriers hindering progress towards a more sustainable and diversified future? Accompanying this overarching question are many granular questions which can be explored in the ERR Template (Appendix A) which contains potential indicators for exploring sustainability through natural, human and physical capital.

Propositions. A proposition is something that should be examined within the scope of the study. The more a study contains specific propositions, the more it will stay within feasible limits. West Virginia is a typical ERR exhibiting a diverse and extensive prior development pattern of boom and bust in timber, coal, oil, and in recent years, a boom in natural gas. This development pattern suggests the need for implementing sustainable development strategies. The theory put forth is—if the natural capital is converted effectively or responsibly—then a community historically dependent on natural resources, should be able to transition to a more sustainable and prosperous community.

Unit of analysis. Yin (2003) states this should be more concrete and not as abstract. The researcher needs to define a specific, real-life case to represent the abstraction and define specific time boundaries for the beginning and ending of the case. This case study explores briefly the past development patterns to gain a further understanding of the 'energy culture' in the region, and in greater detail the pre-boom and most current boom in natural gas specific to Moundsville, in Marshall County. It should be noted, that although the focus is on the community of Moundsville, much of the actual process for hydraulic fracturing occurs throughout Marshall County and therefore should be included in observing the development patterns where data may not be as accessible at the community scale. The time period of most interest will be pre-boom data from approximately 2006-2008 and the current boom continuing from 2008 to 2012.

Logic linking the data to the propositions. Yin (2003) suggests several options for logic linking the data to the propositions: (1) pattern matching (describe several potential patterns, then compare the case study data to the patterns and see which is closer); (2) explanation building (mostly occurs in narrative form which stipulates a presumed set of causal links that are similar to an independent variable in a rival explanation); (3) time-series analysis (asking how and why questions about relationships over time which could be simple, complex, or chronological); (4) logic models (events are observed in repeated cause and effect patterns); and (5) cross-case synthesis (contain at least two cases, but are each treated as separate cases while observing cross-case patterns). The case of Moundsville primarily utilizes a time series analysis through chronological order. However, pattern matching and explanation building were utilized in combination with a time series analysis method for linking data to the proposition.

Criteria for interpreting the findings. The most common technique in case studies is to identify and address rival explanations for the findings, but alternative techniques could include addressing the most significant aspect of the case study and/or utilizing prior expert knowledge. The criteria for interpreting the findings in the case of Moundsville is first addressing the most significant aspect of the case and then utilizing previous expert knowledge from the literature review delimitations process. The theories and observations from previous research as discussed during the literature review—may provide insight to the rival or similar explanations.

Procedure

A mixed methods approach (Creswell, 2003) to this case study design is employed by combining qualitative and quantitative data for investigating the research inquiries. Figure 17 illustrates the process for applying a mixed methods approach created uniquely for this case study. Creswell (2003) states there are three general strategies to a mixed methods approach; sequential, concurrent, and transformative procedures (p. 16). For the purpose in conducting the case of Moundsville, a transformative procedure will be employed. A transformative procedure is defined as:

> A procedure, in which the researcher uses a theoretical lens as an overarching perspective within a design that contains both quantitative and qualitative data. This lens provides a framework for topics of interest, methods for collecting data, and outcomes or changes anticipated by the study. (Creswell, 2003, p. 16)
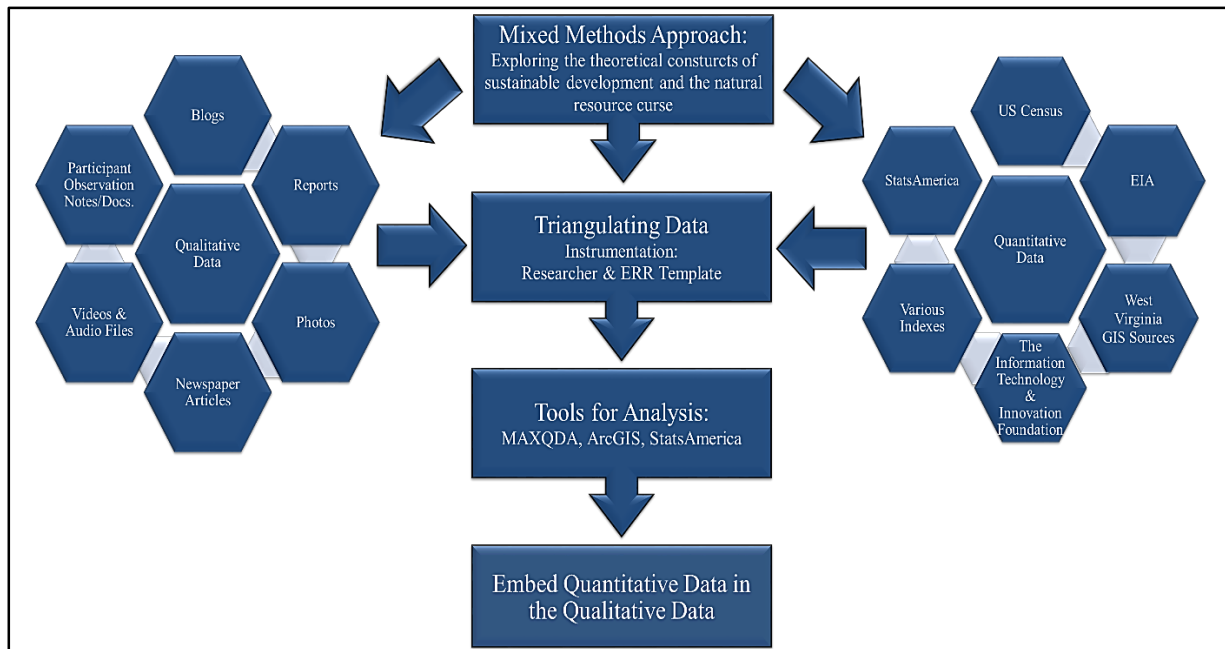
Figure 17. Mixed Methods Approach Process for the Case of Moundsville.

Triangulating data and instrumentation. In referencing Figure 17, a triangulation

technique is used for gathering and analyzing data sources. Jick (1979) defines triangulation as a

means for seeking convergence across qualitative and quantitative methods. Essentially, the

triangulating technique provides results where one method can help develop or inform another

method. In addition, triangulation may be used when two or more methods are employed for

observing similar results—which may add strength for what is being observed versus only using

one method. In the case of Moundsville, by converging quantitative data and methods (expressed

through general numbers and descriptive statistics) with qualitative data and methods (expressed

through language and pictures) enhances the analysis portion of the case study.

It's critical to note, there are two main instruments used in conducting the case of

Moundsville: (1) the researcher and (2) the ERR template. The ERR template is particularly

important because this informs the three primary methods used throughout the case: (1)

participant observation activities with the Community Design Team; (2) conducting an open

coding process for observing seven years of city council minutes with the assistance of

MAXQDA; (3) collecting secondary sourced data from the EIA, US Census and knowledge base

tools such as StatsAmerica and ArcGIS. The data collected from these methods are then placed

in the Moundsville Knowledge Base for further analysis.

   Participant observation activities with the Community Design Team (CDT). Field

procedures are highly dependent on researcher's observations. The method chosen as a

participant observer is led by naturalistic inquiry. "Evaluators attempt to study activities and

programs in a natural setting without the manipulation or planning by the evaluator" (Patton,

1987). Patton (1987) states, "To understand fully the complexities of many program situations,

direct participation in and observation of the program may be the best method" (p. 12). As a

participant observer, "the most distinctive opportunity is related to one's ability to gain access to

events or groups that are otherwise inaccessible to scientific investigation. The researcher has the

ability to perceive reality from the viewpoint of someone inside the case study rather than

external to it" (Patton, 1987).

   The case of Moundsville is a collaborative effort with the West Virginia University

Community Design Team (CDT). The CDT of West Virginia University Davis College started in

1997 and has worked with over forty-five communities in West Virginia. The CDT's goal is to

assist communities in designing and planning a vision for the future using a "community-

centered design" (CDT, 2013). This is primarily conducted by bringing a community together

via implementation of a proposed project, design, and or potential funding proposal. Ultimately,

the hopes are to increase citizen participation to foster a vibrant local culture led by community

leaders.

   Recognizing this opportunity and acting as a participant observer allows a glimpse into

the Moundsville citizens' lives, thus fostering a sense of place throughout the research process.

In September of 2012, a pre-visit consisting of CDT members and graduate students from the

Department of Public Administration arrived and began to conduct research. This group focuses

on the many different aspects found at the community level, including the economy,

transportation, tourism, public services, zoning, green space, etc… The team met with a variety

of community officials such as the city manager, chief of police, zoning manager, and several

council members. Furthermore, the pre-visit provided a general overview of the community

including a tour given by city officials and active community members. A brief view was

provided showing the impacts from the natural gas industry on the community such as camp

sites, campers, portable toilets, and land disputes.

In October, 2012, a more official visit titled "Unifying Moundsville: Unlocking Our

Future," occurred. This extended trip's purpose consisted of developing a comprehensive plan

for the community with fellow colleagues and the citizens of Moundsville. This experience

provided a more holistic perspective of the community due to the additional interaction with

citizens from a broad range of demographics including teenagers, city officials, working adults,

and retirees. In addition, a family graciously volunteered their home and time providing a more

enriched and engaging setting to learn about Moundsville from their family's perspective. The

ultimate objective for this CDT's trip was to assist the citizens of Moundsville for realizing their

community's potential, thus allowing citizens to take an active role in their community's future.

After this experience, final reports were submitted in November, 2012. More recently, this

engagement process lead to updating the community's comprehensive plan in July of 2014—the

first update of its kind since 1972.

Open coding seven years of city council minutes using MAXQDA. The ERR template

informs the researcher for conducting the open coding process for the Moundsville city council

minutes with the assistance of the qualitative data software program MAXQDA. MAXQDA

supports the researcher by exploring the city council minutes which reveals emerging themes.

This process begins by (1) collecting text, pdfs, and/or images; (2) organizing the data into

document groups—by year in this case; and finally, (3) using an open coding system, the

researcher inductively deciphers the data exploring patterns and links between the codes and the

data itself.

      Data collecting from secondary sources. In collecting data from secondary sources, the

ERR template informs the relevant data sources for exploring sustainability through the inclusive

wealth forms of human, physical, and natural capital. Much of the data can be retrieved from the

U.S. Census, West Virginia Geologic and Economic Survey (WVGES), the Energy Information

Administration (EIA) and from knowledge base tools such as StatsAmerica and the software

spatial analysis and mapping program ArcGIS.

      Tools for analyzing the Moundsville knowledge base. After completing these previous

data collecting methods, the data is organized in the Moundsville Knowledge Base. This serves

three main functions: (1) improves the case study's reliability by serving as the case study

protocol (Yin, 2003); (2) provides guidance for exploring and analyzing the constructs of a

community located in an ERR; and most importantly (3) links the data from the ERR template to

the community's sustainable development patterns via inclusive wealth forms which may assist

future decision makers for avoiding boom and bust development patterns.

      The 'Moundsville Knowledge Base' consists of categories, sub-categories, and data items

for purposes in refining the constructs that play a role in the theory (Figure 18). In this

knowledge base, there are three main categories explored; (1) General Profile, (2) Stakeholders,

and (3) Community Wealth.

In referencing the mixed methods approach process, there are three primary tools for analyzing the Moundsville Knowledge Base. (1) ArcGIS- the data sets (shape files) alone from such sources as the WVGES provide a wealth of information including quantitative data on permitted wells, completed wells, cancelled wells, company name, property owner, production etc. This data can then be layers on state and or county maps for observing any spatial patterns. (2)MAXQDA- There are several options MAXQDA has for analyzing qualitative data including 'code matrix browser', 'code relations browser' and 'document portraits'. Other tools assisting the researcher are the 'MaxDictio' and the'Mixed Methods' functions. These assist in quantitative content analysis including word frequencies, variable analysis, crosstabs, and quote matrix. (3) Finally, there are several free knowledge base tools that retrieve secondary sourced data, e.g., U.S. Census, U.S. Bureau of Labor Statistics, that provide options for exploring data differently. One such site for locating such tools is StatsAmerica.org where a suite of tools and information may be employed for analyzing data regionally, including the Innovation Index, Counties in Profile, and Industry Clusters.
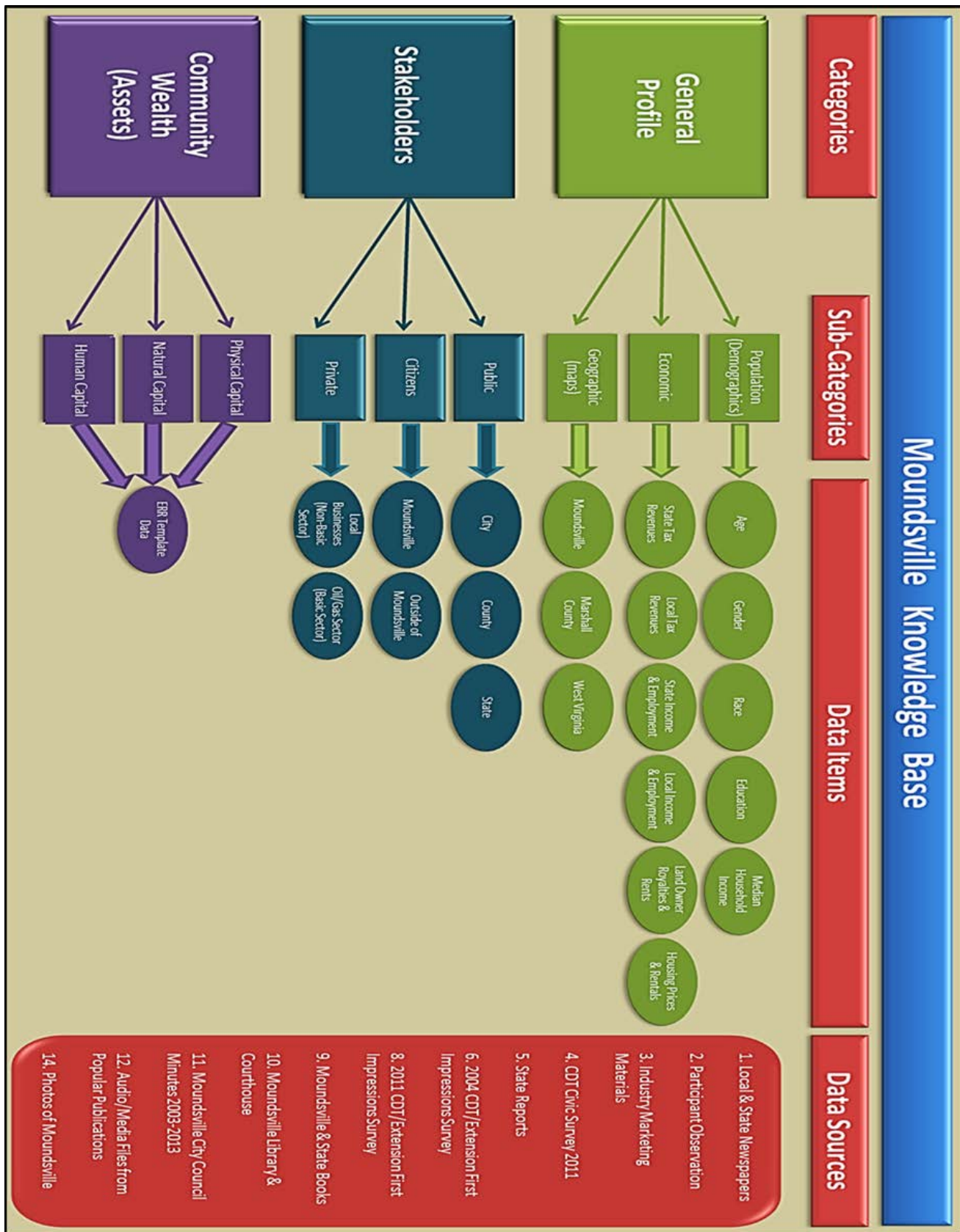
Figure 18. Moundsville Knowledge Base

Embed quantitative data into qualitative data. Finally, the last part of the procedure in the mixed methods approach is embedding the quantitative data into the qualitative data. Much of the data collected throughout this case is of qualitative nature. By combining both quantitative and qualitative results improves the strength of observation (Creswell, 2003). Throughout this process, there have been multiple methods employed which have informed other methods and may reveal similar results (previously identified as triangulation). This is the end product of the procedure where the qualitative results are enhanced by the quantitative results as presented in Ch. IV.

Reliability and Credibility

Lincoln and Guba (1985) suggest the trustworthiness of a qualitative study is important to evaluating its worth. This involves establishing (1) credibility, (2) transferability, (3) dependability, and (4) confirmability. The following provides techniques that were utilized in conducting this case study.

"Validity, in qualitative methods hinges to a great extent on the skill, competence, and rigor of the evaluator because the observer is the instrument" (Patton, 1987, p. 12). "The most common strategy to control for bias in qualitative studies is reflexivity" (Ary, Jacobs, Sorensen, 2010, p. 501). A researcher should be unbiased by preconceived notions, including those derived from theory. Thus, the researcher should be sensitive and responsive. Recognizing and actively seeking researcher bias throughout the data gathering process will support efforts in maintaining reliability and improves the construct validity of the case. Credibility is improved by having multiple sources of empirical evidence and using a mixed method approach to the case study design (triangulation). One such method utilized (participant observation) assists in establishing

credibility of this case study. The observations from this experience were recorded through notes and journal while visiting Moundsville.

An effort for improving the reliability and credibility during the data collection phase of this case study involves the creation of a case study protocol as recommended by Yin (2003) and the creation of the 'Moundsville Knowledge Base'. The protocol should contain the following:

1. An overview of the case study project including background information about the project, the substantive issues being investigated, and the relevant readings about the issues;
2. Field procedures;
3. Case study questions;
4. A guide for the case study report (pp. 84-85).

This allows a researcher to see and thoroughly process the many stages in conducting a case study and creates a more systematic case.

The use of the qualitative data software MAXQDA supports the researcher in addressing the internal validity specifically during the data analysis portion of the case by allowing one to inductively explore the data during open coding 'grounded theory' (Glaser & Strauss, 1967)— developing theory from the data itself.

The transferability of this case study is described in rich detail for potentially replicating this framework for future case studies involving similar communities within energy rich regions. Furthermore, for improving the dependability of the instrument, the ERR template was previously tested in a classroom setting and expert feedback was provided.

Chapter IV

Analysis and Findings

The main purpose of this case study is to explore sustainability through the inclusive wealth forms of natural, physical, and human capital and to determine whether natural capital is being adequately and sufficiently converted to physical and human capital so that 'wealth'— which is total of all three assets, does not decline over time. The previous literature review suggests, if the 'wealth' or total capital stock is not declining, then this would seem to suggest the community of Moundsville is on a more sustainable path.

The following findings begin with an overview of the community wealth and then moves into the capital forms that make up this wealth. Next, a qualitative review of these capital forms enriched with quantitative support from secondary sources and knowledge base tools is provided. Furthermore, throughout this case study findings are the open coding results from the MAXQDA which reveals additional dimensions to these capital forms including a community's efficacy and how this additional dimension ultimately may hinder a community's ability to avoid a boom and bust development pattern. Finally, a brief discussion is needed for linking the previous literature to the findings observed here.

Community Wealth (Assets)

Located along the Ohio River in West Virginia's Northern Panhandle, Moundsville serves as the county seat for Marshall County. Moundsville is named after the largest conical burial mound in the United States, Grave Creek Mound. It was built by the Adena culture approximately 2000 years ago.

Figure 19. The Community of Moundsville. Kiger, B. (Photographer), 2012.

Visiting the community, one may be surprised by the available wealth of community

assets that would be expected from a typical "small rural town" in West Virginia. The

community has a great historical significance—not only from an energy perspective, but in

industry/manufacturing (Fostoria Glass Factory, United States Stamping Factory, Fokker

Aircraft, Louis Marx Toy Factory), home to the West Virginia Penitentiary (Appendix C), and

even some notable beautiful interior and exterior architecture, e.g., the Strand Theater (still in use

today) (Appendix C). The main industries in Marshall County include health care, mining, local

government, manufacturing, and retail. The largest employer is Consolidation Coal

Company(CONSOL Energy), but other major employers included Ohio Power Company,

Marshall County Board of Education, Reynolds Memorial Hospital Inc., PPG Industries, Wal-

Mart, and Williams Energy . However, similar to many other smaller communities throughout

the Appalachia region—Moundsville is experiencing a development pattern of boom and bust

from the 'natural resource curse'. Although, the most recent boom in natural gas is bringing

wealth to the community, it is a critical time for implementing sustainable development

strategies through informed decision making by community leaders. Reiterating, the overarching

inquiry here—is the Moundsville community converting the natural wealth (natural gas) to the

reproducible forms of human and physical capital towards a more sustainable and prosperous

future?

Figure 20. Grave Creek Mound. Kiger, B. (Photographer), 2012.

After inductively coding seven years of city council minutes for Moundsville and then

aggregating these codes into the three main forms of wealth, the assets coded most often are

revealed. It should be noted, a number of sub-codes that appeared fewer than 10 times were

aggregated into the code's parent code for simplifying the coding system. For example, if the

sub-code 'murder' is coded only 3 times, then the segments coded under 'murder' would be

aggregated into the 'murder's' parent code 'crime and death'. This task of coding is made more

systematic and consistent with the assistance of the qualitative data analysis software

MAXQDA. The complete list of 112 codes and sub-codes can be found in Appendix C including

the percent frequency and number of documents for each particular parent code and sub-code.

Table 3

MAXQDA Aggregate Codes for Moundsville City Council Minutes, 2006-2012

Aggregate Code	Activated Coded Segments	Activated Coded Segments %
Positive	493	4.6
Negative	874	8.1
Human Capital	5914	54.6
Physical Capital	3214	29.7
Natural Capital	346	3.2
Total	10841	100

The open coding process is informed by key definitions of natural, physical, and human

capital derived from the ERR template. An assumption is made that greater frequency of

discussions or key words positively correlates with importance and/or are a higher priority. The

results in Table 3 reveal discussions involving natural capital comprised approximately 3% of

the total coded segments. Considering the increase in natural gas activity throughout the county,

the result is counterintuitive—one would expect a greater frequency for natural capital. In

addition, there are times where a particular capital may have poor efficacy, or in other words, not

all human capital is necessarily 'positive'. This became more evident while coding, hence a

dimension of efficacy was added to these capital forms. For example, for each code there may be

a sense of emotion attached such as 'negative' which is apparent in the following example:

> * Councilperson Remke asked what can be done about the buildings with boarded windows or windows falling out? Windows above Ken Blake Photography are broken and falling out; windows at 301 Jefferson Avenue, above Dr. Gresak's Office are falling out and the large window at Cottage Corner, 273 Jefferson Avenue, has been boarded up for a very long time. Councilperson Remke would like to revise the city code to enforce building owners to replace windows with glass. Building Inspector Schneider advised the owners of the building the windows must be replaced.

(CityCouncilMinutes2012\2-07-2012: 415-526)

This segment is coded as the parent codes of both human and physical capital, with sub-codes of negative, small business, policy, and dilapidated structures. In the above example, clearly there is an issue with a dilapidated structure and the council would like the structure to be fixed after years of neglect. In this particular example, it is assumed a dilapidated structure has a negative efficacy dimension of human capital for the community.

The following results are broken into three sections beginning with natural capital and then moving into physical capital and finally human capital. The reader can expect a pie chart at the beginning of each section illustrating the percent frequency of sub-codes for each inclusive wealth form.

Natural Capital
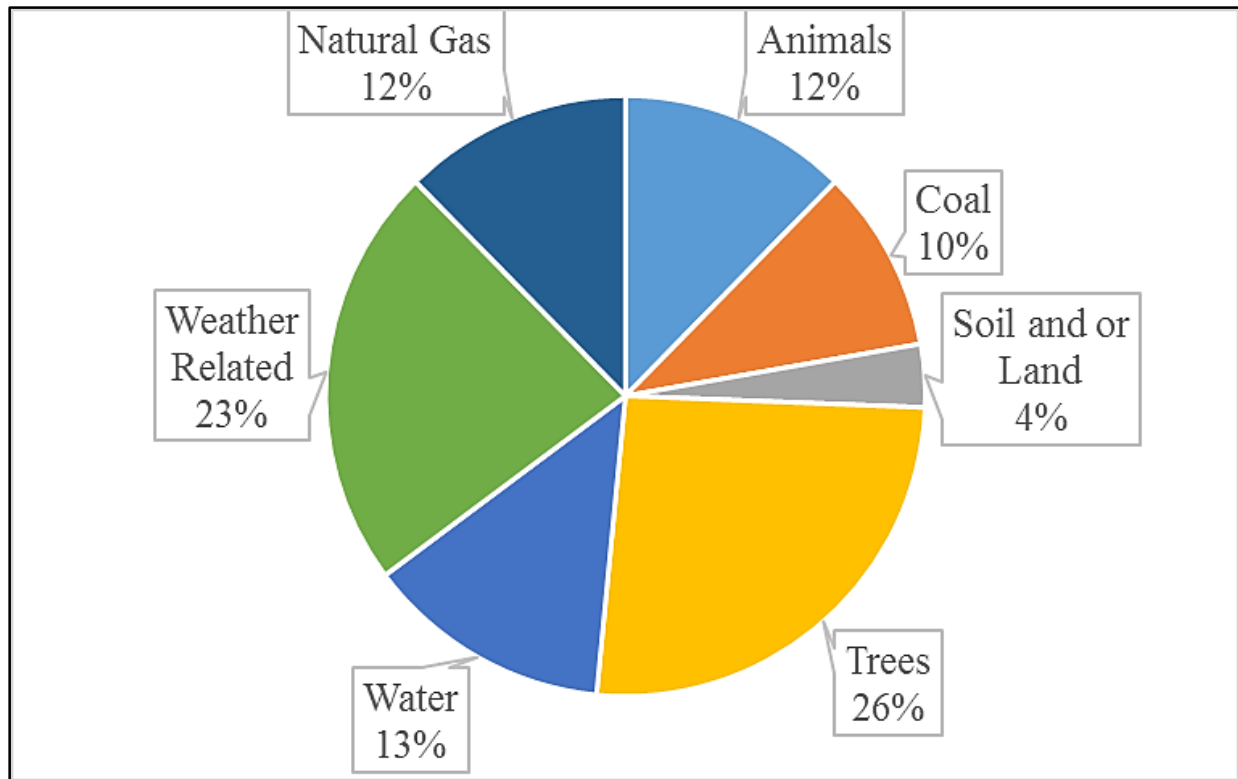
Figure 21. MAXQDA Results Total Percent Proportion of Natural Capital with Primary Sub-codes.

The process for coding natural capital is informed via the potential indicators from the

ERR Template. As previous literature reveals, natural capital most commonly refers to anything

that is mined from the ground, but may also include water, trees, weather, and the eco-services

provided from these natural elements. Figure 21 shows 'Trees' and 'Weather Related' were

coded most often for natural capital. This is primarily due to weather effects on many of the

operations of city including cleaning roads and sidewalks, but also, flooding has been an issue

for the community and most often fallen trees and debris are having to be cleaned-up and/or

maintained. In addition, it may be important to observe by aggregating the sub-codes of natural

gas and coal would reveal discussions revolving around coal and natural gas are quite common.

In observing the natural capital in the Moundsville Community Knowledge-Base, the first documented case of permitting in the Marshall County specific to the Marcellus Shale was used as a baseline. June, 2006 was observed as the first gas well with a drilling completion date of November, 2006. Generally, this documents the pre-boom stage and current boom. Figure 22 references the permitting which lends support for distinguishing between these two periods—pre-boom and current boom. The largest percentage jump for permitting is 525% between years 2010 and 2011. There is a decrease of 38% between the years of 2012 and 2013, but this is more than likely due to an incomplete data set. The last recorded permitted well for this data set ended in June of 2013, thus only allowing half a year of permitting data.

Understanding the past timeline of permitting events informs the most relevant years for analyzing the Moundsville city council minutes. This shortens the time period under most critical observation of 2006-2012 in which one would expect an increase in discussion activity relating to natural gas among stakeholders specifically between public representatives and citizens of Moundsville. Furthermore, in referencing Figure 22, one would expect an even greater frequency of discussions as it relates to natural gas between the years 2010 and 2011.
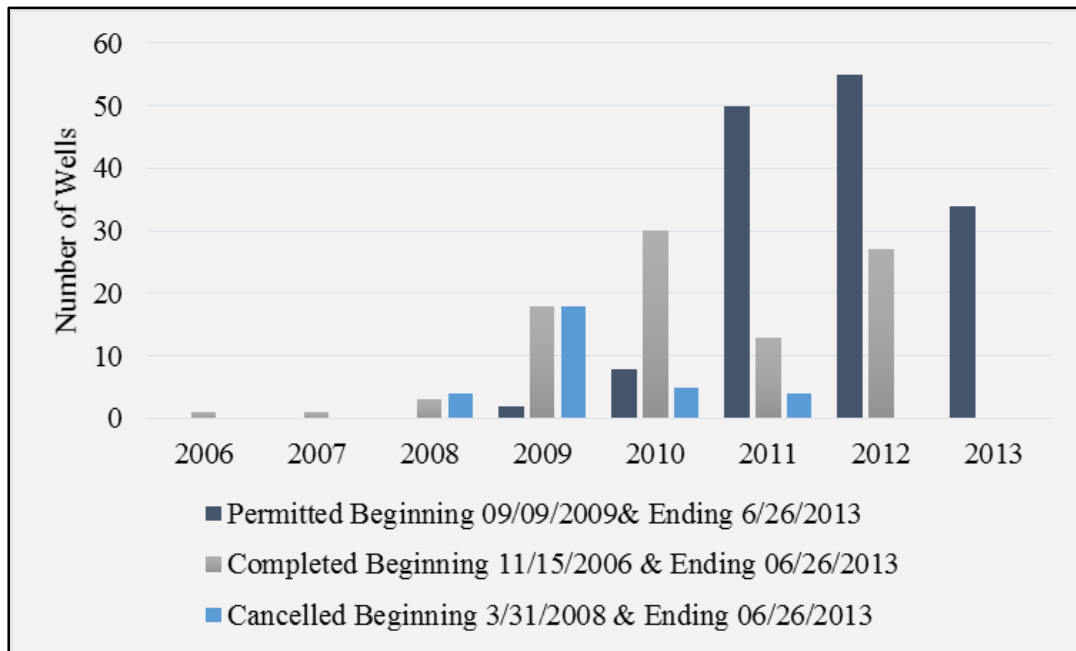
Figure 22. Historical Natural Gas Activity for Marshall County. Data retrieved from WVGES.

As of 2013, Marshall County total gas production was 68,468,821 Mcf and in 2006 it was only 376,895 Mcf (Figure 23). This places Marshall County as the 4th most producing county in West Virginia behind Harrison, Wetzel, and Doddridge counties in that order.
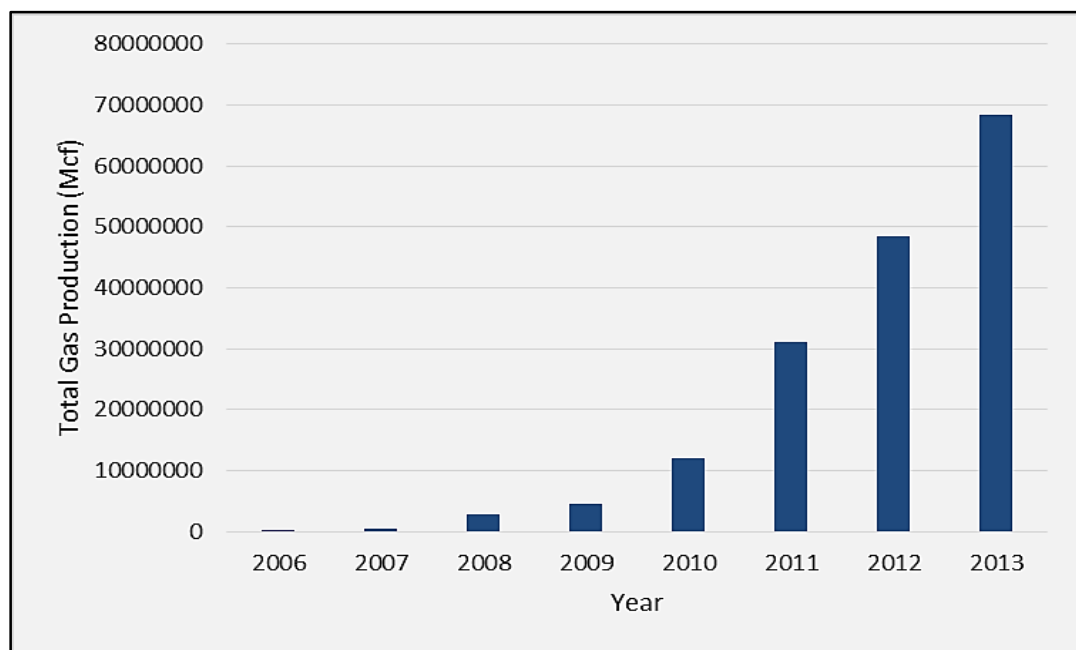
Figure 23. Marshall County Well Production 2006-2013. Data retrieved from WVGES.

Utilizing ArcGIS 10.1 and data sets retrieved from the WVGES, the following maps illustrate spatially the natural gas activity by county in terms of permitted and completed wells beginning at the state level and then narrowing our spatial analysis to Marshall County.

In exploring these maps, a few visual patterns are apparent including a high concentration of permitting in the north central counties (Figure 24) and a high concentration of completed wells in north central counties, and southwestern counties (Figure 25). This is logical considering most drilling in the state began in the southwest central region which is traditionally seen as 'coal country'. Natural gas exploration first began in the southwest portion of the state due to shallower depths resulting in less expense for retrieving the gas. However, as the price of natural gas decreases, permitting in the north central part of the state has increased due to the prevalence of wet gas.
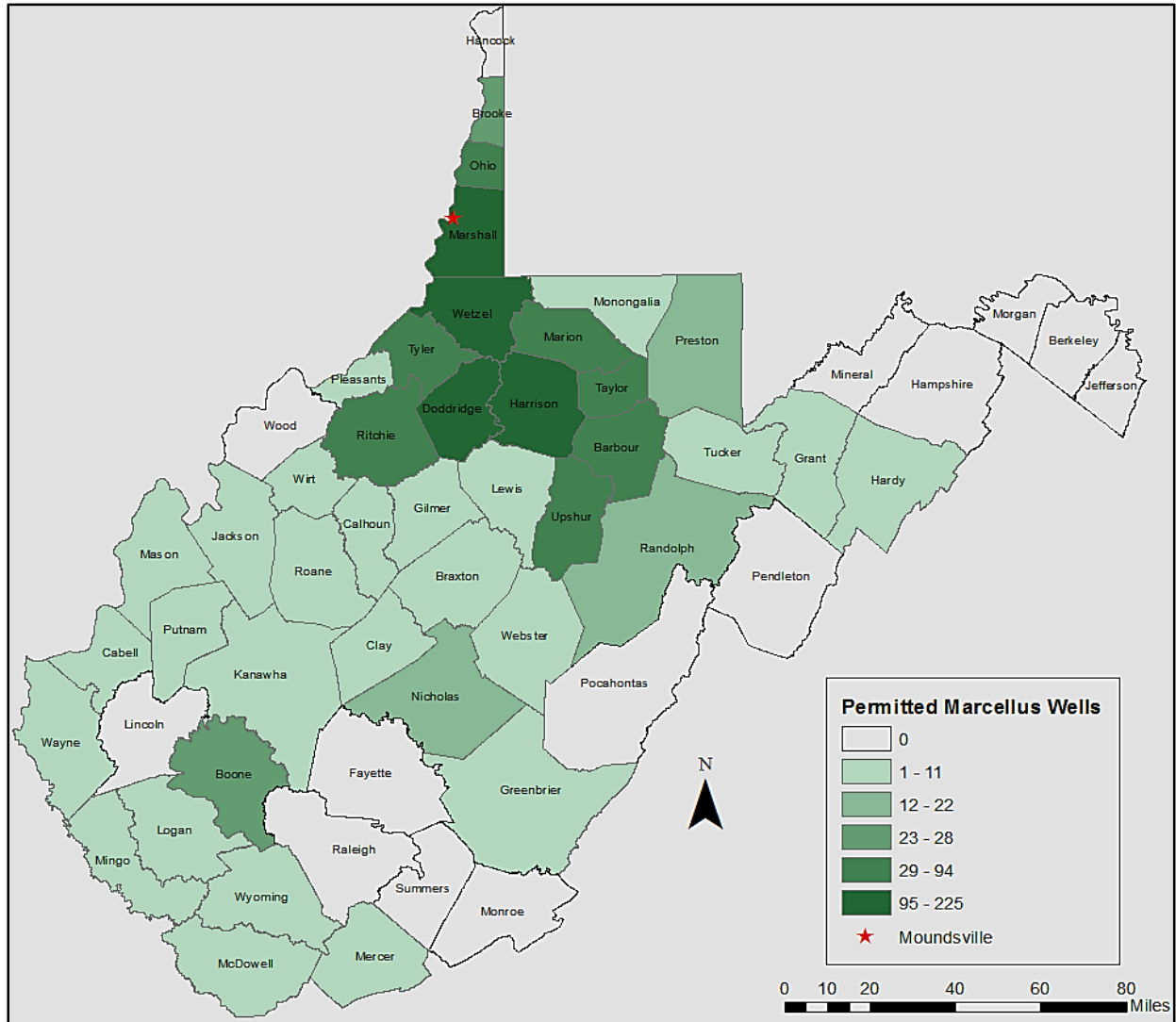
Figure 24. Permitted Marcellus Wells as of June 2013. Data retrieved from
http://www.wvges.wvnet.edu.
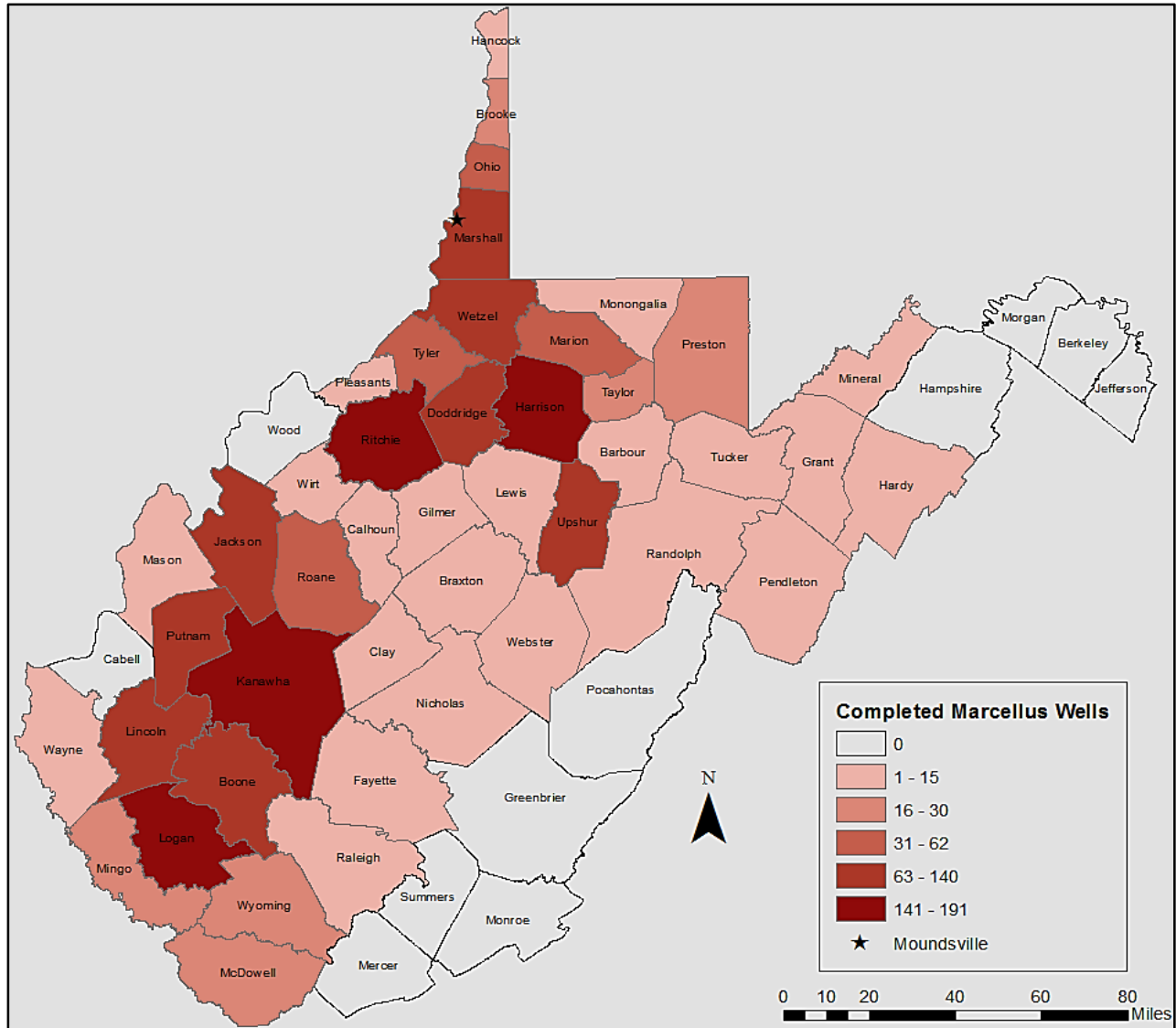
Figure 25. Completed Marcellus Wells as of June 2013. Data retrieved from
http://www.wvges.wvnet.edu.

Aggregating the two previous maps and comparing spatially against the backdrop of the

median household income at the county level lends support to what has been commonly seen in

previous research analyzing the natural resource curse (Figure 26). Although the state may be

rich in natural capital, the human capital is poor in terms of economic wealth and quality of life.

In fact, one indicator of economic wealth and quality of life is the median household income

which shows Moundsville with 37% below the nation's median household income and the state

of West Virginia ranked 49th out of 51 (including D.C.).
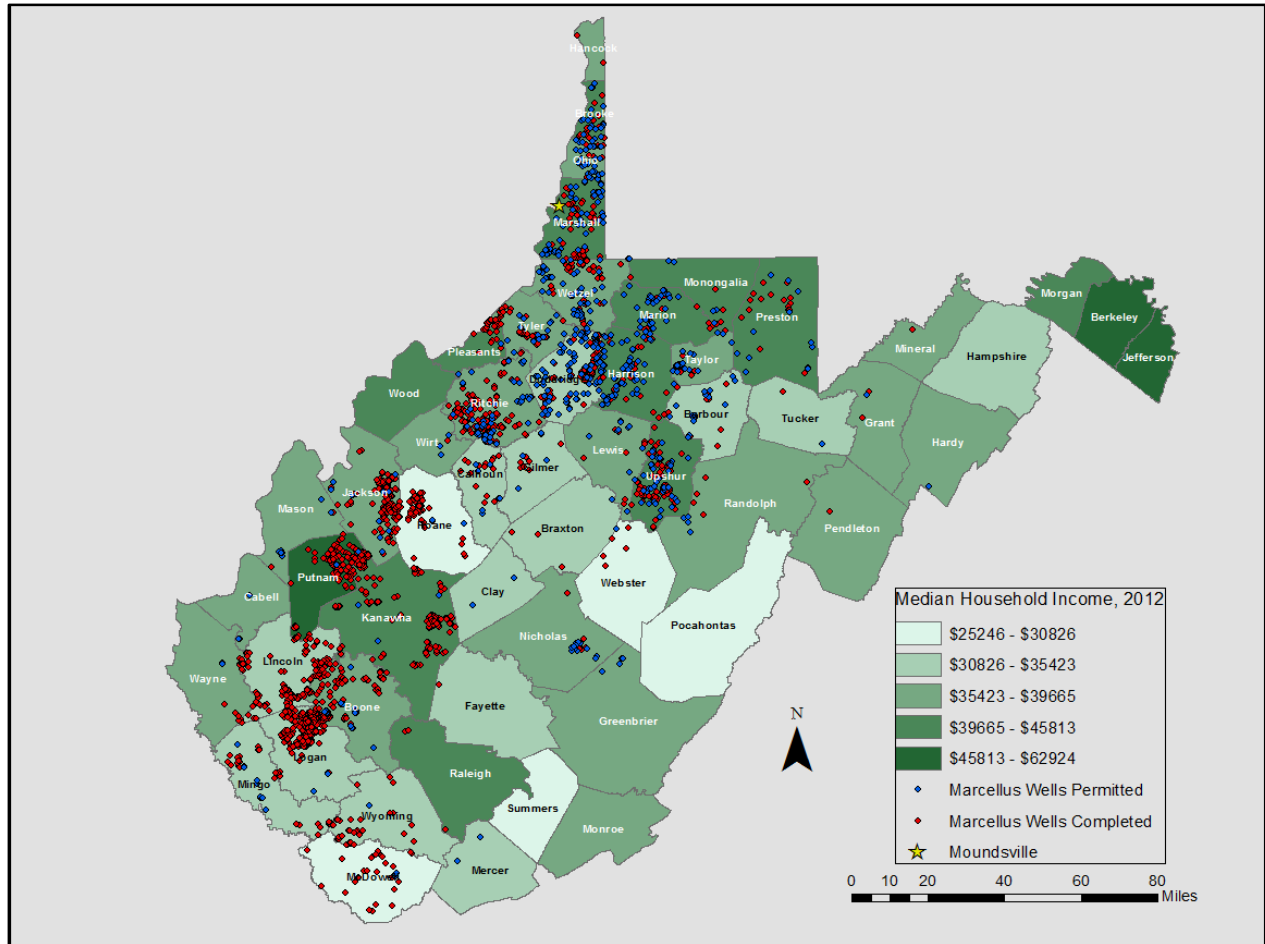
Figure 26. Median Household Income (as of 2012) vs. Natural Gas Activity (as of June, 2013). Data retrieved from www.wvgs.wvnet.edu/.

Table 4

Median Household Income Comparison

Data Item	Moundsville	Marshall County	West Virginia	U.S.	Rank in U.S.
Median Household Income	$33,694	$40,288	$40,400	$53,046	49

Data retrieved from U.S. Census Bureau, 2008-2012 American Community Survey.

Marshall County is located in the north central part of West Virginia with an approximate total land area including open water of 311 square miles (1.3%) of the 24,229 total square miles in the state. There are no major cities found within Marshall County, although there are several small towns including Moundsville, Benwood, McMechen, Glen Dale, and Cameron.

In exploring the impacts resulting from the natural gas industry, it's important to take

stock of the natural features and the potential concerns that may arise relating to the boom in

natural gas. Natural features in Marshall County include one major river, the Ohio River, and 23

watersheds that contain a combination of 1,387 streams, creeks and rivers (WVGES data,

retrieved via ArcGIS).

Table 5

Land Cover Distribution of Marshall County

Environment		
Land Cover *(square miles)*	Region Value	% Total Area
Total Land Area	311.95	100%
Forest & Woodland	237.9	76.28%
Agricultural Vegetation	38.74	12.42%
Developed & Other Human Use	26.96	8.64%
Open Water	8.06	2.59%
Other	0.25	0.08%

Data retrieved using USGS Land Cover Viewer tool found at
http://gis1.usgs.gov/csas/gap/viewer/land_cover/Map.aspx.

Approximately 75% of Marshall County is deciduous forest and pasture/hay is the next

highest land cover type at 12%. The average elevation of Marshall County is 1,137 ft., with a

low of 594 ft. and a high of 1600 ft. Figure 27 reveals the interplay between these natural

features, communities, and natural gas wells throughout the county. As of June, 2013 there were

a total of 273 natural gas wells in terms of permitted and completed. Furthermore, this reveals

the nexus between water and the processes involved in extracting natural gas are seemingly

unavoidable which adds a potential risk to the human health and the environment alike. In

addition, gaining access to these sites is an obstacle due to the hilly country side. Furthermore,

this map shows that exploring the interplay of Moundsville and these drilling sites requires

observing development patterns of Marshall County too. The permitting and drilling of wells

remain outside the municipal boundaries of these smaller five communities including

Moundsville, thus limiting the control and potential economic gains.
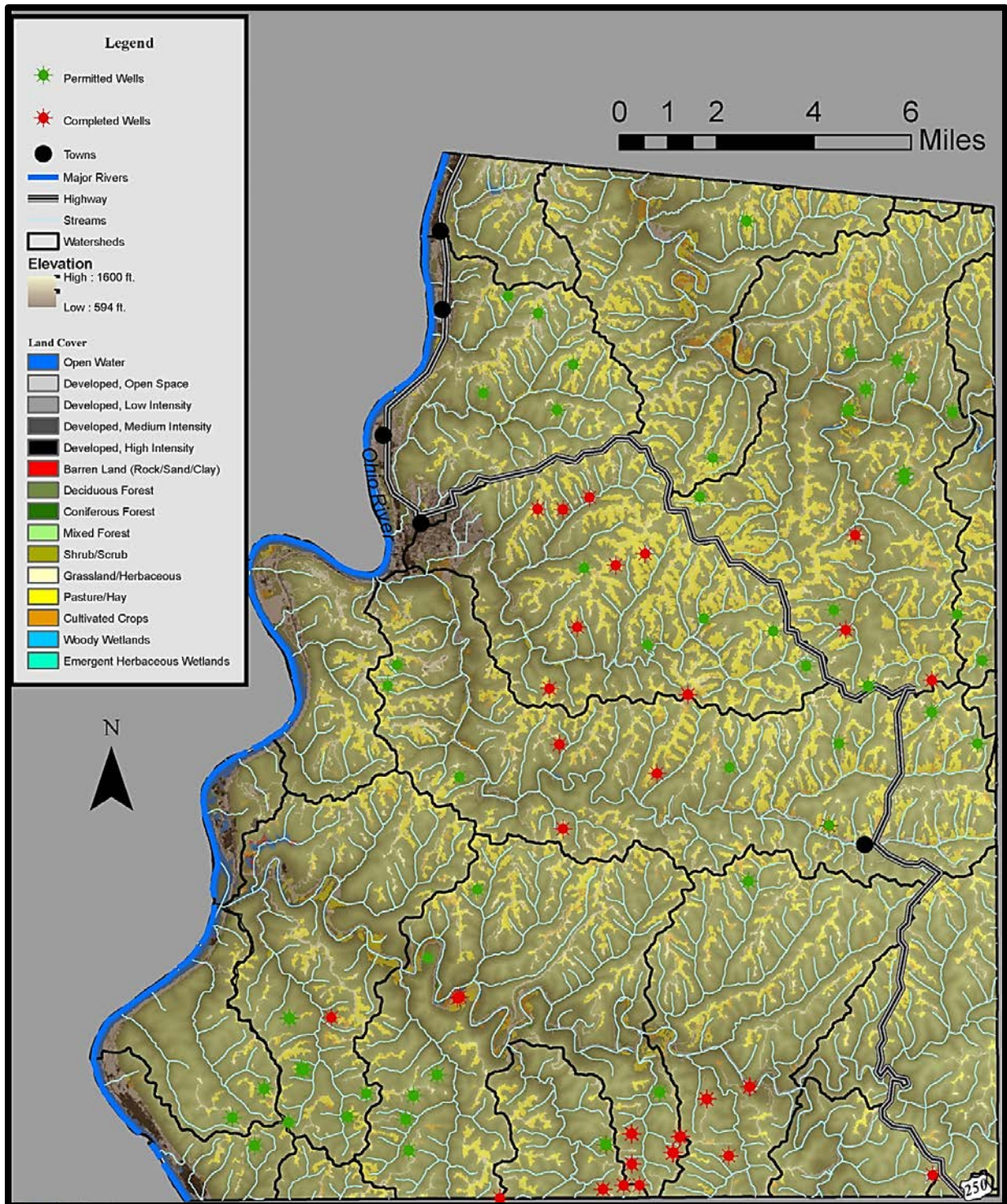
Figure 27. Marshall County Completed and Permitted Wells. Data retrieved from
http://www.wvges.wvnet.edu.
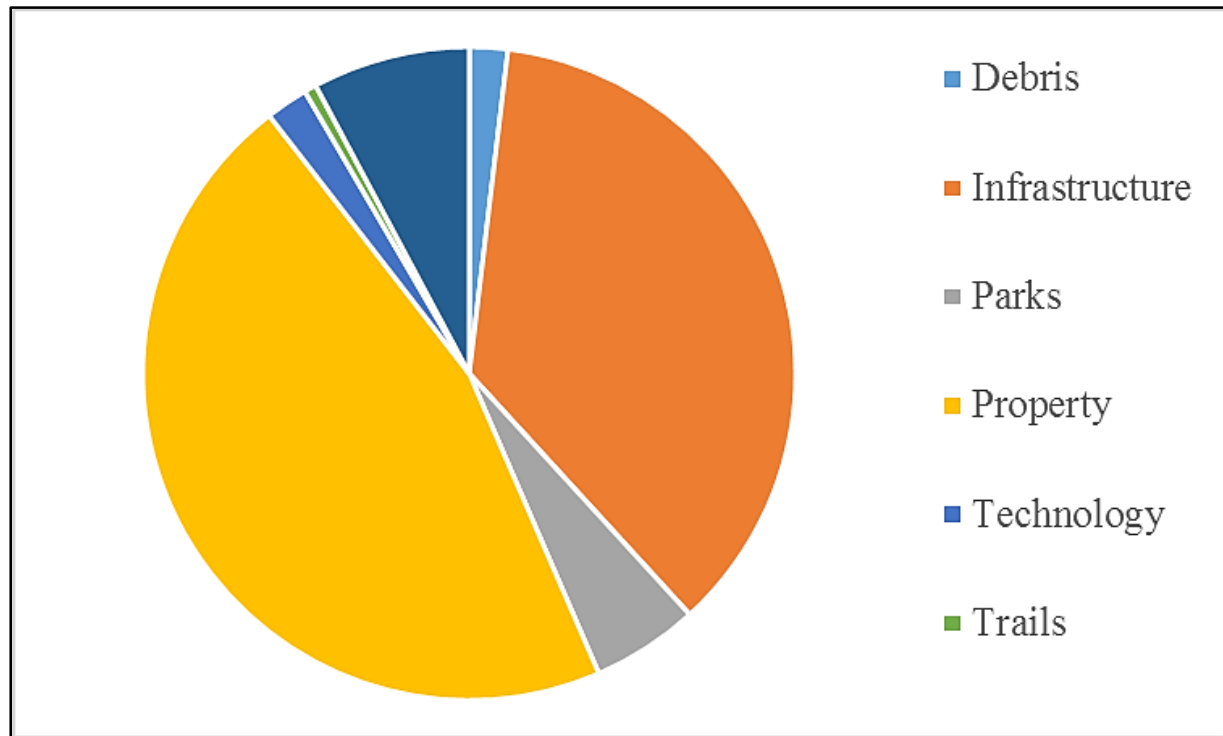
Physical Capital

Figure 28. MAXQDA Results Total Percent Proportion of Physical Capital with Primary Sub-codes.

The process for coding physical capital is informed via the potential indicators from the ERR Template. As revealed in previous literature, physical capital most commonly refers to anything that is man-made such as roads, buildings, housing, vehicles and equipment and parks. One might suggest parks should be coded as natural capital, however for distinguishing the difference, a decision is made based on the fact parks are man-made and require continued maintenance. Figure *28* shows 'Infrastructure' and 'Property' were coded most often for physical capital. This is primarily due to constant complaints of poor road conditions (pot holes, resurfacing needs etc…), dilapidated homes/buildings and property nuisances.
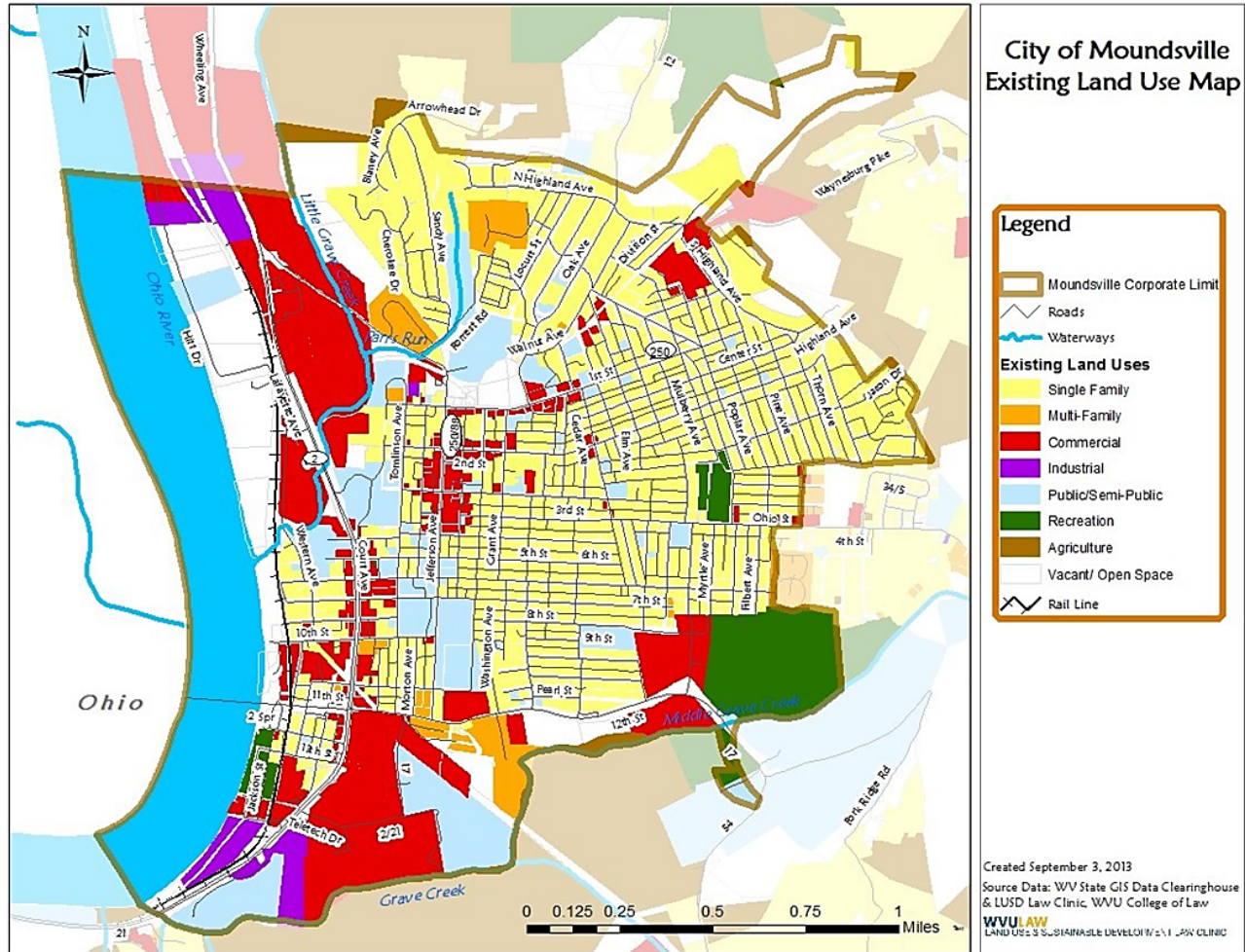
Figure 29. City of Moundsville Existing Land Use Map. Retrieved from City of Moundsville Comprehensive Plan, Adopted July 2014.

The 2014 City of Moundsville Comprehensive Plan provides a detailed overview of the current physical capital in the city and county. The city has approximately eighty-eight acres of parks within its boundaries and include such amenities as baseball and soccer fields, an indoor community pool, and a walking/bike rail trail. There are currently eight elementary schools, two middle schools, and two high schools located throughout Marshall County.

The city operates its own water facility which includes the potable water supply, processing of wastewater and storm water. The plan notes there were upgrades made to the facility beginning in 2006 and have continued for several years. "However, capacity remains an issue, particularly with the influx of oil and gas workers. These workers, often temporary

residents living in RV campgrounds, are required to hook up to the city water lines"

(Moundsville Comprehensive Plan, 2014, p. 2-9).

A large part of the budget is spent on transportation and roads. For FY 2011-2012, the

amount spent on street and transportation was approximately $1.1 million which was 19% of the

total Moundsville budget. There are two small airports in the county, but no active rail lines. In

addition, there are two primary roads that intersect with the city which includes State Route 2

which traverses the Moundsville Bridge (Figure 30) into Ohio, and U.S. Route 250.

Figure 30. Moundsville Bridge Leading into Ohio. Kiger, B. (Photographer), 2012.

When visiting Moundsville as a participant observer, a few images presented themselves

while exploring the community (Figure 31). While coding the city council minutes, a pattern

reveals substantial issues with the built environment including vacant business properties,

dilapidated housing, and property nuisances.

Figure 31. Empty Store Fronts, Main Street, Moundsville. Kiger, B. (Photographer), 2012.

Figure 28 revealed the total physical capital with the main sub-codes. The frequency of

the sub-code 'property' occurs most often at 46%. If we dig deeper into this code, it reveals an

additional layer of sub-codes including those of dilapidated, vacant, and nuisance properties.

A crosstabs function using MAXQDA is applied comparing the variable of 'years' to

these sub-codes listed under the parent code 'physical capital'. The independent variable 'year'

is used with the assumption that the permitting of wells and or drilling of wells are related to the

variable 'year', thus providing a link across time to the physical capital in Moundsville during

the boom in natural gas. The results are listed in Table 6. Highlighted in yellow, we observe a

pattern of coding for the sub-codes of property nuisance, housing, and dilapidated aging or

vacant structures. These sub-codes continue to increase until 2010 and then begin decreasing in

2011. This trend would most likely continue to increase and or even peak through 2011;

however, due to incomplete data, only half of the year's city council minutes are observable as

noted with an asterisk in the number of documents for 2011.

Table 6

Total Physical Capital with Sub-Codes Percentage vs. the Independent Variable Year

Code System	2006	2007	2008	2009	2010	2011	2012	SUM
Physical Capital	33.33	17.46	7.94	12.70	11.11	7.41	10.05	100.00
Physical Capital\Infrastructure	4.76	14.29	9.52	9.52	42.86	7.14	11.90	100.00
Physical Capital\Infrastructure\Electric Lines	5.56	11.11	5.56	16.67	22.22	11.11	27.78	100.00
Physical Capital\Infrastructure\Water and Sewer	24.51	23.53	7.84	20.59	4.90	13.73	4.90	100.00
Physical Capital\Infrastructure\Street Lights and Signals	3.77	8.49	16.98	24.53	24.53	18.87	2.83	100.00
Physical Capital\Infrastructure\Sidewalks	10.89	16.83	9.90	18.81	10.89	14.85	17.82	100.00
Physical Capital\Infrastructure\Parking	11.63	14.73	12.40	18.60	17.05	10.85	14.73	100.00
Physical Capital\Infrastructure\Roads, bridges, and alleys	6.87	13.74	14.07	23.45	19.60	9.55	12.73	100.00
Physical Capital\Property	50.00	3.85	11.54	0.00	0.00	3.85	30.77	100.00
Physical Capital\Property\Zoning	3.11	15.03	11.40	24.35	10.88	6.74	28.50	100.00
Physical Capital\Property\Annexation	18.18	72.73	0.00	0.00	9.09	0.00	0.00	100.00
Physical Capital\Property\Buildings	7.17	11.95	11.16	16.33	17.53	23.11	12.75	100.00
Physical Capital\Property\Buildings\School Building	18.97	32.76	8.62	37.93	1.72	0.00	0.00	100.00
Physical Capital\Property\Buildings\Sanford Center	0.00	0.00	0.00	0.00	70.37	11.11	18.52	100.00
Physical Capital\Property\Buildings\Strand Theater	0.00	0.00	0.00	25.00	50.00	0.00	25.00	100.00
Physical Capital\Property\Buildings\Moundsville Prison	0.00	0.00	0.00	28.57	42.86	0.00	28.57	100.00
Physical Capital\Property\Buildings\Fostoria	1.52	9.09	12.12	25.76	26.52	11.36	13.64	100.00
Physical Capital\Property\Buildings\Property Nuisance	5.64	14.29	18.05	18.05	18.42	13.16	12.41	100.00
Physical Capital\Property\Buildings\Housing	4.76	4.76	11.56	12.93	29.25	15.65	21.09	100.00
Physical Capital\Property\Buildings\Housing\Trailers, Campers, RVs	5.63	9.86	14.08	5.63	4.23	16.90	43.66	100.00
Physical Capital\Property\Buildings\Housing\Dilapidated Aging or Vacant Structures	2.07	19.69	10.88	12.95	22.28	12.95	19.17	100.00
Physical Capital\Decorations	0.00	0.00	0.00	0.00	0.00	60.00	40.00	100.00
Physical Capital\Debris	0.00	10.53	19.30	17.54	15.79	24.56	12.28	100.00
Physical Capital\Vehicles and Equipment	0.00	4.22	11.39	21.94	28.69	13.92	19.83	100.00
Physical Capital\Technology	0.00	3.17	11.11	38.10	9.52	9.52	28.57	100.00
Physical Capital\Parks	0.63	17.50	15.00	6.25	26.25	10.63	23.75	100.00
Physical Capital\Trails	5.56	16.67	22.22	16.67	27.78	0.00	11.11	100.00
SUM	7.65	13.38	12.41	18.79	19.29	12.35	16.12	100.00
N (Documents)	21	21	21	22	23	*12	21	0

With a boom, it is only rational to infer an increase in population for Moundsville. However, many of these new residents are more than likely temporary, (see Figure 32), judging by the numerous portable toilets and campers.

Figure 32. Portable Toilets and Campers Resulting from the Boom in Natural Gas, Moundsville. Kiger, B. (Photographer), 2012.

While a participant observer, a "camper count" was conducted that revealed numerous transient workers and or in some cases families. Furthermore, I discovered that the Marshall County Assessor's Office does not collect data on 'campers'. They collect data for tax purposes only which at the time did not apply to these transient workers. Data is not collected on units that are owned by out-of-state residents nor is it collected on residential units that are being rented out to businesses.

Table 7

Moundsville City Limits Camper Count as of Aug. 15, 2012

Location	Camper Count
Marshall County Fair Grounds	43
12 St. Across from Fairgrounds	30
Pearl St.	12
Varlas	42
Marshall County Co-Op	10
Across from CO-OP behind storage units and railroad tracks	9
Unanimous Resident	12
Small Lot between 4th street and Maxwell	6
Total	164

Data retrieved via participant observation activities contact. Note: Counts are fluid and are subject to change daily.

With this boom, most tend to only focus on the drilling portion, but in actuality, this is but only a small fraction of the entire energy system. There are huge investments in infrastructure needed to transport the gas. Furthermore, most of the jobs created in this boom involves the construction and maintaining of these pipelines. Figure 33 illustrates both the natural gas lines (blue) and the hazardous liquid pipelines (red). Using an open access tool provided by the Pipeline and Hazardous Materials Safety Administration (PHMSA), we are able to calculate the total approximate pipelines in both hazardous liquids and gas pipelines to be at a minimum 210 miles. It should be noted, this map only reveals the transmission lines and not the gathering or distribution lines needed for delivery to a resident's home and/or business.

Furthermore, when Dominion Resources finishes the $500 million natural gas processing facility "Blue Racer" in Marshall County, an additional 110 miles of 20 inch, 24 inch and 30 inch diameter pipeline will be added between this plant and Pennsylvania, as well as four new gas compressor stations that adds approximately 17,000 horsepower.
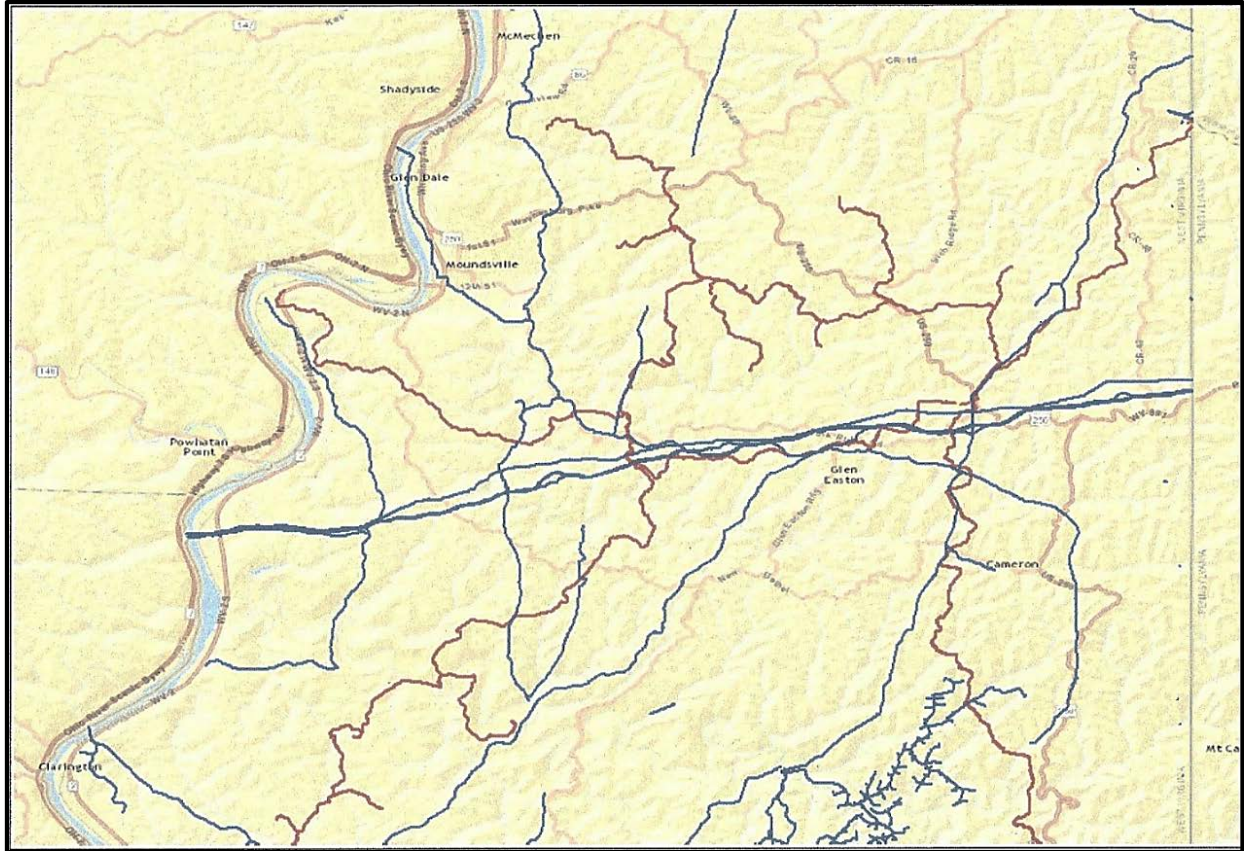
Figure 33. Marshall County Gas and Hazardous Pipelines. Map produced by NPMS Public Viewer tool at www.npms.phmsa.dot.gov. Note: Pipelines depicted on this map represent gas transmission and hazardous liquid lines only.

Human Capital
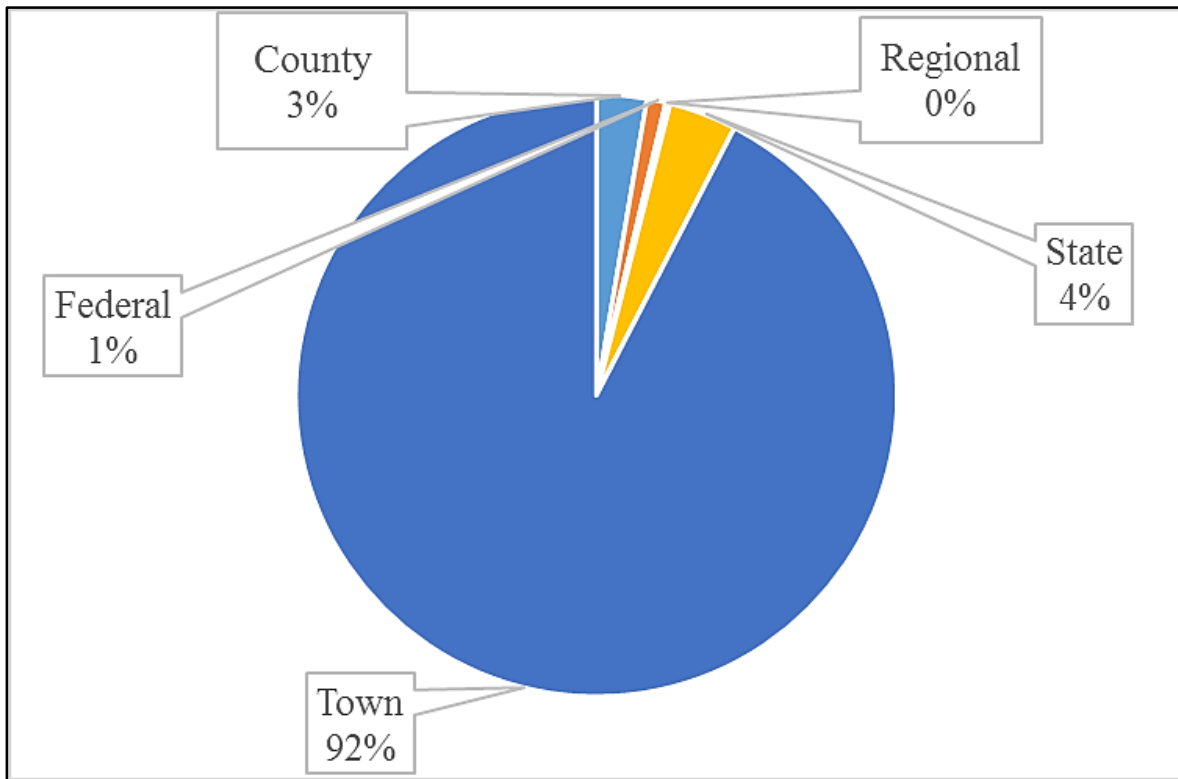
Figure 34. MAXQDA Results Total Percent Proportion of Human Capital with Primary Sub-codes.

The process for coding human capital is informed via the potential indicators from the

ERR Template. As revealed in previous literature, human capital primarily consists of a

society's education, skills, diversity, freedoms, competence, innovation etc.—most of which is

intangible and difficult to measure. There was much difficulty in coding human capital because

practically everything involves humans—our ideas, decision-making, concerns, reasoning,

emotions etc., and it is not practical or perhaps valid to mark everything as human capital. For

purposes in narrowing this view, the codes were broken by categories of stakeholders. As

expected, the most commonly coded stakeholder was the community itself (92%). Obviously,

this is primarily due to the fact that the stakeholders who are going to be at city council meetings

are the people themselves and staff/employees of the city.

In exploring the human capital of the Moundsville Knowledge Base, several good

indicators, (but certainly not an exhaustive list) include education, active labor force (ages 18-

65), job growth rate, income, and creativity/innovation.

Previous literature has noted one of the most observable elements in a boomtown is the

in-migration of populations representing either individual or companies in hopes of increasing

their wealth. Figure 35 reveals this concept of boom and bust in terms of population dynamics

comparing Moundsville and Marshall County. Peaks in red, reveals extreme cases (especially at

the county level) of rising and then falling over a period of a few or couple decades. What is of

most concern, as of 2010, the population of Marshall County and Moundsville is seeing a

continuous decrease in population—representing the community's lowest level since the 1920's.
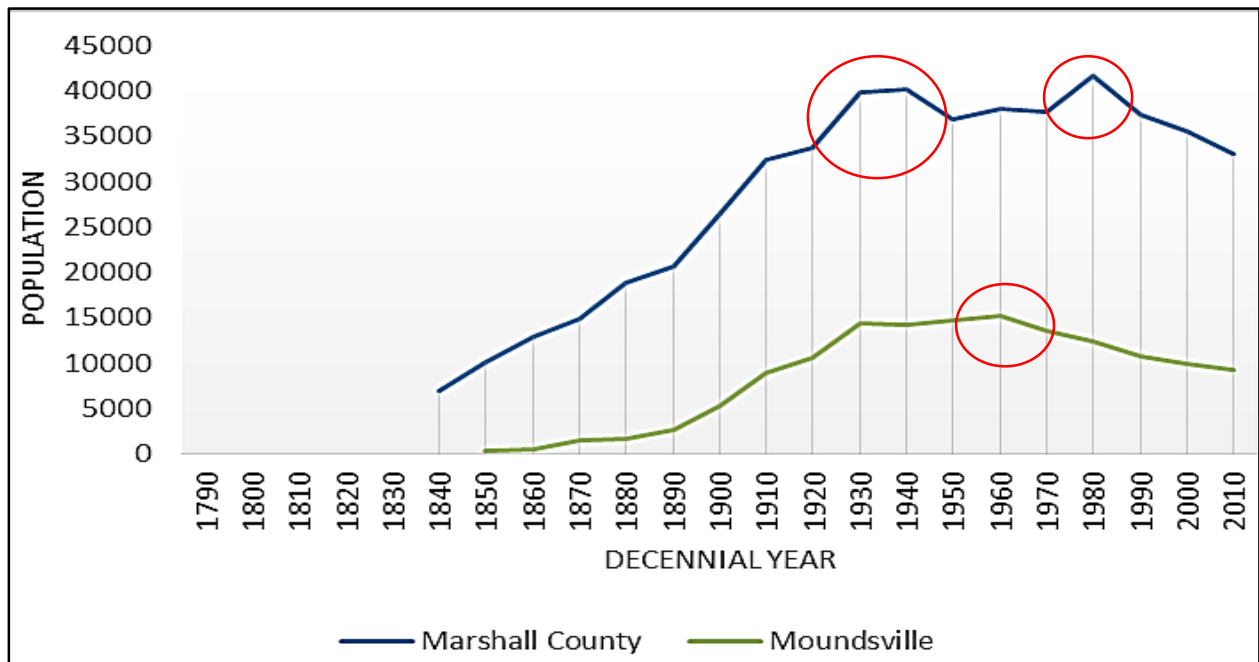
Figure 35. Population Boom and Bust in Marshall County and Moundsville. Data retrieved from
http://www.census.gov/prod/www/decennial.html.

The population data suggests although the community and county alike are going through

an energy boom, the population continues to decline. However, it seems the population decline

in Moundsville has slowed, although still a negative percent change. This contradicts previous

boomtown research and is surprising considering the how capital intensive the energy industry

and typically establish a large pool of skilled labor in the process of setting up extraction sites.

Furthermore, it should be noted, the transient workers are not likely included in these population

estimates because these workers are not establishing residency and contributing to the tax base.

Table 8

Population Percent Change Comparison

Population Change	Moundsville	Marshall County	Rank in State (55 Counties)	West Virginia	US Rank
Growth % since 2010 Census to 2013	-4.6	-2	42	0.1	47
Growth % since 2000 Census to 2013	-11.1	-8.6	NA	2.5	NA
2000 to 2010 % Change	-6.8	-6.8	51	2.5	47
1990 to 2010 % Change	-13.3	-11.4	47	3.3	50
1980 to 2010 % Change	-25	-20.4	47	-5	50

Data retrieved from StatsAmerica.org using Counties in Profile tool. Moundsville data derived from http://www.census.gov/prod/www/decennial.html.

Moundsville and West Virginia are continuing to see an outmigration of young

professionals and an ever increasing median age currently at 46.5. Compare this to a US

population where the median age is 37.6. This population decline feeds into a downward spiral

in loss of tax revenue and human capital. Furthermore, the percent of those with a bachelor's

degree or more is much less in Moundsville (11.3%) compared to the U.S. (28.8%) and where

West Virginia ranks last out of all states. This suggests an outmigration of the most educated in

the community of Moundsville and state of West Virginia.

Table 9

Population Demographics Comparison

Population Key Figures	Moundsville (2013 ACS 5-year)	Marshall County 2013	West Virginia 2013	Marshall County within WV (Rank out of 55 Counties)	US 2013	WV within US Rank
Total Population	9,048	32,459	1,854,304	18	316,128,839	38
Median Age	46.5	44.7	41.9	18	37.6	4
H.S. Diploma or More - % of Adults 25+ (2013 ACS 5 yr.)	86.6	88.1	83.9	7	86	43
Bachelor's Deg. Or More - % of Adults 25+ (2013 ACS 5yr)	11.3	14	18.9	25	28.8	51
Median Household Income	$33,234	$41,583	$41,195	12	$53,046	49
Poverty Rate %	21.2	16.9	18.4	40	11	11
Gender Female %	51.7	50.9	50.6	NA	50.8	NA
White Alone %	95.1	97.7	93.8	18	77.7	36

Data retrieved from U.S. Census Bureau using "Counties in Profile" tool by StatsAmerica.org. Data Source: 2009-2013 American Community Survey.

Quality of life positively correlates with wealth, thus a reasonable indicator is to observe the median household income.   From a citizen's perspective, the clear winners in a boom are those who own many acres of land. However, this may only be the case if the landowner owns both the surface rights and the mineral rights. In the past it was common practice to sever the mineral rights from the surface rights. This therefore limits the amount of economic gain for today's surface owners in West Virginia. Furthermore, there is a lag in time when exploring the effects on median household income due to many factors including a delay for these wells to begin producing gas for the marketplace and a delay in severance tax distribution to the county and community levels.

The initial boom brings with it a wide range of companies both small and large. There are approximately eighty different oil and natural gas companies engaged in a direct role in West Virginia's shale play (WVGES). However, approximately thirteen companies have a stake in

76% of the overall completed wells (calculated via ArcGis, WVGES, Oil and Gas Well Data).

Most of the major players are out-of-state companies including Chesapeake Energy (Oklahoma),

Cabot Oil & Gas Corp. (Texas), and Antero Resources Corp. (Colorado). Furthermore,

Chesapeake, Antero Resources and EQT combined produce 84% of the state's total shale gas

production (calculated via ArcGis, WVGES, Oil and Gas Well Data). These companies do have

regional offices; however, their headquarters are in other states which may have an effect on the

amount of wealth staying in state and/or in these local communities. In Marshall County alone,

the major producers include Chesapeake Energy, Chevron, Trans Energy, CNX, and Gastar.

These drilling companies can increase the economic wealth of the households

through leases, bonus payments (typically $200 - $500/acre) and annual royalty payments

to landowners in exchange for their drilling activities. Furthermore, signing bonuses for

the Marcellus Shale Play have been documented to be as high as $2,000 - $2900 per acre

(King, H.B. & WVCBP, 2014). The royalty rates are based on production; so although

landowners may have signed agreements for the lease of their minerals rights, it could be

several years before any natural gas is produced. In fact, the initial signing bonus may be

the only source of income a household may receive. Since royalties are based on the

amount of natural gas produced — if a well is not producing, then there is no royalty.

West Virginia statute states this royalty rate to be at a minimum of 12.5 percent to 19

percent. In these agreements, typically known as "Memorandum of Oil and Gas Lease", a mutual

agreement is declared between landowner/Lessor and the energy company/Lessee for the lease of

property in producing oil or gas. The initial primary term is typically set at five years with an

additional five year option granted to the Lessee to extend. It is important to reiterate, the

potential royalties for the landowner depend on if a gas well is producing. This can be greatly

impacted by the price of natural gas. Even natural gas companies admit a gas well's production typically declines by 40% in the first year alone (WVCBP, April, 2014) and economically recoverable gas production is uncertain beyond five years.

The Marshall County Assessor's Office claims it has currently over 8,000 mineral accounts because of the recent boom in natural gas, however, data on royalties to landowners is not available, therefore limiting the ability to analyze the income from the natural wealth that would increase household wealth. Similar case studies (Wetzel County Case Study, WVCBP, 2014) have found this to be true and agree the overall economic impact of these lease and royalty payments is unclear. In addition, a case study of Wetzel County (neighbor to Marshall County) observes, "More than 25% of active gas wells are on land controlled by two lumber companies, the state of West Virginia, a private university, and an energy company" (WVCBP, 2014, p. 4), thus again, limiting direct distribution of wealth to the individual households.

Local citizens also hope for an increase in job growth. It is intuitive to think there would be an overall job increase for the local community; however, it has been observed from previous studies that the opposite tends to be true in providing oil and gas jobs. In a recent case study by the West Virginia Center on Budget and Policy (WVCBP) — a neighboring county to Marshall (Wetzel), many oil and gas jobs are going to out-of-state workers where the industry tends to be more developed and/or the workers are more skilled. It was also observed when oil and gas companies were asked why more of the local population has not been hired, they claim, "It is difficult to find local workers who can pass a drug test" (p. 6, 2014). However, it seems no one can truly validate this claim. While a participant observer, this claim by the natural gas industry was also purported by local Moundsville citizens. In previous case studies, local citizens who own businesses such as campgrounds, restaurants, and hotels have reported an increase in

economic activity. This has been purported by Moundsville citizens; however, there is no data to validate this claim at this time.

In general, the local and state government is responsible for looking out for its citizens and to properly manage budgets, revenues, and safety. At the state level, a 5% severance tax is levied on the natural gas industry as well as oil, coal, limestone/sandstone, sand, gravel, and other natural resources. Furthermore, 5% of gross value for both natural gas and oil and 10% of net tax is distributed to local governments (National Conference of State Legislatures, 2012). Due to the recent boom, there has been a drastic increase in business property valuations. Therefore, Marshall County commissioners have been able to lower the levy rates five of the past eight years (as of 2014). In fact, the Marshall County Assessor reported values of real and personal property in the county has increased by $577.2 million, excluding the public utility values, and forecasts a "total taxable assessed value of all property in Marshall County to be approximately $2.7 billion"—essentially doubling since 2007 (The State Journal, Feb., 2013).

Local governments in West Virginia depend on revenue from property taxes. The Marshall County Assessor states, approximately 76 cents of every dollar paid on a property tax bill goes to the Board of Education, 18 cents to the County Commission, and 6 cents to the Cities. The Marshall County Board of Education received over $11 Million primarily due to increasing property tax revenue over the past two years. In general, this is a good example in how natural capital may be converting to human capital—where increasing revenue from increasing property taxed as a result from the natural gas boom is received by the Board of Education. An assumption is made, the revenue that is allocated to the Board of Education will in return be spent on education or human capital or perhaps even maintaining physical capital (school buildings).

Table 10 highlights the most direct economic impact at the state level (severance taxes) from the recent natural gas boom. However, there seems to be a rather contentious dynamic between county, community, and state officials as to how best to distribute the money from this natural wealth. A recent article reveals the sentiment and complexity, "Marshall County's share of oil and gas severance tax revenue has increased by more than $358,000 during the past three years, but none of that money will be used to work on roads, county officials said" (Hanson, March 20, 2014). And in another article points to an issue with funds being held up for distribution to counties causing county budgets to fall short. "Marshall County Commission believes state officials are withholding about 1.6 million worth of severance tax revenue for coal, oil and natural gas — a development that may lead the county into a shortfall at the end of the fiscal 2014 year". The commissioner then states, "I don't know how we can tell our constituents that, here we are in the middle of the Marcellus shale, and we don't have any oil and gas severance money" (Junkins, July 9, 2014).

Table 10

West Virginia State Tax Revenues, 2006-2013 ($000)

Item	2013	2012	2011	2010	2009	2008	2007	2006
Total Revenue	$ 14,581,453	$ 13,247,295	$15,397,630	$13,712,959	$11,112,547	$ 10,736,112	$ 12,525,048	$ 11,435,036
General Revenue	$ 12,390,766	$ 12,294,552	$12,714,234	$11,709,919	$11,113,125	$ 10,766,289	$ 10,631,568	$ 10,262,195
Intergovernmental Revenue	$ 4,325,052	$ 4,359,169	$ 4,748,528	$ 4,426,116	$ 3,775,786	$ 3,274,439	$ 3,256,627	$ 3,234,430
From Federal	$ 4,230,663	$ 4,267,399						
From Local	$ 94,389	$ 91,770						
Total Taxes	$ 5,378,122	$ 5,285,773	$ 5,210,925	$ 4,803,704	$ 4,787,352	$ 4,881,908	$ 4,642,230	$ 4,547,929
General Sales and Gross Receipts Taxes	$ 1,255,377	$ 1,277,328	$ 1,210,255	$ 1,156,513	$ 1,110,017	$ 1,109,822	$ 1,129,531	$ 1,125,766
Selective Sales and Gross Receipts Taxes	$ 1,323,634	$ 1,282,258	$ 1,277,362	$ 1,184,510	$ 1,116,306	$ 1,157,069	$ 1,083,810	$ 1,051,436
License Taxes	$ 137,437	$ 137,670	$ 150,029	$ 143,456	$ 192,985	$ 193,468	$ 184,370	$ 185,432
Individual Income Taxes	$ 1,795,947	$ 1,755,746	$ 1,665,885	$ 1,521,895	$ 1,557,403	$ 1,518,746	$ 1,360,511	$ 1,297,720
Corporation Net Income Taxes	$ 242,429	$ 192,385	$ 307,278	$ 237,159	$ 420,530	$ 538,839	$ 539,136	$ 533,027
Severance Tax*	$ 608,371	$ 626,203	$ 440,875	$ 400,591	$ 359,578	$ 338,177	$ 312,246	$ 314,727
All Other Taxes *	$ 14,927	$ 14,183	$ 159,241	$ 159,580	$ 30,533	$ 25,787	$ 32,626	$ 39,821
Current Charges	$ 1,504,885	$ 1,406,361	$ 1,483,565	$ 1,318,893	$ 1,343,499	$ 1,279,211	$ 1,232,116	$ 1,100,687
Miscellaneous General Revenue	$ 1,182,707	$ 1,243,249	$ 1,271,216	$ 1,161,206	$ 1,206,488	$ 1,330,731	$ 1,500,595	$ 1,379,149
Utility Revenue	$ 2,435	$ 2,906	$ 2,108	$ 2,272	$ 439	$ 362	$ 544	$ 421
Liquor Stores Revenue	$ 90,403	$ 88,321	$ 84,268	$ 79,614	$ 80,497	$ 74,508	$ 69,729	$ 66,036
Insurance Trust Revenue	$ 2,097,849	$ 861,516	$ 2,597,020	$ 1,921,154	$ (81,514)	$ (105,047)	$ 1,823,207	$ 1,106,384
Unemployment Compensation Systems	$ 3,022	$ 237,208						
State-Administered Pension Systems	$ 2,090,972	$ 530,477						
Workers' Compensation Systems	$ 3,855	$ 93,831						
Total Expenditure	$ 13,234,155	$ 13,222,912	$13,000,033	$12,343,051	$11,501,520	$ 10,561,575	$ 10,165,499	$ 9,781,296
Intergovernmental Expenditure	$ 2,469,535	$ 2,618,032	$ 2,533,582	$ 2,382,633	$ 2,232,558	$ 2,131,100	$ 2,074,429	$ 2,067,829
Direct Expenditure	$ 10,764,620	$ 10,604,880	$10,466,451	$ 9,960,418	$ 9,268,962	$ 8,430,475	$ 8,091,070	$ 7,713,467
Current Operations	$ 7,755,238	$ 7,477,840	$ 7,372,142	$ 6,984,904	$ 6,696,595	$ 6,265,863	$ 5,962,561	$ 5,874,295
Capital Outlay	$ 1,074,774	$ 1,213,167	$ 1,100,556	$ 1,004,272	$ 1,094,253	$ 893,891	$ 943,538	$ 935,262
Insurance Benefits and Repayments	$ 1,446,341	$ 1,436,585	$ 1,480,834	$ 1,505,492	$ 1,047,745	$ 851,629	$ 847,501	$ 521,608
Assistance and Subsidies	$ 234,604	$ 226,909	$ 269,701	$ 198,482	$ 183,911	$ 163,971	$ 161,837	$ 157,607
Interest on Debt	$ 253,663	$ 250,379	$ 243,218	$ 267,268	$ 246,458	$ 255,121	$ 175,633	$ 224,695
Exhibit: Salaries and Wages	$ 1,868,736	$ 1,832,088	$ 1,771,738	$ 1,731,700	$ 1,574,456	$ 1,441,006	$ 1,380,391	$ 1,335,625
General Expenditure	$ 11,708,850	$ 11,709,303	$11,445,676	$10,767,434	$10,376,402	$ 9,634,090	$ 9,246,817	$ 9,189,486
Intergovernmental General Expenditure	$ 2,469,535	$ 2,618,032	$ 2,533,582	$ 2,382,633	$ 2,232,558	$ 2,131,100	$ 2,074,429	$ 2,067,829
Direct General Expenditure	$ 9,239,315	$ 9,091,271	$ 8,912,094	$ 8,384,801	$ 8,143,844	$ 7,502,990	$ 7,172,388	$ 7,121,657
General Expenditure, by Function:								
Education	$ 4,333,893	$ 4,335,500	$ 4,161,900	$ 3,931,867	$ 3,892,978	$ 3,676,900	$ 3,572,629	$ 3,418,218
Public Welfare	$ 3,526,796	$ 3,293,863	$ 3,287,709	$ 3,042,614	$ 2,860,952	$ 2,565,426	$ 2,434,315	$ 2,376,902
Hospitals	$ 126,185	$ 125,062	$ 120,540	$ 121,617	$ 114,021	$ 106,482	$ 88,713	$ 81,233
Health	$ 345,537	$ 361,623	$ 318,411	$ 291,129	$ 290,263	$ 309,702	$ 307,646	$ 300,750
Highways	$ 1,102,651	$ 1,217,378	$ 1,224,162	$ 1,157,005	$ 1,209,882	$ 1,015,587	$ 975,292	$ 1,022,191
Police Protection	$ 75,101	$ 81,483	$ 76,036	$ 72,880	$ 101,691	$ 65,468	$ 61,691	$ 54,295
Correction	$ 300,693	$ 288,148	$ 275,564	$ 270,717	$ 256,169	$ 241,996	$ 233,639	$ 214,702
Natural Resources	$ 225,833	$ 260,494	$ 227,838	$ 236,900	$ 187,066	$ 170,496	$ 178,911	$ 159,490
Parks and Recreation	$ 51,269	$ 55,674	$ 60,557	$ 62,639	$ 55,731	$ 67,572	$ 59,975	$ 52,237
Governmental Administration	$ 438,545	$ 443,170	$ 418,183	$ 400,680	$ 415,531	$ 412,403	$ 432,943	$ 553,033
Interest on General Debt	$ 253,663	$ 250,379	$ 243,218	$ 267,268	$ 246,458	$ 255,121	$ 175,633	$ 224,695
Other and Unallocable	$ 928,684	$ 996,529	$ 1,031,558	$ 912,118	$ 745,660	$ 746,937	$ 725,430	$ 731,740
Utility Expenditure	$ 4,854	$ 4,110	$ 3,728	$ 3,521	$ 10,128	$ 12,836	$ 12,076	$ 13,851
Liquor Stores Expenditure	$ 74,110	$ 72,914	$ 69,795	$ 66,604	$ 67,245	$ 63,020	$ 59,105	$ 56,351
Insurance Trust Expenditure	$ 1,446,341	$ 1,436,585	$ 1,480,834	$ 1,505,492	$ 1,047,745	$ 851,629	$ 847,501	$ 521,608
Unemployment Compensation Systems	$ 365,722	$ 352,252						
State-Administered Pension Systems	$ 990,402	$ 955,411						
Workers' Compensation Systems	$ 90,217	$ 128,922						
Debt Outstanding, Long Term and Short Term	$ 7,355,630	$ 7,306,756	$ 7,406,254	$ 7,144,323	$ 6,501,995	$ 6,365,585	$ 5,628,065	$ 5,406,391
Cash and Security Holdings	$ 21,396,404	$ 19,706,538	$20,305,005	$17,847,539	$16,208,457	$ 16,357,378	$ 15,726,138	$ 11,098,283

Retrieved from US Census Bureau Annual Survey of State Government Tax Collections. *Notes: Severance tax amounts for 2012 and 2013 were retrieved from US Census Bureau Annual Survey while 2006-2011 were retrieved from TransparencyWV.org. In addition, severance tax amounts were subtracted from "All Other Taxes" accounts category for minimizing duplication error.

Severance tax revenue from coal and natural gas has been on a steady incline both at the

state level and for Marshall County. Unfortunately, the only available data at the county level

was for FY 2011- FY 2013. In FY 2011, the county received $71,161; FY 2012, 236,643; and

FY 2013 $429,810 (Junkins, July 9, 2014).
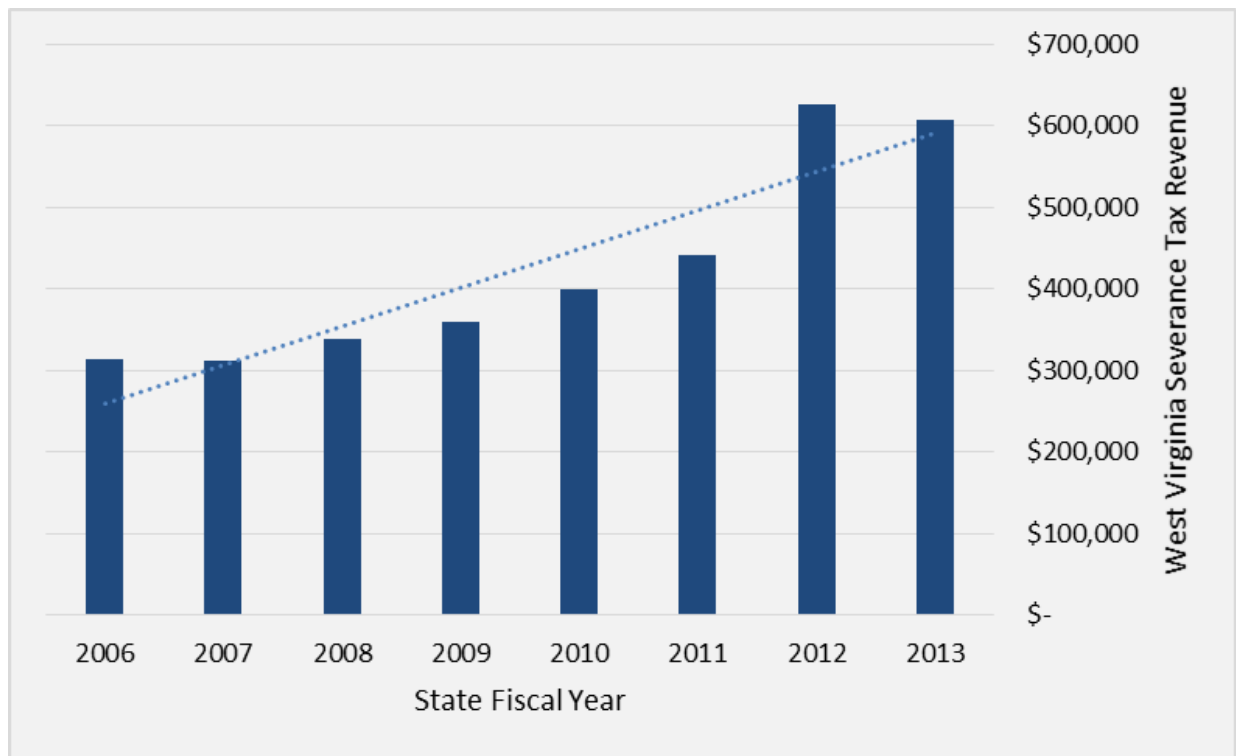
Figure 36. Severance Tax Revenue Trend in West Virginia ($000). Data retrieved from US
Census Bureau Annual Survey of State Government Tax Collections.*Notes: Severance tax amounts
for 2012 and 2013 were retrieved from US Census Bureau Annual Survey while 2006-2011 were retrieved from
TransparencyWV.org. In addition, Severance tax amounts were subtracted from "All Other Taxes" accounts
category for minimizing duplication error.

Table 11 reveals the Location Quotient (LQ) change between years 2006 and 2012. What

is most significant is the growth in the industrial cluster of "Energy (Fossil & Renewable)". The

NAICS definition of this cluster includes drilling for oil and natural gas, natural gas extraction

etc… and many supporting industries such as pipeline transportation. An industry cluster is a

group of similar industries closely connected by supply chains and/or similar labor pools located

within the same region. A location quotient (LQ) measures how concentrated an industry cluster

is in a given region as compared to the nation. An LQ greater than 1 means the cluster is an

export industry. Industries with a high LQ are typically, but not always, export-oriented

industries bringing money into the region rather than simply circulating money that is already in

the region. An LQ of less than 1 means it typically has to import from outside to satisfy local

demand.

Table 11

Industry Cluster LQ and Employment Comparison, 2006-2012 for Marshall County

Description	QCEW Cluster - Employment 2006	Industry Cluster Employment LQ 2006	QCEW Cluster - Employment 2012	Industry Cluster Employment LQ 2012	Change in Industry Share
Chemicals & Chemical Based Products	1,008	5.12	193	1.21	-815
Advanced Materials	1,101	2.47	303	0.84	-798
Education & Knowledge Creation	356	0.93	215	0.51	-141
Biomedical/Biotechnical (Life Sciences)	1,115	1.04	1,010	0.83	-105
Forest & Wood Products	280	1.75	204	1.97	-76
Mining	95	5.74	53	3.07	-42
Manufacturing Supercluster	186	0.34	145	0.35	-41
Fabricated Metal Product Mfg.	186	1.51	145	1.37	-41
Defense & Security	333	0.59	295	0.48	-38
Agribusiness, Food Processing & Technology	53	0.21	33	0.13	-20
Business & Financial Services	227	0.24	211	0.21	-16
Printing & Publishing	38	0.19	23	0.13	-15
Information Technology & Telecommunications	32	0.07	19	0.04	-13
Arts, Entertainment, Recreation & Visitor Industries	107	0.25	122	0.28	15
Glass & Ceramics	8	0.3	70	3.63	62
Transportation & Logistics	116	0.35	190	0.56	74
Energy (Fossil & Renewable)	1,651	3.39	2,544	5.05	893
Apparel & Textiles	443	4.28	NC	NC	NC
Total All Industries	10,984	1	11,130	1	146

Data retrieved using statsamerica.org cluster analysis tool. Source: U.S. Bureau of Labor
Statistics, Quarterly Census of Employment & Wages (QCEW) and Purdue Center for Regional
Development (cluster definitions).

Finally, in exploring human capital, the StatsAmerica knowledge base tool 'innovation index' is utilized. Although useful for local decision makers and economic developers, unfortunately, the tool lacks the ability to explore human capital at the community level. However, with Moundsville representing a similar demographic distribution and furthermore being the largest community in the county, one may predict the results to be similar.

The methodology used for this particular tool in calculating the human capital involves (1) the percent of adult population with some college or an associate's degree, 2012; (2) the percent of adult population with a bachelor's degree or higher, 2012; (3) the population growth rate of young adults ages 24-44 between the years 1997-2012; (4) the average high-tech employment share between 1997-2012; and (5) the technology-based knowledge occupations share of total employment for 2011. The aggregate of these indicators reveals a comparison for the human capital index between the United States, West Virginia, and Marshall County.
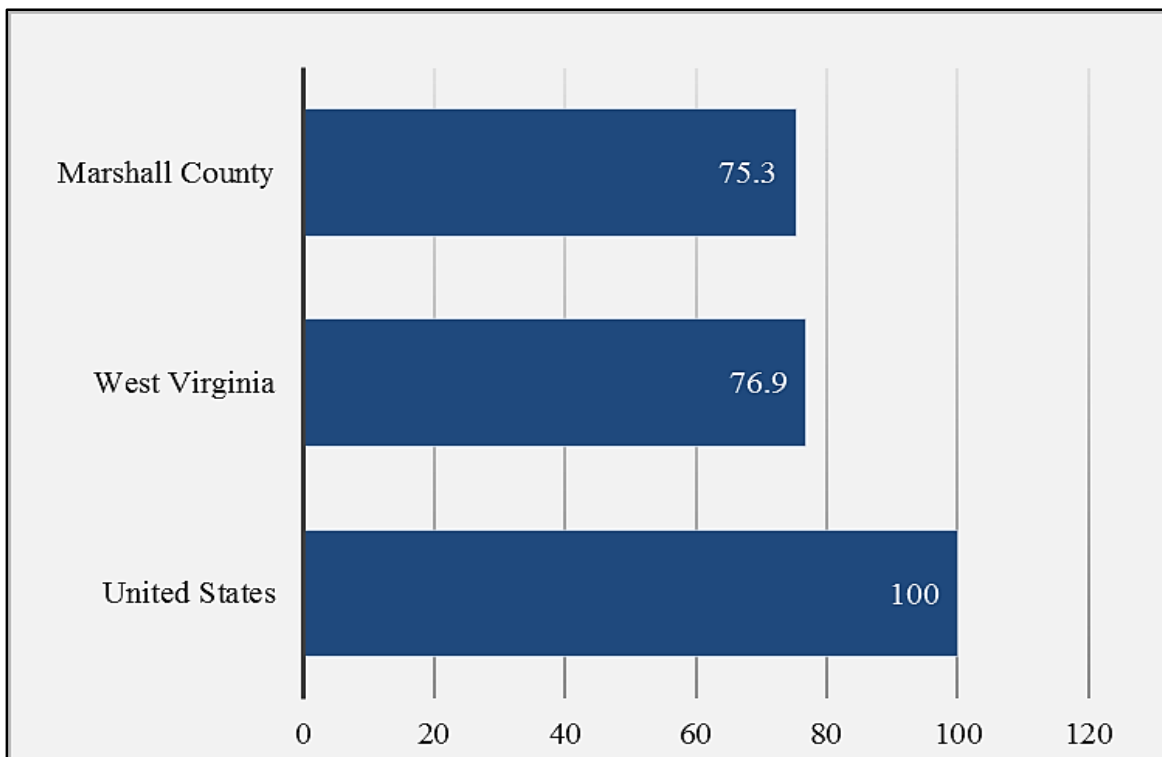

Figure 37. Human Capital Index for Marshall County. Data retrieved using the innovation index tool from http://www.statsamerica.org/innovation/innovation_index/region-select.html.

In exploring the relationship between the boom in natural gas on the community of

Moundsville, a theme of codes emerge including the most obvious which are 'natural gas',

'natural gas company', and those that may be less obvious including 'transient workers',

'trailers, campers, and RVs', and finally, 'vehicles and equipment'. Once again, a cross tabs

function with the assistance of MAXQDA is applied comparing the code system relating to

natural gas to the variable of 'year'. Additionally, in order to observe the relationship that may

exist between the codes of efficacy ('positive' and 'negative') and the key codes related to

natural gas, a crosstab function is applied using the independent variable of 'year' (Table 12). In

observing this table, it seems the coding of transient workers does not even appear until year

2011 which is 5 years after the first well was drilled in Marshall County.

Table 12

Time Series Analysis of Natural, Physical, and Human Capital Interplay with Natural Gas

Code System	2006	2007	2008	2009	2010	2011	2012	SUM
Natural Capital\natural gas	2.50	2.50	5.00	5.00	45.00	15.00	25.00	100
Human Capital\Town\Economic Development\Corporations\Natural Gas Company	0.00	0.00	0.00	2.56	74.36	0.00	23.08	100
Human Capital\Town\Economic Development\Corporations\Natural Gas Company\Transient Workers	0.00	0.00	0.00	0.00	0.00	36.36	63.64	100
Human Capital\Town\Population\Citizen\Concerned Citizen	11.27	21.10	14.16	20.81	13.01	4.91	14.74	100
Human Capital\negative	4.35	13.04	17.28	16.82	18.65	13.04	16.82	100
Human Capital\positive	8.11	12.17	15.62	23.53	15.62	10.14	14.81	100
Physical Capital\Property\Buildings\Housing\Trailers, Campers, RVs	5.63	9.86	14.08	5.63	4.23	16.90	43.66	100
Physical Capital\Vehicles and Equipment	0.00	4.22	11.39	21.94	28.69	13.92	19.83	100
SUM	5.75	12.49	14.89	18.57	18.99	11.31	18.00	100
N (Documents)	21	21	21	22	23	*12	21	0

This adds support that the community has not properly integrated the stages of resource

development into the planning process. Unfortunately, this decision to wait may hurt the

community in the long-run allowing industry to take the lead instead of the community.

Communities need to be reminded that energy companies are thinking thirty plus years in advance—and perhaps it would be advantageous for the community to plan this far in advance which may allow for a more positive post-resource outcome.

In Figure 38, crosstabs function is applied (x) year and (y) frequency of capital form. The results from applying this MAXQDA crosstabs function seem to suggest a small negative pattern for human capital and a small positive trend for both natural and physical capital, therefore inconclusive.
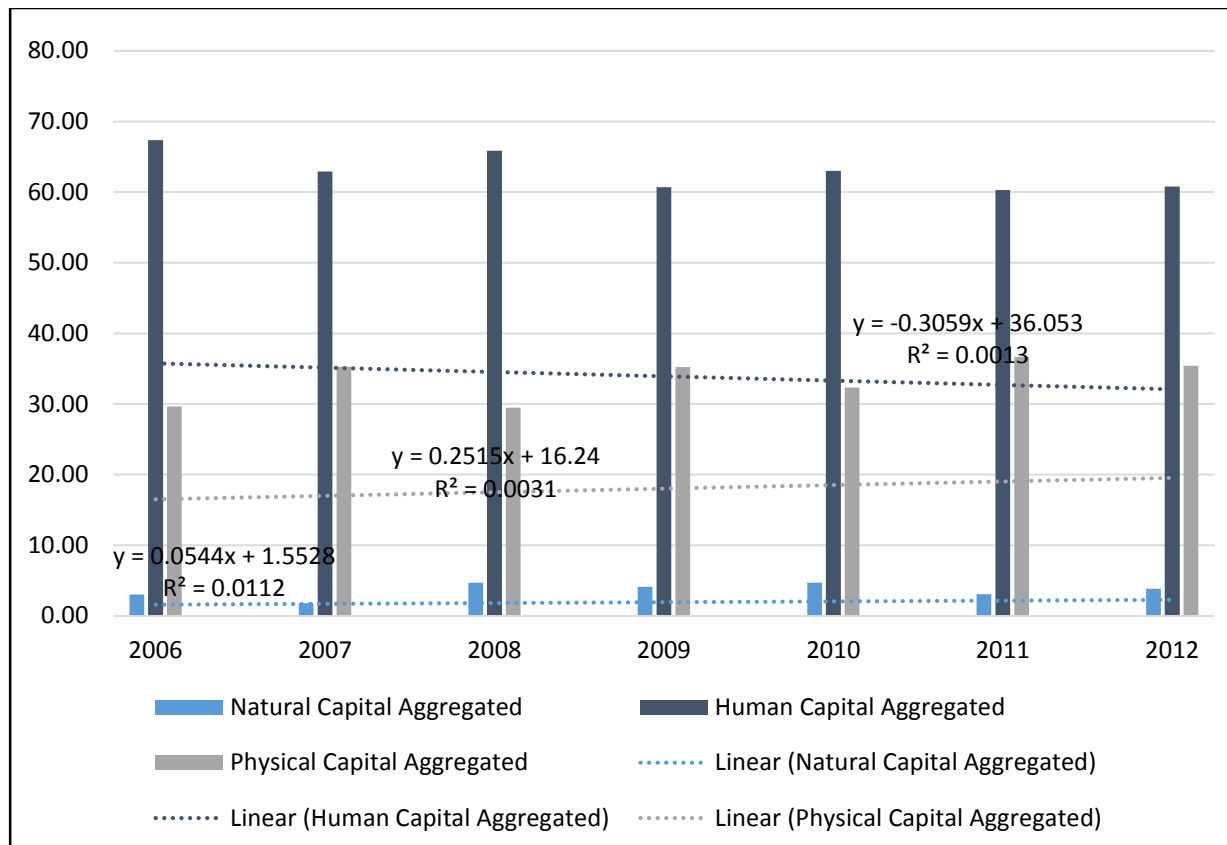
Figure 38. MAXQDA Crosstabs Function for Illustrating Time Series of Natural, Physical, and Human Capital.*Note: Efficacy codes of 'negative' and 'positive' are not included.

However, when applying the crosstabs function in MAXQDA, in comparing time series (x) to the efficacy dimensions of human capital reveals somewhat conclusive results. There seems to be a strong upward trend of the code 'negative' over time and a strong downward trend

for the code 'positive' over time. Assuming these codes represent the efficacy of the community

would suggest a downward spiral of efficacy (Figure 39).
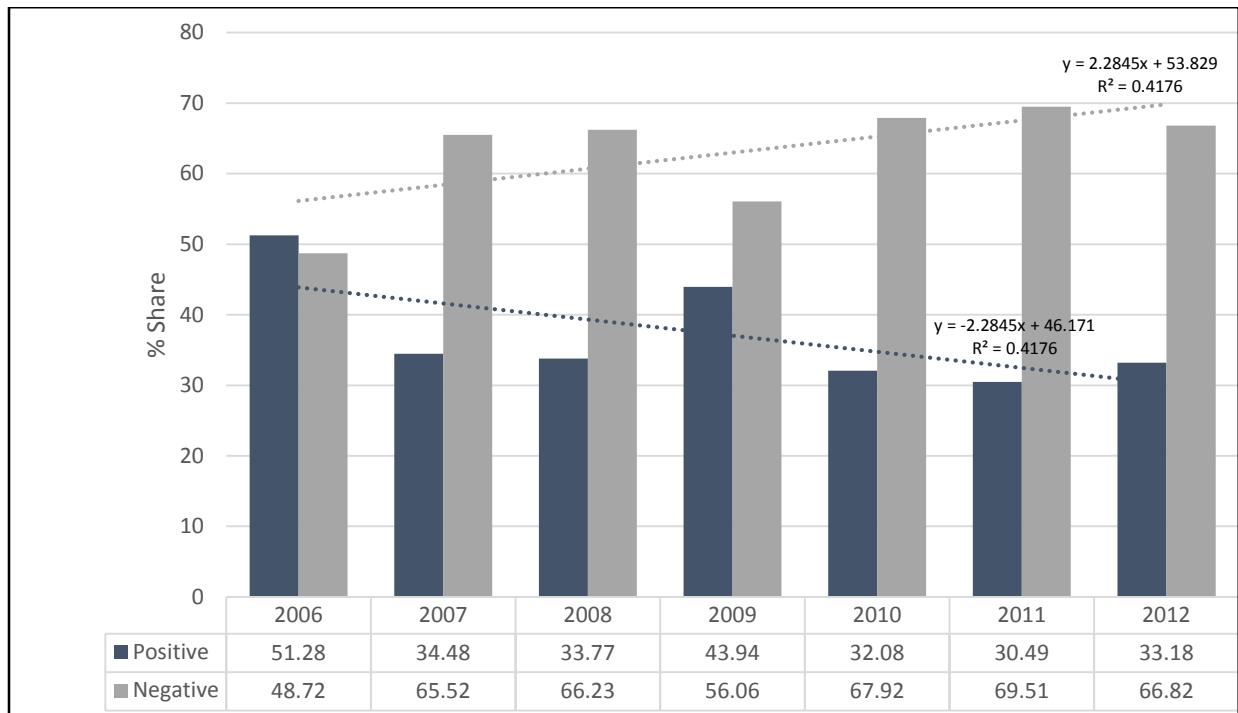
Figure 39. MAXQDA Crosstabs Function for Illustrating Time Series of Community Efficacy.

Discussion

The results in conducting this case study while simultaneously coding the city council

minutes, seems to suggest Moundsville is not engaging in sustainable development strategies.

First, and potentially most important, this study reveals the constructs of an energy systems

model posited here, that although human capital under our definitions and coding structure is

considered high, a social dimension of low community capital efficacy is revealed. Even though

human capital may be high—if the effectiveness of the human capital is not engaged, then this

hinders the ability for progress to be made towards a more sustainable and prosperous future.

This theory of efficacy is supported through early research by Linsley et al. (1995). If the

'efficacy-performance spirals' phenomenon is being observed at the individual, group, and

organizational level; perhaps in the case of Moundsville, the community itself could be thought

as a type of 'organization'. What the community of Moundsville is historically experiencing is a development pattern of boom and bust, or what one might call an up-spiral followed by a down-spiral. Assuming we treat the community of Moundsville like an organization, one possible reason for existing in this wicked cycle may be due to the existing community having a low efficacy-performance which amplifies a bust. This situation is exacerbated by the failure to recognize the constructs leading to the bust. Until a community understands fully what leads to the boom and/or maintains sustainable development—only then may self-correcting measures be implemented, thus avoiding this continued boom and bust development pattern. It may also be important to point out a rival explanation to this theory could be that it is human nature to be quick to complain rather than give thanks or appreciation for something. To clarify, since much of this study is based on the city council minutes, the people that typically come to these meetings are those who are disgruntled or concerned about an issue; thus, this could skew the results.

In addition, the concept of 'boomtown' as defined by Gilmore's (1976) and other researcher's definition of a communities' population exceeding 15% annually does not seem to apply in the case of Moundsville. Although this may have been true for boomtowns in the past, this may not be valid today. This most likely is due to major technological advances and the increasing virtualization of the workforce. Furthermore, it should be noted the in-migration of transient workers are not integrated into these estimates and therefore may not capture the entire population.

Lending support to Tainter's concept of increasing complexity leading to collapse may be revealed to an extent in the case of Moundsville. As an example, this social phenomenon may explain why resource dependent economies tend to remain 'stuck' in this cycle of boom and

bust. The historical culture of West Virginia is increasingly becoming more complex. As

decisions are intertwined in money and politics, self-interests and or the human-will to solve

problems may result in increasing investments that have decreasing payback for society as a

whole. With time and money being diverted for purposes of maintaining non-renewable sources

of energy as a staple for the West Virginia economy, reveals a wicked trade-off of short-term

gains for long-term negative consequences.   By not effectively investing into the more

reproducible form of human capital and instead diverting resources to less sustainable

development patterns will most likely result in a boom and bust cycle.

In exploring, Freudenberg's (1992) theory of 'overadapting' in which industry takes over

a local economy, it becomes more evident why a community may remain in this cycle of boom

and bust. Currently, the county is experiencing a vast expansion of infrastructure dedicated

specifically for the energy sector. By overadapting and allowing industry to effectively take over

leaves community stakeholders stuck in a system built primarily for unsustainable extraction of

finite resources.

Recognizing the wicked problems that are occurring in this community reminds us that

such problems are not solvable, but instead can only be improved. As cited in Banathy (1996),

Rittel and Webber state, "Solutions to design problems are good or bad. They are not true or

false. Judgments of 'goodness of fit' of the solution may vary depending on people's interest,

values, and perspectives" (p. 31). In the case of Moundsville, it seems this is particularly true

that essentially this region of the country is informed by a values system based on an 'energy

culture'.

Recent Developments

As this case study has evolved, there have been a number of notable headlines that have

occurred after the observations of the most critical time period of 2006-2012. The following is a

brief description of each:

1. February, 2015 – Ohio and Marshall County mineral owners sign for $100
million in Marcellus Shale lease agreements with Texas based driller Tug Hill
with price per acre as much as $8,000 with 20% royalties, but as low as $5/acre
with only 12.5 % royalties.

2. February, 2015 – Gastar is one of several companies bidding with the West
Virginia Department of Commerce (a potential $40 million deal for West
Virginia) to extract oil and natural gas from state-owned land below the Ohio
River (calling it River Fracking) bordering Marshall County, but concerned
citizens say it's not worth the environmental risks.

3. October, 2014 – Trans Energy to pay $3.6 million in penalties for violating the
Clean Water Act by impounding three Marshall County streams for building frack
ponds.

4. August, 2014 – Marshall County will take ownership of a natural gas plant in
the sum of $1. This was approved by county commissioners as a 'Payment In
Lieu of Tax' to facilitate the construction of the $615 million 549 MW
Moundsville Power gas electricity generator. However, some are concerned the
$31 million worth of lease payments over 30 years is inadequate for the county.

5. August, 2014 – Noble Energy Inc. funds a student dropout prevention program
called "Energizing Our Youth". Noble Energy Inc. provided $300,000 over three
years in partnership with Marshall County Schools and the Marshall County
Chamber of Commerce for exploring careers in the energy field.

6. July, 2014 – Marshall County chooses to install additional water lines and
perform maintenance work on the county courthouse with $2.94 million worth of
coal severance cash.

7. February, 2014 – An 8-ft sinkhole developed after a sanitary collection line
collapsed on Jefferson Avenue resulting from the transportation of heavy
equipment for supplying natural gas industry sites with well pads, compressor
stations, and piping.

8. April, 2014 – Gas pipeline ruptures causing a huge fireball near Moundsville
prompting concerned residents to consider moving away from Moundsville.

9. March, 2014 – Permits for companies hosting sites with 10 or more people must apply for a labor camp permit.

10. March, 2014 – Oil and gas severance tax revenues jump more than $358,000 during the past 3 years. $0 will be used on local roads, but instead on state roads.

11. February, 2014 – Due to the 2011 Bill passed by the West Virginia legislature, a plant that was built in Marshall County only has to pay 5% of $900 million gas plant that was built, effectively losing 10 million in tax revenue and even more for years to come.

12. June, 2013 – A Tulsa, Oklahoma based company, Williams, plans on investing $4.5 billion to process gas in Marshall County. The company processes gas for Chesapeake Energy, Gastar, Chevron, Stone Energy, Noble Energy and Trans Energy. Once complete, the company claims it will be able to process 2.5 billion cubic feet of natural gas per day and will employ approximately 250 permanent workers. (Retrieved from http://www.shaleplayohiovalley.com)

Another major development that should be noted is the passing of the 2014 Moundsville Comprehensive Plan. This process began with enlisting the services of the West Virginia University Public Administration faculty and students, and the Community Design Team (CDT) in 2011. This seems to be a major step forward for bringing community stakeholders together and "unlocking their community's future". However, although one of their goals in this plan is to "Properly plan for the natural gas industry," when it came to implementing this goal—it was ranked as a "low" priority (see Table 13). Ranking this action as a low priority potentially represents a disconnect between local stakeholders and properly planning for a more positive post-resource outcome. However, it may also reveal local stakeholders feel they do not have the voice, time, resources, or support for ranking this as a high priority.

Table 13

Implementation Matrix for "Goal 5—Properly Plan for the Natural Gas Industry"

Recommendation	Priority	Responsible Party	Potential Partners	Estimated Costs	Funding Sources
Help facilitate long-term local employment opportunities in the natural gas industry	Low	City of Moundsville	Natural Gas Companies	Staff Time	NA
Work with local school officials to develop technical and trade education opportunities	Low	City of Moundsville	Marshall County Board of Education/Trade Schools	Staff Time	NA
Be proactive in identifying whether the city can provide all essential services to persons living in trailer camps	Low	City of Moundsville	NA	Staff Time	NA
Properly plan the placement and development of trailer camps	Low	City of Moundsville	WVU Land Use and Sustainable Development Law Clinic	Staff time in preparing land use ordinances	NA

Adapted from the City of Moundsville Comprehensive Plan, July, 2014, p. 5.

Chapter V

Conclusions

The following is a concise overview for the Case of Moundsville beginning with summarizing the framework and methods used for analyzing the on-going theory. Then, major findings are presented including those of expected results and those that were seemingly counterintuitive. Finally, a discussion is needed for the limitations of this study and potential recommendations for improving the framework and moving theory into action for communities experiencing the cyclical development pattern of boom and bust.

Summary

The Energy Rich Region (ERR) of West Virginia exhibits a diverse and extensive prior pattern of boom and bust in timber, coal, oil, and natural gas. This region is blessed with ubiquitous amounts of natural wealth, however, people have remained comparatively more poor than other regions who lack natural wealth. The theory presents a path towards a more sustainable energy system. If total stock is maintained while converting natural capital to the more reproducible forms of human and physical capital, then we may assume the region is on a more sustainable path and therefore avoid the reoccurring cycle of boom and bust. The framework presented explores one such community, Moundsville, within an ERR which may assist future research dedicated to similar cases located in other Energy Rich Regions—allowing for multiple case comparisons. The framework presents an instrument known as the ERR Template which contains potential indicators for exploring sustainability through the inclusive wealth forms of natural, physical, and human capital. The template informs the primary methods utilized (1) Secondary data sources, 2) MAXQDA Open Coding, and 3) Participant Observation) including the open coding process of seven years of city council minutes with the assistance of

MAXQDA. The data and information from these methods are then added to the Moundsville

Knowledge Base for analysis.

The results reveal the wicked human problems that exist hinder the transition towards a

more sustainable and diverse society. Furthermore, a dimension of poor community efficacy is

revealed which may be a contributing factor to the inability to transform the natural capital into

the more reproducible capital forms of human and physical capital. Unless human-will

intervenes at the local level and commits to a more sustainable energy systems model, the

development pattern of boom and bust will continue.

Major Findings

The overarching question of whether the natural capital (natural gas) is being converted

effectively to the reproducible forms of human and physical capitals to avoid the reoccurring

boom and bust cycles of the past is still unclear. Currently, ubiquitous amounts of natural gas is

being produced in Marshall County, among several other resources including shale oil and coal.

What this case study reveals is there are several 'wicked problems' relating to the boom in

natural gas.

(1) Although there are vast sums of investment in the exploration, leasing, and

infrastructure from the boom and natural gas — it seems these investments do not

affect everyone equally. Primarily landowners (could be households, the State,

University, or out-of-state Corporations) that have both mineral and surface rights

with lots of land will be the winners, but only as long as these wells are producing

which is dependent on the price of natural gas. Furthermore, the natural capital

(natural gas) does not coincide with municipal boundaries and therefore limits the

potential gain for such rural communities.

(2) The enormous amounts of physical capital being put in place suggests corporate investors, Marshall County, and West Virginia are betting this boom is here for the foreseeable future. However, it seems most investments are moving towards energy specific infrastructure and not necessarily the built community environment, such as homes, buildings, schools, and local roads.

(3) What may be of most significance, is the development pattern of human capital and the additional social dimension of community's efficacy. Although there is a surge in natural capital, the human capital is decreasing in the community and county alike. Population — is continuing to decline (although this is slowing). The ability for the community to attract and keep the most educated for building a diverse and skilled workforce seems to also be a significant issue. Furthermore, by combining some of these descriptive statistics and coding seven years of city council minutes, seems to suggest a decline in community efficacy.

Revealing the multiple dimensions/layers occurring simultaneously may provide citizens and policymakers a more integrated/holistic approach to policy design. Additionally, the case of Moundsville, may promote a new framework for analyzing a community's sustainability through the inclusive wealth forms of natural, physical, and human capital. The research implications reveal the need for a sustainable development programming guide for informing local and state stakeholders in transcending a model of boom and bust towards a more sustainable model of diversity.

Limitations

Yin (2003) states, "A previously developed theory is used as a template with which to compare the empirical results of the case study". If two or more cases are shown to support the

same theory, replication may be claimed. Currently, this is one case with potential future

research dedicated to similar cases at the community level. Until the framework/approach

employed here is conducted again, this limits the extent in which a community can be accurately

compared to a similar community because such research using the approach seen here does not

exist. However, for time and tractability purposes, the researcher for the case study of

Moundsville assumes there are similar phenomena occurring throughout communities in West

Virginia; thus informing a regional development pattern of boom and bust.

"Validity, in qualitative methods hinges to a great extent on the skill, competence, and

rigor of the evaluator because the observer is the instrument" (Patton, 1987). Keeping this in

mind, I am not perfect, however steps were taken to make this case more systematic and

unbiased. Efforts were made including those of reflexivity, using multiple methods for

comparing results (triangulation), the use of the software program MAXQDA which allows the

researcher to inductively explore the data itself (grounded theory), testing the ERR template in a

classroom setting with the assistance of expert knowledge and feedback, and finally as

recommended by Yin (2003) a protocol was created via the "Moundsville Knowledge Base"

which allows a researcher thoroughly process the many stages in conducting a case study and

creates a more systematic case. However, even with these techniques in maintaining errors, open

social systems are extremely complex and therefore imperfections are likely.

Finally, other limitations include data quality and time. Data was retrieved where

possible, however in some cases there were incomplete data sets, and data was retrieved from

different sources for gathering specific dates, or in some cases no data existed. Time was a

limiting factor too. The use of the qualitative data software program MAXQDA was self-taught

and therefore limits the preferred methods for analysis or capabilities to explore deeper into integrating this software with programs like SPSS.

Future Research

Further research could involve the framework presented here, however a future framework could be improved by providing additional quantitative results behind the qualitative results. The program MAXQDA has the ability to interface with statistical programs such as SPSS which may provide improved statistical results by using a correlation and or a simple regression model.

Typically programming is seen to apply only to architectural and or design projects for specific clients. However, programming could be appropriate for thoroughly understanding the problem and needs for a particular community to better inform the decision-making process.

This programming process could be utilized for smaller historically resource dependent communities strategizing on approaches for transforming their boom and bust development patterns towards a more sustainable development pattern. However, for such a process to successfully assist a community—the community must first recognize and engage the human-will to change through an iterative decision making process. Furthermore, there seems to be a 'sit and wait until something happens' mentality. A strategic energy planning process would assist a community in dealing with the latest boom in natural gas. By the time leases are signed and campers are moving in—this is too late, and can result in rushed and negligent decision making by all stakeholders. Of course, this cannot all be projected from the inaction of one community. This community is already overwhelmed by the normal day to day decision-making and lack the time and appropriate resources. At times there seems to be a lack of empowering local decision making. This is partially because the decision making process (especially as it applies to oil and

gas) is a state decision, thus limiting the power a local community has over its resources. And

then there is the issue of severance taxes. This wealth first goes to the state and then is

distributed to the county level. However, the county has a ruling in how this money is dispersed

to the local communities. This seems to be a rather complex, redundant, and ineffective system

and should be re-evaluated.

In addition, it may be advantageous to explore the idea of having a federal or state agency

program that provides assistance for natural resource dependent communities. As an example,

given the lack of time and resources at the local government level, there may be a role for the

USDA or perhaps the state extension office to provide guidance in sustainable development

strategies by holding stakeholder meetings and or providing education resources.

In recognizing these additional constructs and processes of this energy system should

assist in the development of a programming guide. To reiterate, a general guide to sustainable

community development was suggested by the President's Council of Sustainable Development.

Perhaps before a community programming guide is developed, the following principles may be

advantageous for informing this programming guide:

> (1) All people have access to educational opportunities that prepare them for jobs
> to support themselves and their families in a dynamic local economy that is
> prepared to cope with changes in the national and global economy.
> (2) People are involved in making decisions that affect their lives.
> (3) Businesses, households, and government make efficient use of land, energy,
> and other resources, allowing the area to achieve a high quality of life with
> minimal waste and environmental damage.
> (4) These communities are healthy and secure, and provide people with clean air
> to breathe and safe water to drink. (PCSD, May, 1999)

The findings and implications in conducting the case of Moundsville could be significant

not only at the community level, but internationally. The IEA states, "Taking all new

development and policies into account, the world is still failing to put the global energy system

onto a more sustainable path (2012)." In addition, the IEA claims a cumulative investment of

$37 trillion is needed worldwide to meet the energy demands through 2012-2035 (2012). Placing

this into perspective, real change through human-will can begin at the community level bringing

new insight to the commonly quoted expression "think globally and lead locally". This can

effectively transform these wicked problems into actions of progress, thus changing the

landscape of a region for a more sustainable and prosperous future.

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Appendices

Appendix A: Energy Rich Region (ERR) Template.

Snapshot Profile for *(Your Region)*					
Society					
Population Composition & Key Figures	**Region Value**	**Compare to State Rank**	**Compare to US Rank**	**Source/Link**	**Additional Source/Link**
Total Population (2012)				STATS America	
Growth % *since 1980-2010*				STATS America	
Median Age				STATS America	
Total Population 25 and Older				STATS America	
Total % Receiving a High School Diploma or More				STATS America	
Total % Completing a Bachelors Degree or More				STATS America	
Average Household Size				STATS America	
Average Family Household Size				STATS America	
Unemployment Rate % *(Dec, 2012)*				STATS America	
Median Income (2011) in 2011 Dollars				STATS America	
Median Household Income (2011) in 2011 Dollars				STATS America	
Per Capita Personal Income *(2011)*				STATS America	
Poverty Rate for all ages % *(2011)*				STATS America	
Cost of Living % *(US=100)*				Moody's Précis State	Moody's Précis Metro
Net Domestic Migration *(chg. 2010/2011)*				STATS America	
Net International Migration *(chg. 2010/2011)*				STATS America	
Well-Being Index Score *(2012)*				Gallup-Healthways Well-Being Index	
Environment					
Land Cover *(square miles)*	**Region Value**	**% Total Area**			
Land Area				USGS Land Cover Viewer	
Forest & Woodland				USGS Land Cover Viewer	
Agricultural Vegetation				USGS Land Cover Viewer	
Developed & Other Human Use				USGS Land Cover Viewer	
Open Water				USGS Land Cover Viewer	
Other				USGS Land Cover Viewer	
Energy Figures	**Region Value**		**Compare to Rank in US**		
Total Energy Production (trillion BTU)				U.S. EIA	
Total Energy Consumed per Capita, 2010 (million BTU)				U.S. EIA	
Energy Consumption per Real Dollar of GDP (Thousand BTU/chained 2005 dollars)				U.S. EIA	
CO_2 emissions 2011 (metric tons) from Electric Power				U.S. EIA	

Total Assets (Wealth)		
Evaluation Area	**Values**	**Source/Link**
Physical Capital		
Buildings		
Buildings (Residential)		2010 Census
Buildings (Non-Residential)		Hospitals Government, Commercial, etc.
Land		
Roads,Highways, Bridges		TAMU Urban Mobility Information
		US Dept. of Transportation RITA
Rail Lines		US Dept. of Transportation RITA
Mass Transit Lines (buses, subways, light rail)		US Dept. of Transportation RITA
Waterways		
Navigation Channels and Ports		Regional and state government
		US Dept. of Transportation RITA
		Port authorities
Air		
Air Routes and Airports		US Dept. of Transportation RITA
Pipelines		
Pipelines		EIA - Natural Gas Pipeline Network
		American Petroleum Institute (API)
Information and Electric Connectivity		
Telecommunications		The Information Technology & Innovation Foundation (ITIF)
Electric Grid, Transmission & Distribution		Federal Energy Regulatory Commission (FERC)

Human Capital			
Education			
K-12 Education Systems			National Assessment of Educational Progress (NAEP) Scores
			College Board SAT/ACT Scores
			ETS Graduation Rates
			STATS America Educational Attainment
Community Colleges and Technical Schools			Community College Trends and Statistics
Four-Year Colleges and Universities			US News and World Report Rankings
			WebCASPAR US National Science Foundation (NSF)
			Almanac of Higher Education 2012 Chronicle of Higher Education
Workforce and Training Programs			U.S. Department of Labor Services By Location
Workforce Availability/Occupational Analysis			American FactFinder Community Facts Education
			Bureau of Labor Statistics data
Innovation & Technology			
High Tech Jobs			The Information Technology & Innovation Foundation (ITIF)
Scientists and Engineers			The Information Technology & Innovation Foundation (ITIF)
			Bureau of Labor Statistics data
Patents			US Patent & Trademark Office
			The Information Technology & Innovation Foundation (ITIF)
Industry Investment in R&D			The Information Technology & Innovation Foundation (ITIF)
			National Science Foundation R&D
Non-Industry Investment in R&D			The Information Technology & Innovation Foundation (ITIF)
			National Science Foundation R&D
Movement towards a Green Economy			The Information Technology & Innovation Foundation (ITIF)
			U.S. Energy Information Administration
			DSIRE USA
			BLS Green Technologies and Practices
Venture Capital			The Information Technology & Innovation Foundation (ITIF)
			PWC MoneyTree

Natural Capital		
Energy-Finite Resources		
Oil Proved Reserves		U.S. Energy Information Administration
Natural Gas Proved Reserves		U.S. Energy Information Administration
Coal Proved Reserves		U.S. Energy Information Administration
Energy-Renewable Resources		
Wind		U.S. Energy Information Administration
Solar Photovoltaic & Thermal		U.S. Energy Information Administration
Hydro		U.S. Energy Information Administration
Biomass		U.S. Energy Information Administration
Geothermal		U.S. Energy Information Administration
Energy-Other		
Nuclear		U.S. Energy Information Administration
Mineral Resources		
bauxite, copper, gold, silver, iron, lead, nickel, phosphate, tin, zinc, rare earth elements, limestone, uranium		USGS Mineral Resources Data System
Other		
Timber Resources		World Bank Changing Wealth of Nations
		US Forest Service Research
		USGS Land Cover Viewer
Nontimber Forest Resources		World Bank Changing Wealth of Nations
		USGS Land Cover Viewer
		US Forest Service Research
Cropland		World Bank Changing Wealth of Nations
		USGS Land Cover Viewer
		USDA AG Census
Pastureland		World Bank Changing Wealth of Nations
		USGS Land Cover Viewer
		USDA AG Census
Protected Areas		World Bank Changing Wealth of Nations
		USGS Land Cover Viewer
		National Conservation Easement Database
		National Marine Protected Areas Center
		National Park Service
		US Fish and Wildlife Service

Creative Industries:	1. Information about NAICS and all the codes can be found at the US Bureau of Labor Statistics, but for ease of use, click on StatsAmerica below. Here, researches have categorized the industries into clusters for understanding the industry composition throughout the US.
	StatsAmerica
	2. Under "Get Industry Cluster Data", click on "Cluster Definitions."
	3. Click on "Aggregated Industry Cluster Definitions."
	4. Using previous creative reports as a guide, look at the 3, 4, &6 digit NAICS codes, and from these choose the Clusters that seem most appropriate for exploring the creative industry. These clusters you choose will be included for using the Industry Cluster Tool later. (Include these clusters in your report and explain why you chose these clusters)
Creative Occupations:	1. For finding the creative occupations for your region, go to StatsAmerica found here:
	StatsAmerica
	2. Under "Get Occupation Cluster Data," click on "Cluster Definitions."
	3. Click on "Detailed Occupation Cluster Definitions." Here, "knowledge-based" occupations have been aggregated and placed in 15 clusters. These are not all SOC codes, but StatsAmerica has filtered through all of the Bureau of Labor Statistics SOC codes, and came up with an aggregated version of knowledge-based occupations. *(Note: the "Job Zone" categories you may ignore if you wish. Job Zone 1 are jobs that need little or no training, and Job Zone 2 are jobs that need at least a GED and some training.)*
	4. Using previous creative reports as a guide, look at these SOC codes, and from these choose the clusters that seem most appropriate for exploring the creative occupations. (Include these clusters in your report and explain why you chose these clusters)

Appendix B: MAXQDA Open Coding System with Frequencies and Number of Documents.

Parent code	Code	Activated coded segments %	Documents
Human Capital		0.07	6
Human Capital	Regional	0.12	13
Human Capital	Town	0.24	23
Human Capital	County	0.45	37
Human Capital	Federal	0.53	37
Human Capital	State	1.00	71
Human Capital	Positive	4.37	127
Human Capital	Negative	7.75	132
Human Capital\County	Marshall County Fair Board	0.10	10
Human Capital\County	Marshall County Board of Education	0.17	14
Human Capital\County	Marshall County Commission	0.27	25
Human Capital\County	Marshall County Chamber of Commerce	0.43	36
Human Capital\State	Extension Service	0.02	2
Human Capital\State	DEP	0.36	33
Human Capital\State	Department of Highway	0.52	44
Human Capital\Town	Population	0.02	5
Human Capital\Town	Economic Development	0.07	8
Human Capital\Town	Education	0.11	12
Human Capital\Town	Tourism and Recreation	0.17	18
Human Capital\Town	Transportation	0.21	22
Human Capital\Town	University	0.22	17
Human Capital\Town	Non Profits and Organizations	0.28	24
Human Capital\Town	Crime and Death	0.36	24
Human Capital\Town	Beautification	0.37	35
Human Capital\Town	Moundsville Daily Echo	0.47	42
Human Capital\Town	Public Safety	0.59	48
Human Capital\Town	Human Health and Environment	0.65	42
Human Capital\Town	City Departments and Employees	0.85	59
Human Capital\Town	Culture	1.43	86
Human Capital\Town	Policy	3.09	104
Human Capital\Town	Finances	5.46	134
Human Capital\Town\City Departments and Employees	Sanford Resource Center Board	0.09	9
Human Capital\Town\City Departments and Employees	Attendance	0.12	9
Human Capital\Town\City Departments and Employees	Historic Landmarks Commission	0.12	14
Human Capital\Town\City Departments and Employees	Petition	0.12	11
Human Capital\Town\City Departments and Employees	Liability Insurance	0.13	12
Human Capital\Town\City Departments and Employees	Moundsville Housing Authority	0.14	15

Human Capital\Town\City Departments and Employees	Zoning Board	0.19	13
Human Capital\Town\City Departments and Employees	Storm Water Department	0.25	20
Human Capital\Town\City Departments and Employees	Building Commission	0.28	28
Human Capital\Town\City Departments and Employees	Comprehensive Plan	0.40	28
Human Capital\Town\City Departments and Employees	Training	0.41	32
Human Capital\Town\City Departments and Employees	Executive Session	0.42	31
Human Capital\Town\City Departments and Employees	Voting and Elections	0.42	34
Human Capital\Town\City Departments and Employees	Water Department	0.56	43
Human Capital\Town\City Departments and Employees	Planning Commission	0.60	43
Human Capital\Town\City Departments and Employees	Policy Committee	0.74	58
Human Capital\Town\City Departments and Employees	Council, Commission, Board Turnover	0.78	50
Human Capital\Town\City Departments and Employees	Parks and Recreation Commission	0.78	57
Human Capital\Town\City Departments and Employees	Legal	0.81	59
Human Capital\Town\City Departments and Employees	Contracts and Agreements	0.82	54
Human Capital\Town\City Departments and Employees	Sanitation Department	0.82	51
Human Capital\Town\City Departments and Employees	Communication	0.82	61
Human Capital\Town\City Departments and Employees	Traffic Committee	0.97	74
Human Capital\Town\City Departments and Employees	City Employee Benefits	1.15	69
Human Capital\Town\City Departments and Employees	Finance Committee	1.21	84
Human Capital\Town\City Departments and Employees	Street Department	1.21	74
Human Capital\Town\City Departments and Employees\Building Commission	Building Inspectors	0.35	26
Human Capital\Town\Crime and Death	Drugs and Alcohol	0.24	24
Human Capital\Town\Crime and Death	Vandalism	0.25	24
Human Capital\Town\Culture	Museum	0.10	10
Human Capital\Town\Culture	Festival	0.12	10
Human Capital\Town\Economic Development	Corporations	0.34	28
Human Capital\Town\Economic Development	Jobs	0.34	29
Human Capital\Town\Economic Development	Small Business	2.09	100

Human Capital\Town\Economic Development\Corporations	Natural Gas Company	0.35	21
Human Capital\Town\Economic Development\Corporations\Natural Gas Company	Transient Workers	0.20	13
Human Capital\Town\Finances	Revenues	0.46	27
Human Capital\Town\Finances	Donation	0.60	43
Human Capital\Town\Finances	Grants	1.31	73
Human Capital\Town\Human Health and Environment	Personal Health	0.13	13
Human Capital\Town\Human Health and Environment	Conservation and Energy Efficiency	0.15	13
Human Capital\Town\Human Health and Environment	Health Care	0.21	19
Human Capital\Town\Non Profits and Organizations	Family Resource Network	0.12	9
Human Capital\Town\Population	Citizen	2.23	99
Human Capital\Town\Population\Citizen	family	0.12	11
Human Capital\Town\Population\Citizen	Neighbor Disputes	0.18	18
Human Capital\Town\Population\Citizen	Youth	1.38	89
Human Capital\Town\Population\Citizen	Concerned Citizen	3.07	116
Human Capital\Town\Public Safety	Medical Service	0.20	18
Human Capital\Town\Public Safety	Fire Department	1.64	98
Human Capital\Town\Public Safety	Police	3.30	115
Human Capital\Town\University	Community Design Team	0.06	6
Natural Capital	Soil and or Land	0.10	10
Natural Capital		0.20	16
Natural Capital	Coal	0.28	23
Natural Capital	Animals	0.35	26
Natural Capital	natural gas	0.35	29
Natural Capital	Water	0.38	31
Natural Capital	Weather Related	0.66	42
Natural Capital	Trees	0.74	55
Physical Capital	Decorations	0.04	6
Physical Capital	Trails	0.16	17
Physical Capital	Property	0.23	18
Physical Capital	Infrastructure	0.37	30
Physical Capital	Debris	0.51	35
Physical Capital	Technology	0.56	43
Physical Capital	Parks	1.42	82
Physical Capital		1.68	88
Physical Capital	Vehicles and Equipment	2.10	92
Physical Capital\Infrastructure	Electric Lines	0.16	17
Physical Capital\Infrastructure	Sidewalks	0.90	77
Physical Capital\Infrastructure	Water and Sewer	0.90	64
Physical Capital\Infrastructure	Street Lights and Signals	0.94	71
Physical Capital\Infrastructure	Parking	1.14	82
Physical Capital\Infrastructure	Roads, bridges, and alleys	5.29	130
Physical Capital\Property	Annexation	0.10	10

Physical Capital\Property	Zoning	1.71	81
Physical Capital\Property	Buildings	2.23	104
Physical Capital\Property\Buildings	Moundsville Prison	0.06	8
Physical Capital\Property\Buildings	Strand Theater	0.07	9
Physical Capital\Property\Buildings	Sanford Center	0.24	24
Physical Capital\Property\Buildings	School Building	0.51	37
Physical Capital\Property\Buildings	Fostoria	1.17	82
Physical Capital\Property\Buildings	Housing	1.30	77
Physical Capital\Property\Buildings	Property Nuisance	2.36	97
Physical Capital\Property\Buildings\Housing	Trailers, Campers, RVs	0.63	46
Physical Capital\Property\Buildings\Housing	Dilapidated Aging or Vacant Structures	1.71	87

Appendix C: Participant Observation Photos of Moundsville, West Virginia.

Figure 40. Moundsville Penitentiary, Moundsville. Kiger, B. (Photographer), 2012.

Figure 41. Moundsville Penitentiary, Moundsville. Kiger, B. (Photographer), 2012.

Figure 42. Exterior Strand Theater, Moundsville. Kiger, B. (Photographer), 2012.

Figure 43. Exterior Strand Theater, Moundsville. Kiger, B. (Photographer), 2012.