

**Breaking Down the Barriers Inhibiting the Introduction of Emerging Industries into  
Central Appalachia**

A Technical Report submitted to the Department of Engineering Systems and Environment

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Bachelor of Science, School of Engineering

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## **Technical Report**

### **Introduction**

There will probably never be another dominant industry like coal in Appalachia ever again. The industry served as the backbone of the communities of central Appalachia. The future of the region will be dependent on multiple industries: Nathan Hall, a central Appalachia native and former coal miner, knows this well. He states that "there will be no silver bullets, but rather 'one thousand silver BBs' to replace lost coal jobs." Working to convert mining-impacted lands in central Appalachia into "a mix of commercially viable sustainable [opportunities]," he goes on to say that he "wants to be a part of the silver buckshot, that's going to hopefully transform this region" (Stolberg, 2016). In order to make this change, however, people must be open to working in new industries, which is not a simple task. Many times, people do not consider working in sectors different from the one they used to work in, but the coal industry is dying and with central Appalachian unemployment and poverty rates on the rise, miners must begin to consider other work. To attract interest in new opportunities, companies can use behavioral science which would in turn benefit both the company itself and those unemployed as a result of the loss of the coal industry.

### **Methods**

Research methods include documentary research, interviews, and discourse analysis. The results obtained from such methods are organized thematically. Unemployment statistics in addition to employment statistics from central Appalachia are evaluated to provide evidence of the problem. Additionally, interviews with central Appalachian coal miners provide primary research contributing to the proposed solution (Appendix A). A sample of these interview questions include: What do you like about working in the industry? What do you not like about

working in the industry? Would you consider working in another industry in the future if located close to home? A full list of interview questions is found in the appendix.

## **Results and Discussion**

### **The Problem in Central Appalachia**

Appalachia – in general – has long been characterized by high rates of poverty and unemployment and lately, the area has been notorious for its high rates of opioid addiction. However, the real gap in such statistics does not lie between Appalachia and the rest of the United States but between central Appalachia and the remainder of the region. Although Appalachian poverty rates hover much higher than those of the nation as a whole, “central Appalachia tends to have the highest poverty rates within Appalachia by far.” Additionally, central Appalachia, the area of Appalachia traditionally composed of counties with the “highest dependence on the coal industry,” also has higher unemployment rates than those non-mining Appalachian counties and the rest of the U.S (Bowen et al, 2020). Bill Bishop, a contributing editor at *The Daily Yonder*, states that “[Appalachian Regional Commission] researchers found that the people who live there [in central Appalachia] have greater drug abuse ... problems than Appalachians who live in regions that aren’t dominated by a coal economy (2008). These issues – unemployment, poverty, and addiction – oftentimes reinforce each other and unfortunately, crime becomes a part of the cycle (Rafaiee et al, 2013). This cycle is a vicious one, and it certainly has begun to threaten the region; however, central Appalachia is not yet lost.

### **Central Appalachia: America’s Newest Hot Spot?**

A Gallup survey conducted at the end of 2020 showed that nearly half of American respondents indicated that they would rather live in a rural community as opposed to a city or suburb (Roper, 2021). Likely attributed to the COVID-19 outbreak that dominated 2020, people

are beginning to value rural living. Luckily, central Appalachia offers just that, and in addition to the area's rich history, natural beauty, and abundance of outdoor activities, the region holds opportunity for new industries.

The mountains of central Appalachia have had and still have a lot to give. Before coal, it was timber, and time will tell what the next industries supported by the Appalachian Mountains may be. In recent years, government incentives to produce energy from carbon-free sources has made the coal industry extremely unpredictable, and while there remains plenty of coal to be mined, there have not been investments in mining such coal seams due to the uncertainty which surrounds the industry. Thus, there is an abundance of unoccupied land in central Appalachia waiting to be repurposed.

Agriculture and tourism are two industries which people have already begun to explore on reclaimed mine land in central Appalachia. AppHarvest, for example, proposed a project in 2017 which involved "constructing a 2 million square-foot greenhouse on 60 acres of reclaimed mined land" in Pikeville, Kentucky where tomatoes and other produce would have been grown using new "hydroponic techniques" (Payne, 2017). Although the project in Pikeville was not approved, the company has since opened a greenhouse in Morehead, KY and has "broken ground" on two additional greenhouses in the state (2021 AppHarvest, n.d.). Nathan Hall, a native of central Appalachia and former coal miner himself, also has big plans for the region. In an interview with the *Yale Alumni Magazine*, Hall discussed growing herbs and fruits, such as lavender and grapes, on reclaimed mine lands adding that "the final piece is to have as much value-add in the region as possible: processing centers, the production of wine, that sort of thing" (Walsh, 2018).

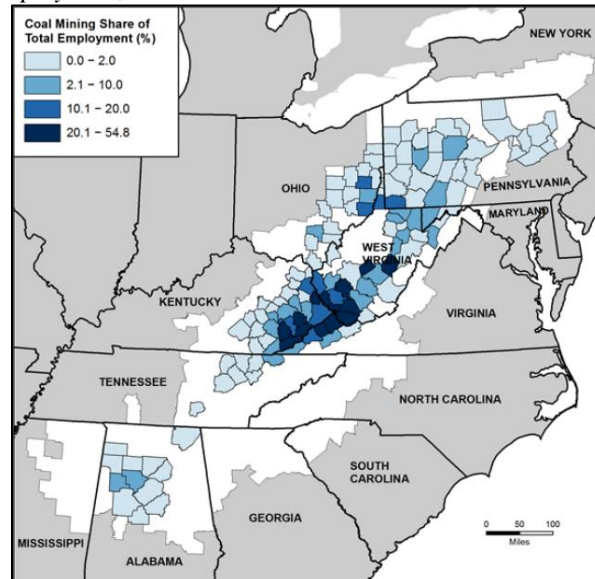
Hall also serves as the president of the Reclaiming Appalachia Coalition which focuses on repurposing abandoned mining land with a majority of their projects contributing to the tourism industry. Some examples include: the Wise County Extension Learning Center, “a new facility to support its educational programs to farmers, gardeners, and ranchers in the region” with plans to sit on an abandoned coal mine site; and The Wilds of Emily Creek (TWEC), a “7,000-acre wilderness-based ecotourism attraction on former mine sites in the eastern Kentucky counties of Martin and Pike” (*AML Pilot Projects Map*, n.d.).

### **Target Employees of Emerging Central Appalachian Industries**

In addition to the large amount of land which could be useful for industries looking to invest in central Appalachia, the area has a large number of eligible workers. As seen in Figure 1 below, ten counties had a “coal mining employment share” of between 10 and 20 percent, and 13 counties had a share of more than 20 percent in 2005. The higher employment shares were mostly concentrated in central Appalachia and in fact, “all of the counties with an employment share of more than 20 percent” were located there. However, employment in the coal industry fell “by around 54 percent between 2005 and 2020” (Bowen et al). As a result, central Appalachia took the hardest hit as compared to other Appalachian counties. As seen in Figure 2 below, for the six years following 2007, the unemployment rate of Appalachian mining communities (central Appalachia) remained well below that of Appalachian non-mining communities. In 2013, however, the unemployment rates of both the Appalachian mining and non-mining communities began to hover at about the same rate before the unemployment rate of the non-mining communities overcame that of the mining communities in 2015. According to a report in September of 2015, “the total number of operating coal mines ... hit its lowest point on record” during that time (Magill, 2015). Thus, the reduction in the number of operating coal

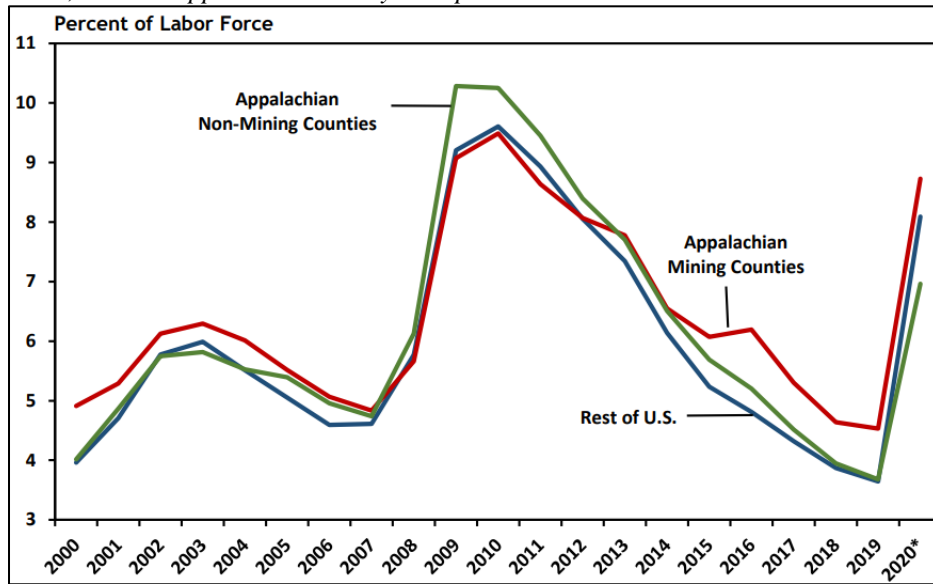
mines resulted in a significant displacement of coal miners, many of who had relied on a job in the coal business throughout their entire working careers.

Figure 1  
*Coal Mining Share of Total Employment, 2005*



*Note.* Figure includes only Appalachian coal-mining counties. Adapted from Bowen, E., Christiadi, Deskins, J., & Lego, B. (2020). (rep.). *An Overview of Coal and the Economy in Appalachia* (p. 19). Appalachian Regional Commission. Retrieved September 22, 2021, from [https://www.arc.gov/wp-content/uploads/2021/04/Coal-and-the-Economy-in-Appalachia\\_Q4\\_2020-Update.pdf](https://www.arc.gov/wp-content/uploads/2021/04/Coal-and-the-Economy-in-Appalachia_Q4_2020-Update.pdf).

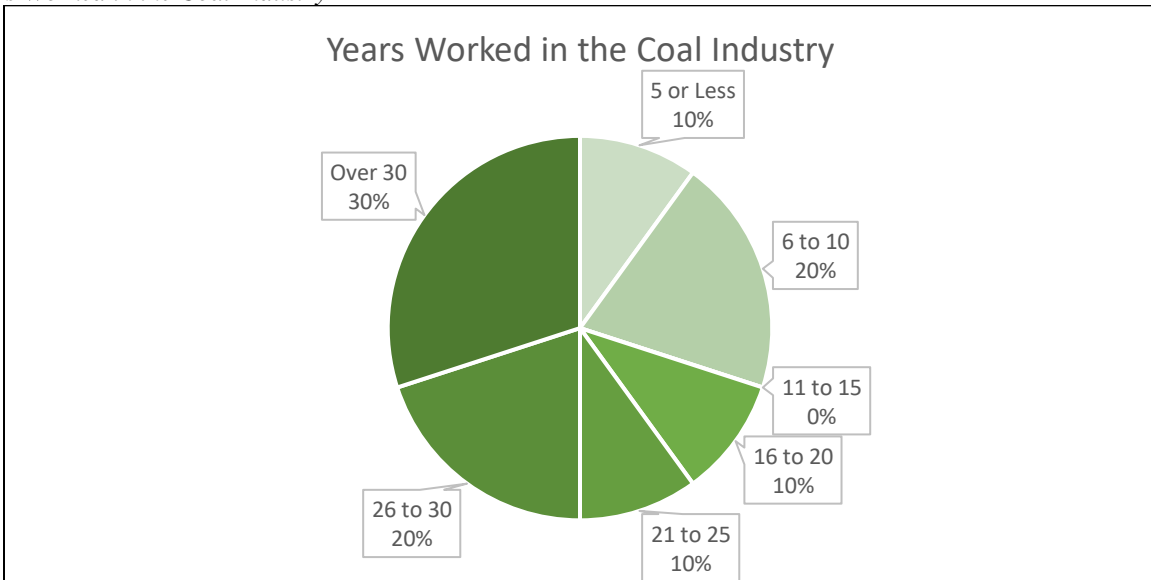
Figure 2  
*Unemployment Rate, Various Appalachian County Groups*



Note. \* = The 2020 rate represents the average of the first 11 months of 2020. \* = The 2020 rates are averages of the first 11 months of 2020. The significant increase in the unemployment rate of 2020 can be attributed to the effects of the COVID-19 pandemic. Adapted from Bowen, E., Christiadi, Deskins, J., & Lego, B. (2020). (rep.). *An Overview of Coal and the Economy in Appalachia* (p. 24). Appalachian Regional Commission. Retrieved September 22, 2021, from [https://www.arc.gov/wp-content/uploads/2021/04/Coal-and-the-Economy-in-Appalachia\\_Q4\\_2020-Update.pdf](https://www.arc.gov/wp-content/uploads/2021/04/Coal-and-the-Economy-in-Appalachia_Q4_2020-Update.pdf).

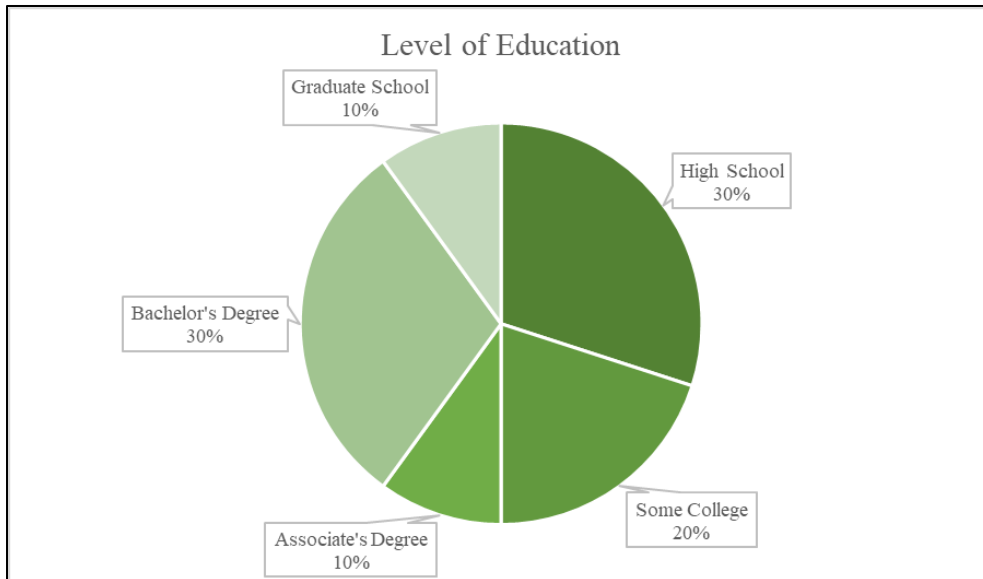
Due to the coal mining community being a well-defined population of people which have become affected by the unemployment crisis in central Appalachia, ten coal miners from central Appalachia were interviewed. Due to the constraints of both time and resources, the population used for interviews regarding the life and work of central Appalachian coal miners was limited. Thus, in an attempt to obtain the most accurate responses, a diverse population was chosen. While 100% of the interviewees are from central Appalachia, the group varies in terms of the years which they have worked in the coal industry, their levels of education, and their working experience outside of the coal industry. Those with over 20 years of experience in the coal industry make up 60% of the interviewing population (Figure 3). Additionally, while some of the miners may not have graduated, 70% of those interviewed attended some level of college (Figure 4). Lastly, 40% of the miners interviewed have had no experience outside of the coal industry with the remaining 60% having over five years outside of the industry (Figure 5).

Figure 3  
*Years Worked in the Coal Industry*



*Note.* Data obtained from interviews found in Appendix A.

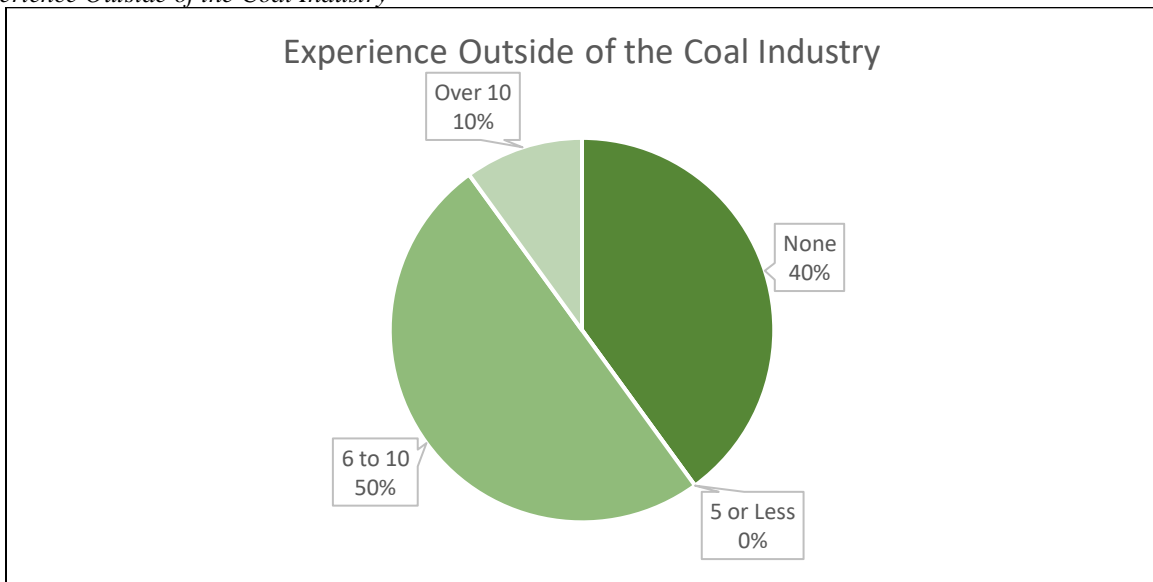
Figure 4  
*Level of Education*



*Note.* Data obtained from interviews found in Appendix A.



Figure 5  
*Experience Outside of the Coal Industry*



*Note.* Data obtained from interviews found in Appendix A.

In addition to the fact that the coal mining community has been disproportionately affected by unemployment in central Appalachia, these people are open and willing to work, making them a prime demographic to consider as the target employees of emerging central Appalachian industries. Coal miners are a group of people which have been conditioned to never pass up on an opportunity to make themselves more valuable, which they attribute to the industry being one of “feast or famine.” Historically, the success of the coal industry has had multiple highs and lows; thus, coal miners work to obtain any certification or skill that could set them apart from their counterparts in the event that their company must lay off. The responses to interview question #7 – what positions have you held in the coal industry? – illustrate this idea as all but two respondents recited that they had done “a bit of everything,” from being a laborer to working in the laboratory to working in an administrative role (Appendix A). This idea has also been demonstrated at BitSource, “an internet start-up founded by two Pikeville businessmen [out of a renovated Coca-Cola bottling plant] determined to prove a point: that with training and encouragement, Kentucky miners can learn to code.” BitSource was able to employ ten laid-off

mine workers who were eager to get back to work, regardless of what that may ensue; roughly 1000 displaced miners applied for those ten positions (Stolberg, 2016). In an interview in 2016, Nathan Hall stated that “people in Appalachia are hungry for new opportunities in the wake of the near disappearance of the coal industry” (1982 – 2022 Yale Center for Business and the Environment, 2016). Hall makes a clever point but more importantly, *coal miners* are hungry for new opportunities in the wake of the near disappearance of the coal industry. When miners were asked whether they would consider working in another industry if located close to home, 100% of interviewees responded “yes” given the job would have similar pay and benefits to that of the coal industry.

### **Using Behavioral Science to Increase the Success Rate of Emerging Central Appalachian Industries and Employ Displaced Coal Miners**

Jamie Phillips of Oxford HR, defines behavioral science as “the psychology of predicting how people will behave in certain situations” and using such can be equally as useful in recruiting applicants for a position as selecting a candidate for hire (2015). In recruiting applicants for a position, it is important to note that word choices and means of communication – whether personal or mass – used have a significant impact on the number and types of applications which are received. Moreover, in selecting candidates, recruiters must be aware of their own biases, both implicit and explicit, as “behavioral science tells us that we hire people who are like us” (Phillips, 2015). Thus, as emerging industries are introduced into central Appalachia and are working through recruitment and selection processes, behavioral science could be a useful tool in ensuring their success there. By using these insights, the inconsistencies that exist between the way people make decisions and their actual decisions can be understood

and people can be helped to “make and follow through on the best decisions for themselves – and for society” (*Ideas42 Home*, 2019).

Ideas42, a non-profit, that describes themselves as using “insights from behavioral science to improve lives, build better systems and policies, and drive social change” is one of the key players already using this psychology to make a difference (*Ideas42 Home*, 2019). Their work spans 6 continents and touches on many social issues such as: education; global health; economic justice; and environmental sustainability. Most importantly, Ideas42 has achieved success through behavioral science. There is not evidence that suggests, however, that Ideas42 or any other organizations have used behavioral science to improve upon the issues that exist in central Appalachia.

To ensure their success and most effectively use behavioral insights in introducing emerging industries into central Appalachia, recruiters must be prepared to “challenge their status quo” and understand the modes of persuasion which they should appeal to in recruiting and selecting the displaced coal miners (Phillips, 2015). According to Phillips of Oxford HR, “people tend to like and choose candidates who are the most similar to themselves or their colleagues” and if the person recruiting the displaced miners is not from Appalachia, they may not sense many similarities between themselves and the candidate. Therefore, recruiters need to be made aware of this before interviewing so that they remain as unbiased as possible throughout the recruitment and selection process. A challenge is presented, however, in terms of merely recruiting people and encouraging potential applicants to apply: Oftentimes, “people don’t consider working in a different sector as the one they used to” (Marques, 2021). In order to encourage a greater turnout, behavioral insights can be applied – such as utilizing appeals to the

population's identities – throughout the advertisement of the position and application, to “help people consider [the] new job opportunities” (Marques, 2021).

In order to appeal to the identities of the displaced miners, the likes and dislikes of the workers must be assessed. It should be noted that as seen in Figure 5, 40% of miners interviewed have had no experience outside of the coal industry and another 40% of those interviewed left their coal mining jobs between 2014 and 2016 due to the uncertainty present within the industry. Many coal miners have little to no experience outside of the coal industry; thus, using behavioral science to help these people consider new opportunities is an important piece of this puzzle.

Central Appalachian coal miners take pride in being from central Appalachia and do not wish to see the demise of the region they call home. A study commissioned by the Appalachian Regional Commission showed that the “total population has fallen by over five percent in the coal mining counties of Central Appalachia in recent years, perhaps partly as a result of the decline in the coal industry” (Bowen et al). Moreover, of those interviewed, 80% of the miners have always lived in central Appalachia, and the remaining 20% only moved out of the region due to a change in occupation after 2016. These people want to live at home among their people; thus, recruiters from industries being introduced into central Appalachia must emphasize the fact that these people can do so.

Appealing to the displaced miners' pasts will not be an effective strategy in recruitment as 90% of those interviewed indicated that they had family ties to the industry. Instead, new industries should stress the fact that their industry is sustainable and has job certainty. When coal miners were asked what they do not like about working in the coal industry, they did not have a lot to report. However, all but one miner, cited the uncertainty and job insecurity that has surrounded the industry in recent years as one dislike.

Lastly, and most importantly, new industries must capitalize on the characteristics of the coal industry that the miners appreciate. Although feedback regarding people's dislikes in the coal industry was lacking, the miners interviewed listed many features of the industry that they do like. Many enjoy the constant challenge and puzzle which mining provides; they emphasized the idea that every day in the coal industry is something new. Mundane jobs will not be popular among the people of central Appalachia. Additionally, respondents cited the benefits and pay of the coal industry as the best that central Appalachia had (and sometimes still has) to offer. It must be considered that many of those in the industry, were making upwards of \$100,000 per year. Thus, industries must be aware that their investment in the region will not be a low-cost endeavor. Lastly, coal miners value the people and comradery that exists within the coal industry. Emerging industries in Appalachia might never be able to replace the coal mining industry and what it has offered its people; however, if these new industries are able to successfully utilize behavioral insights in recruiting those disproportionately affected by the fall of the coal industry, the culture created there could be reminiscent of the industry that once was.

### **Conclusion**

Once willing to look past the stereotypes of central Appalachia as well as push aside one's beliefs surrounding the industry that built the region, what is left is a large community of people who are willingly to work and a large amount of land that is waiting to be repurposed. With recent survey results showing that almost half of Americans would rather live in a rural community as opposed to a city or suburb and the new found ability to work from anywhere, now is the time to invest in central Appalachia and all it has to offer. The story in the Appalachian Mountains has always followed the same narrative: People come to the region, take

what they want, and leave. It is finally time that people come, build upon what is there, and make it their home.

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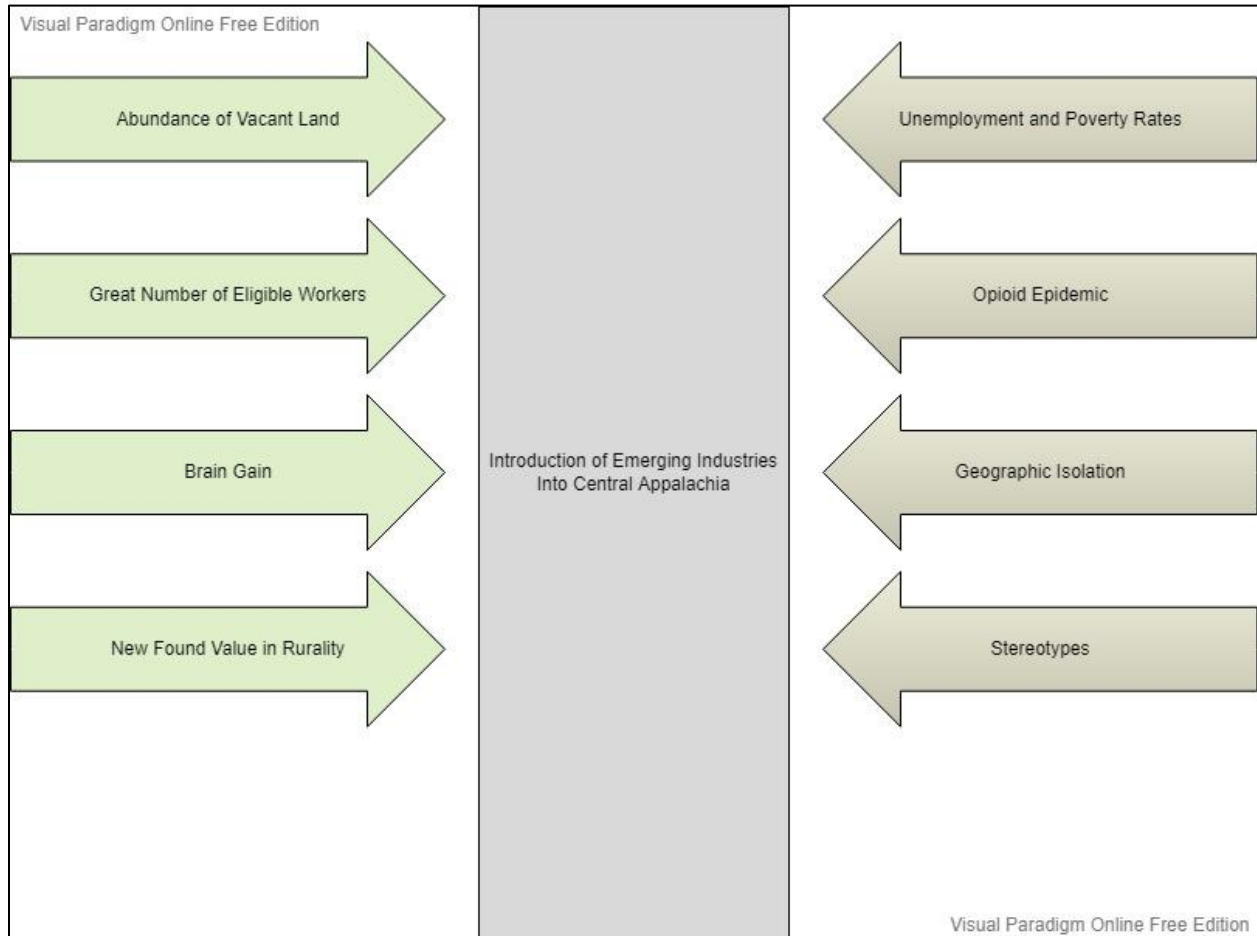
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## Appendix A

1.	Where are you from?
2.	Have you always worked in this region? If not, where else have you worked?
3.	How long have you worked/did you work in the coal industry?
4.	How did you get started in the industry? Family ties? Referred by a friend? School?
5.	What industries have your ancestors traditionally worked in?
6.	Did you attend college? Did you obtain an Associate's Degree? Bachelor's Degree?
7.	What positions have you held in the coal industry?
8.	What do you like about working in the industry?
9.	What do you not like about working in the industry?
10.	Would you say the answers to the two previous questions are fairly universal across the industry?
11.	Have you worked outside of the industry? If so, what industry did you work in and for how long? Why did you leave that industry? What did you like about that industry?
12.	Would you consider working in another industry in the future if located close to home?
13.	Do you have anyone in mind that you would recommend me speaking to?

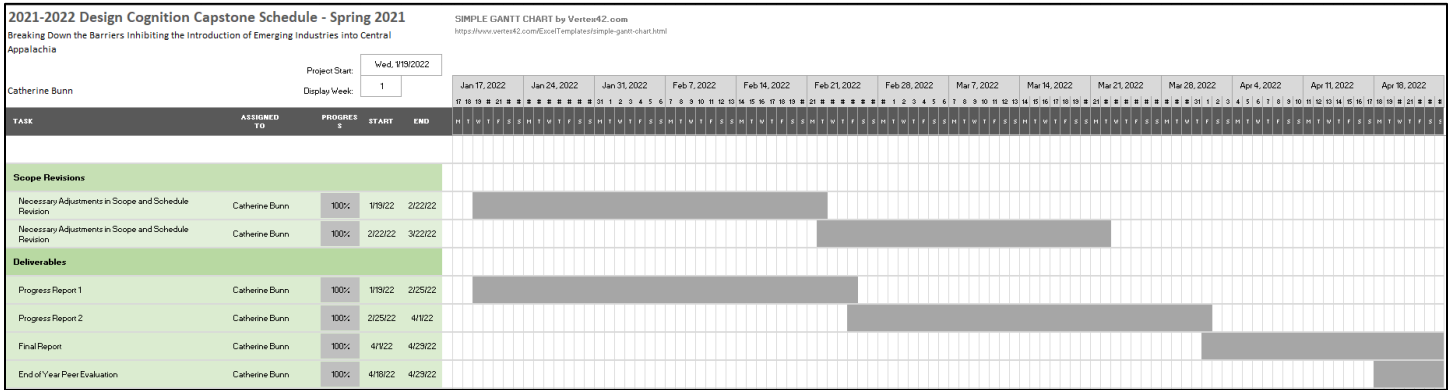
Appendix A. List of Interview Questions for Central Appalachian Coal Miners Regarding Their Life and Work

## Appendix B



Appendix B. Force Field Model Illustrating the Push and Pull Factors Surrounding the Introduction of Emerging Industries into Central Appalachia. Adapted from VP Online - Online Drawing Tool. (n.d.). Retrieved April 29, 2022, from <https://online.visual-paradigm.com/app/diagrams/#diagram:workspace=sdagnnio&proj=0&id=1>

# Appendix C



Appendix C. Detailed Project Schedule. Adapted from Vertex42 LLC. (2021, December 3). Simple Gantt Chart. Vertex42. Retrieved April 29, 2022, from [https://www.vertex42.com/ExcelTemplates/simple-gantt-chart.html?utm\\_source=ms&utm\\_medium=file&utm\\_campaign=office&utm\\_content=url](https://www.vertex42.com/ExcelTemplates/simple-gantt-chart.html?utm_source=ms&utm_medium=file&utm_campaign=office&utm_content=url)