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The Determination of Nitrogen Fertilizer on Barley Production in Ethiopia: A Review

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Abstract:
The productivity of barley stands in most parts of Ethiopia is constrained by the low fertility status of the soils. In order to address the problem, a review was done with the purpose of figuring out the ideal dose of nitrogen-based fertilizer for barley cultivation in Ethiopia's barley-growing districts. The review found that increasing nitrogen application amounts influenced practically every aspect of growth and yields. According to the review, nitrogen fertilizer application rates ranging between 0 kilograms per hectare and 230 kilograms per hectare produced the best plant height, spike length, grains per spike, straw, biomass yield, and grain yield of barley. However, there are not the same responses to different agro-ecologies and crop varieties. As observed from this review, nitrogen rates, which gave the highest yields, are not the same. It is different from place to place and from crop type to crop type. Therefore, it is necessary to conduct a detailed and further study to identify the optimum nitrogen rate for barley production throughout the country as per location, agro-ecology, and crop variety responses.

Keywords: nitrogen rate, fertilizer, barley production

INTRODUCTION

Barley (Hordeum vulgare L.), a cereal that is produced annually on 48 million hectares across a variety of environments, is the fourth most popular cereal in the world (ICARDA, 2011). Ethiopia, Africa's second-largest producer of barley, contributes almost 25% to the total crops (FAO STAT, 2014). According to CSA (2014–2015), barley ranks fifth in importance among all cereal crops grown in the country, after teff, wheat, maize, and sorghum. Food barley accounts for 90% of barley production, compared to malt barley (Alemu et al., 2014). The national yield of barley continued to be under 1.3 t/ha CSA (2014–2015), even though the potential yield at the experimental farms can approach 6 t/ha (Lakew et al., 1996). Lack of better cultivars and inadequate soil management are cited as reasons for the reduced yield of food barley (Woldeab et al., 1991). In Ethiopia's highlands, soil fertility is the biggest obstacle to the cultivation of barley (Woldeyesus et al., 2002). Poor plant nutrients and inadequate agricultural methods are further causes of low barley productivity (Gete et al., 2010). According to Abera et al. (2011), traditional agricultural practices and deficient soil fertility are the main causes of barley's low productivity.

In significant farming areas of the world, nitrogen tends to be the factor that most restricts crop yield; hence, comprehensive nitrogen management strategies typically result in considerable financial gains for farmers. Efficient nitrogen usage is also vital for reducing environmental pollution (Scharf and Alley, 1988). As a result, splitting nitrogen fertilizer applications to follow the crop's nitrogen requirements throughout the growing season is likely the best technique for achieving large grain yields while maintaining malt quality.

The primary raw substance necessary for plant growth is nitrogen. While it is a necessary part of every protein, it plays a role in every process of plant growth. Furthermore, nitrogen is involved in cell multiplication, which causes an increase in the size and length of leaves and stems, particularly grain and stalks; increases chlorophyll, which gives the leaves their dark green color; participates in the production of proteins in the plant; and is a component of many compounds in the plant, including certain types of basic acids and hormones. Nitrogen lack restricts cell division and expansion, chloroplast development, chlorophyll concentration and expansion, and enzyme activity. General stunting and yellowing, particularly in older plant portions, are symptoms of a nitrogen deficiency. According to Ortiz-Monasterio et al. (1997), nitrogen deficiencies in bread wheat mostly impacts leaf expansion and nitrogen concentration. Hence, a review was done with the purpose of figuring out the ideal dose of nitrogen-based fertilizer for barley cultivation in Ethiopia's barley-growing districts.

OVERVIEW OF NITROGEN

According to Taiz and Zeiger (2006), nitrogen is a mineral that plants need in high concentration, but normally the amount of nitrogen available to plants is constrained. As a result, nitrogen plays a crucial role in plant distribution, biology, which is development, and multiplication, which is why it accounts for the majority of agricultural supplies. The plant must have enough nitrogen in order for additional nutrients to be absorbed. It frequently participates in cell division, which results in the expansion of leaves and stems' size and length. Since nitrogen is a nutrient found in numerous important components, it is impossible to imagine how plants could thrive without it (Hansen et al., 2005).

The amount of nitrogen a plant can absorb has an impact on how well it's able to produce chlorophyll and engage in the process of photosynthesis (Hansen et al., 2005). This influences the amount of protein one at a time. Cereal leaves stay green for an extended period after the process of emergence, enhancing the rate of photosynthesis (Ozen and Onay, 2007). Due to nitrogen's significance as a macronutrient for plant nutrition and its role in promoting plant development by means of enhanced leaf formation and an increase in chlorophyll level in leaves, which may reflect advancements in the mechanism of photosynthesis, higher nitrogen fertilizer levels may increase yield (Mekdad, 2015).

Nitrogen Fertilizer on Plant Growth of Barley

Plant Height:

Kassa and Sorsa (2015) observed that increased nitrogen levels lead plants to grow higher in the Damot Gale District, Wolaita Zone, Ethiopia. They discovered that the shortest (61.3 cm) and tallest (83.1 cm) plants were grown in treated plots, and that a supply of 69/30 kg/ha nitrogen fertilizer resulted in a 32.62% plant height advantage over unfertilized plots. An increase in plant height and an increase in fertilization supply may both be strongly related to nitrogen's consequences, which encourage vegetative development. Similar findings were made by Fasil and Demelash (2021), who noted that the longest plant height (from 71.6 to 82.7cm) was shown as fertilizer with a nitrogen rate raised from 11.5 to 57.5 kg/ha. Nitrogen levels have a substantial impact on the plant's height. Similarly, a plant height advantage of 8.64% was seen for barley with 120 N kg/ha in comparison to a treatment that did not receive any fertilizers.

According to Niguse and Kassaye (2018), fertilizer at 69 N kg/ha produced the highest mean plant height (100.7cm), while fertilizer at 0 N kg/ha produced the lowest mean plant height (100.7cm). Furthermore, the height of the plants increased by 10.7 percent, exceeding the untreated

treatment. The addition of large nitrogen contents along with balanced fertilizers has a substantial impact on boosting vegetative growth in crop plants since nitrogen is a crucial component of chlorophyll and proteins, which aid in the growth and development of plants. Kassie et al. (2021) revealed that in the period of three years, the tallest plant's height was achieved with 222 kg/ha of nitrogen given; however, the shortest measurement was from under control.

Spike Length and Grains per Spike:

As reported by a number of researchers, spike length rose dramatically with rising N levels. As stated by Niguse and Kassaye (2018), the variety known as EH1493 yielded the greatest length of spikes (8.06 cm), followed by the one grown locally (7.89 cm), but the HB1307 variety gave the shortest spikes (7.10 cm). In another study, Fasil and Demelash (2021) found that the Holker variety had the longest spike length (5.6 cm) and the Fanaka variety had the shortest spike length (5.0 cm); additionally, the longest and shortest spike lengths (5.7 cm) were recorded from 57.5 N kg/ha and 11.5 N kg/ha use of fertilizer, respectively. The one that was treated with 92 kg/ha of nitrogen fertilizer level application had the longest spikes (6.89 cm), which was 25% longer than the shortest spikes (5.15 cm) found in the plot that received 23 kg/ha of nitrogen fertilizer use (Jemal and Aliyi, 2021). The duration of a malt barley spike is significantly influenced by nitrogen fertilization. According to Addisu (2020), the longest spike length (6.04 cm) was measured at a nitrogen level of 46 kg/ha, while the shortest spike length (7.27 cm) was measured at nitrogen rates of 115 kg/ha, 92 kg/ha, and 69 kg/ha.

According to Hunde and Hirpa (2017), the variety Grace produced the most grain per spike (32.0) at 65 kg/ha of nitrogen fertilizer application, whereas the control plot produced the lowest (26.2) grain per spike. When compared to the lowest grain produced with fertilizer application on the control, this greatest amount of grain improved by approximately 20.61%. In comparison to the control (23.36 kernels per spike), Ejigu and Eticha (2018) achieved the highest level of nitrogen at 50 kg/ha and produced the most kernels per spike (25.76).

Nitrogen on Yield, and Yield-Related Traits of Barley

Yield (kg/ha):

The crop reaction to nitrogen fertilizers in relation to plant development differs with the dosage and timing. In several physiological reactions inside the plant, it is crucial. As a plant grows, it absorbs and uses nitrogen for photosynthesis and other purposes. As a result, a lack of N can significantly affect grain growth and cause a considerable reduction in the amount of grain produced. Nutrient shortages and a lack of balanced fertilizers lower the yield of crops (Khan et al., 2014). Although the productivity and quality of malted barley are improved at the optimum nitrogen levels, too much nitrogen also reduces the yield and quality of barley seeds. Effective nitrogen doses differ depending on the place.

Shewangizaw et al. (2022) studied the effect of four nitrogen doses (0, 46, 92, 138, 184, and 230 N kg/ha) on barley yield in 83 farmers' fields in the main barley-growing Siemen Shewa Zone, the southern Tigray Zone, and the Bale Zone in Ethiopia from 2014 to 2016. They came to the conclusion that, as compared to the control, the nitrogen rate by agro-ecological zones interaction improved grain production by 59 percent in warm sub-moist mid-highlands (SM3), 37 percent in cool sub-moist mid-highlands (SM4), and 18 percent in warm sub-humid mid-highlands (SH3). Furthermore, the SM3 and SM4 agro-ecological zones saw the greatest yield increase. When N rate by soil type interaction was addressed, consistent yield gains of 26 percent (544

kilograms per hectare)–59 percent (1213 kilograms per hectare) on Cambisols and 18 percent (416 kilograms per hectare)–74 percent (1750 kilograms per hectare) on Vertisols were seen when compared to the reference.

Nitrogen fertilizer applied throughout the length of the barley improved its grain production. This is analogous with the research results of Hunde and Hirpa et al. (2017), who observed that nitrogen use at an amount of 65 kilograms per hectare resulted in the highest barley grain production (5880 kg/ha). The neglected plot, on the other hand, generated the least amount of grains (1780 kg/ha), which was reduced by seventy percent when compared to those treated with the highest nitrogen rate (65 kg/ha). The yield of crops improved significantly from 2.05 to 5.29 t/ha when nitrogen levels ranged from 0 kg/ha to 92 kg/ha in the Allicho-Woriro district, Silte Zone, Southern Ethiopia (Mekonnen, 2018). The study also showed that grain yield rose by 158.05 percent as compared with the untreated plots (0 N kg/ha). According to Ejigu and Eticha (2018), the variety known as 'Miscal-21' produced the best yield of grain (3690.66 According to Ejigu and Eticha (2018), the variety known as 'Miscal-21' produced the best yield of grain (3690.66 kg/ha) when using a nitrogen concentration of 30 kilograms per hectare, though the variety 'Holker' produced the smallest quantity of grain (1438 kilograms per hectare) at a nitrogen rate of 0 kilograms per hectare. These results are in line with those of Kefale et al. (2016), who found that the local variety with the lowest nitrogen fertilizer application rate (51.5 kilograms per hectare) produced the highest mean grain yield of nitrogen (4918.3 kilograms per hectare), while the highest nitrogen fertilizer application rate (98.5 kilograms per hectare) produced the highest nitrogen mean grain yield (4918.3 kilograms per hectare). When using a nitrogen concentration of 30 kilograms per hectare, though the variety 'Holker' produced the smallest quantity of grain (1438 kilograms per hectare) at a nitrogen rate of 0 kilograms per hectare. These results are in line with those of Kefale et al. (2016), who found that the local variety with the lowest nitrogen fertilizer application rate (51.5 kilograms per hectare) produced the highest mean grain yield of nitrogen (4918.3 kilograms per hectare), while the highest nitrogen fertilizer application rate (98.5 kilograms per hectare) produced the highest nitrogen mean grain yield (4918.3 kilograms per hectare).

By applying a total of four distinct nitrogen fertilizer dosages (0, 23, 46, and 69 N kilograms per hectare), Niguse and Kassaye (2018) carried out an experiment on the ground in Limo district, Southern Ethiopia, in order to assess the growth and yield indicators associated with three food barley varieties: Local Variety (Darshina), HB 1307, and EH 1493. They arrived at the decision that the cultivar EH 1493 had the greatest average grain production (4510 kg/ha) at a nitrogen application rate of 69 kg/ha. The cultivar HB 1307 with a 0% nitrogen rate produced the least grain yield (1420 kg/ha). Combined with 69 N kg/ha, EH 1493 outperformed HB 1307 and local varieties by roughly 39 and 22%, respectively. Fasil and Demelash (2021) claim that fertilization rates of 57.5 and 11.5 kg/ha with the Ibon and Fanaka cultivars, respectively, resulted in the highest (2.63) and lowest (1.39) t/ha grain yields. Food barley (var. HR0713) was the target of a study by Kassie et al. (2021) that examined the effects of various nitrogen (N) concentrations on yield and yield characteristics over the course of three years, from 2013 to 2016. The highest grain yields of barley came about when nitrogen was applied at a rate of 222 kg/ha, relative to the lowest yields throughout a three-year period when the control was used. Additionally, according to Jemal (2022), the traveler barley varieties treated with a nitrogen fertilizer rate of 150 kg/ha and the Ibon barley varieties treated with a nitrogen fertilizer rate of 0 kg/ha, respectively, produced the highest (2078.10 kg/ha) along with the lowest (1136.30 kg/ha).

Aboveground Biomass and Straw Yield:

As stated in Jemal and Aliyi's (2021) report, The lowest quantity of biomass from above (23 kilograms per hectare) matched statistically equivalent nitrogen fertilizer rates of 46 and 69 kilograms per hectare, while the largest amount of biomass yield (6.23 tons per hectare) was found at a nitrogen fertilizer rate of 92 kilograms per hectare. Furthermore, compared to the 23 kilograms per hectare nitrogen fertilizer rate, the maximum biomass yield of barley increased by 25 percent at the nitrogen fertilizer rate of 92 kilograms per hectare. Likewise, they believed that the use of nitrogen led to notable enhancements in plant height, tillering, spike length, the number of spikelets per spike, and grain yield, which ultimately resulted in an increase in crop biomass yield. These results were in line with those of Hunde and Hirpa (2017), who discovered that nitrogen fertilizer application rates ranging from 0 to 65 kg/ha increased biological yield by sixty percent. They also noticed that the greatest amount of biological yield (12,138.9 kg/ha) occurred at a nitrogen rate of 65 kilograms per hectare, which was much greater than the result obtained from the control plot (4,916.7 kilograms per hectare). This outcome showed that greater nitrogen utilization of fertilizers in addition to crop attributes related to crop biomass were responsible for the effects of nitrogen on the production of biological products. According to these findings, nitrogen encourages plant vegetative development at higher fertilizer application rates per hectare. Increases in the volume of nitrogen applied improved the quantity of straw produced in a linear way, as determined by Addisu (2020). He found that the nitrogen concentration of 115 kilograms per hectare resulted in the maximum straw yield (4920 kg/ha) of malt barely. The minimal straw yield (3870 kilograms per hectare) was produced from 46 kilograms per hectare of nitrogen. The plants' quick vegetative development may be the cause of the higher straw production after high nitrogen applications. The local variety with the highest nitrogen fertilizer application rate (98.5 kg/ha) produced the highest mean straw yield of nitrogen (9127.7 kilograms per hectare), while the Sabini variety with the lowest nitrogen fertilizer application rate (51.5 kilograms per hectare) produced the lowest mean straw yield of nitrogen (3455.3 kg/ha).

CONCLUSION

Generally, the review found that increasing nitrogen application amounts influenced practically every aspect of growth and yields. According to the review, nitrogen fertilizer application rates ranging between 0 kilograms per hectare and 230 kilograms per hectare produced the best plant height, spike length, grains per spike, straw, biomass yield, and grain yield of barley.

However, there are not the same responses to different agro-ecologies and crop varieties. As observed from this review, nitrogen rates, which gave the highest yields, are not the same. It is different from place to place and from crop type to crop type. Therefore, it is necessary to conduct a detailed and further study to identify the optimum nitrogen rate for barley production throughout the country as per location, agro-ecology, and crop variety responses.

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Geospatial Assessment of the Physical Expansion in Urban Development in Bwari Area Council, Federal Capital Territory, Abuja, Nigeria

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Abstract:
Globally, urbanization has become an inevitable occurrence increasing at a faster rate in developing countries, especially in Nigeria. This has called for the present strategies in the monitoring and management of its limited environmental resources. The research is aimed at monitoring the spatial extent of physical expansion in urban development of Bwari Area Council, Abuja using satellite imageries of Landsat TM (1986), Landsat ETM+ (2003) and Landsat OLI (2020) a period of 34 years and predict the future change in the next 30 years (2050) using an integrated Cellular Automata and Markov Chain Model. The Maximum Likelihood Algorithm was applied for the image classification in which five feature classes of Built-up, Vegetation, Bare surface, Rock outcrop and Water body were extracted. Future growth prediction was carried out by applying the Cellular Automata and Markov Chain Model analysis. The result reveals an observable land cover changes of the study area for the three epoch years. It shows a continuous increase in Built up areas between the years 1986, 2003 and 2020. Further analysis also reveals the trends in the urban expansion. In addition, the classification accuracy for the three periods of 1986, 2003 and 2020 of the classified imageries showed an overall accuracy of 95.8%, 99.9% and 99% respectively while the kappa statistics for the selected images were given as 0.89, 0.99 and 0.98 respectively. The information retrieved from this research will serve as a veritable tool for decision makers such as the government, city planners, and relevant authorities to effectively plan towards the formulation of sustainable future urban development.

Keywords: Urban development, Supervised classification, cellular automata and Markov chain

INTRODUCTION

In many parts of the world, urbanization has been viewed as one of the major change indicators which directly impacts on the increasing rate in the growth of the population (China, 2006). Hussain and Imtiyaz (2016) define urbanization as an increase in the proportional increase of the population size living in the urban settlement. Urbanization is also a form of land transformation caused by the alterations spatially as regards the dynamics in population and socio-economic activities (Jokar, Helbich, and Noronha, 2013). Wei Sun et al., (2020) described urbanization as a major socioeconomic indicator with far-reaching impacts on the development of a region or country, social progress-wise and economically. The proportion of urbanization is induced by living and property costs, physical geography, demand for more living space, and lack of proper planning policies (Bhatta, 2010).

Globally, urbanization is an inevitable occurrence that has led to the continued transformation and alteration of the natural landscapes and how these further impacts on the function and development of the societal framework (Griffith, 2009). In most metropolitan of the world, there has been occurrences of rapid rate of spatial urbanization, particularly in developing countries (Ogunleye, 2013). This is largely attributed to economic development, infrastructure initiatives and rapid population (Jat, Garg and Khare, 2008). According to Angel, Sheppard, Civco, et al. (2005), the urban built up area occupied over 400,00 square kilometers which would amount to about 0.3% of the world's land mass in the year 2000, of which its projection by the year 2030 is to consume 1,100,000km^2 (about 0.85%) if the growth rate is being sustained. Other statistics as reported by China (2006) projected of the world's population, over more than half would have occupied the urbanized areas by 2050, attributed to rural-urban migration with an average growth at the rate of 55.2% (United Nations, 2021; China, 2006).

Unprecedented urban growth often results in poor conditions of the environment, destroys natural resources, disrupts the ecosystem which would invariably lead to various forms of hazards with its adverse effects on both the natural and human environment, increased pressure on the current urban infrastructure and afterward results in resource limitations (Institute for Sustainable Communities, 2013; Akpu et al, 2017). Although urban development adds to socio-economic growth and improves the quality of life, it is the most prevalent and noticeable factor that has led to the changes in the natural environment (Herold, Goldstein and Clarke, 2003). According to Schlein, De Capua, and Kruger (2007), the most endangered of them would be the vegetation.

In Nigeria, urban centers are identified on the basis of population, legal or administrative criteria and adopts a threshold population of 20,000 people or more for defining an urban center compared to many other countries (Ofem, 2012). The population increase in the urban centres of Nigeria could be attributed to the expansion of existing built-up areas, the development of new and noticeably urban settlements (Bloch, Fox, Monroy, and Ojo, 2015). In addition to this, all states like the Federal Capital Territory, Abuja and Area council headquarters (Bwari Area council inclusive) have historically, legally or administratively been regarded as urban centers (National Urban Development Policy, 2006).

The Draft of the National Urban Policy Development (2004), also notes that Nigerian towns are grows without appropriate planning procedures and permits. The relocation of the nation's administrative capital to Abuja in 1991 was considered the fastest growing cities in the western sub region (Aliyu and Bashiru, 2015) and the proximity of settlements around the administrative capital led to the prosperity and economic transformation of the area, particularly of the satellite towns (Bwari and its Environs inclusive) from a remote rural settlement to a vibrant urban area (Olujimi, 2009). Since the creation of Bwari Area council (BAC), Nigeria law school, Jamb office, and other institutions influences her growth rate in terms of population and development within the town. Also, due to the problem of housing affordability, high rent and policy in land acquisition within the Federal Capital City, these have force development towards the satellite towns leading to haphazard and uncontrolled development. These changes in development need to be monitored and evaluated at regular intervals in ensuring environmental sustainability (Mohan, 2006). This will enable that instituted policies and planning strategies are adequately evaluated in addition to its accountability and effectiveness in urban governance.

Remote Sensing and Geographic Information System (GIS) is conceived a veritable tool pivotal to the monitoring and modelling urban expansion rates to aimed towards achieving sustainable

development. As cited in Ufuah, (2003); Bello and Ojigi, (2003), the effective planning and infrastructural development of any country is fundamentally hinged upon its ability to provide up to date and reliable spatial data from various outlets such as satellite Remote sensing, ground surveying, and crowd sourced mapping. According to Zhang and Cao (2019), a geographic information system (GIS) is an integrated operating system of hardware, software, and a GIS database that is controlled by qualified personnel and is able to thoroughly and methodically gather, store, search for, and analyze complicated spatial information.

Modeling urban growth appears to play a significant part in urban planning to assist in decisions that are related to sustainable urban development as a result of the increasing development of urbanization and the attendant environmental repercussions (Esch et al., 2009). Khoshgoftar and Mohammad (2010), analyzed and modeled Tehran's urban development over the past two decades in a report entitled "Tehran's urban growth modeling, using CA-Markov". In this work, the simulation was extended to 2025, and the mechanism of urban growth was examined using historical data from Landsat satellite photos taken in 1988, 2000, and 2006. Urban areas grew by around 11% between 1988 and 2006, according to a comparison of changes. The findings demonstrated how well the hybrid CA-Markov model predicted urban growth for the upcoming years based on the growth pattern of the preceding years. Balogun et al. (2011) employed field surveys, multitemporal remote sensing data, and GIS approaches to identify changes in land use and land cover in Akure, a city in southwest Nigeria, between 1986 and 2007. Their investigation revealed considerable alterations in Akure's land usage and land cover between 1986 and 2007. They also found that the pattern of change will continue along the same path through the year 2020. Aishwarya et al., (2019) attempted to compare Urban Growth Modeling using Neural Network- Cellular Automata and Deep Belief-Cellular Automata. The data they adopted was Landsat 7 and 8 of 2010 and 2013, and 2017. Support Vector Machine (SVM) was used for the preparation of land cover maps of all the epochs. The different land covers were converted into binary types as built up and non-built up. Hotspots of urbanization using buffer of 500m was determined. The prediction was done using agents of urbanization such as the Landsat datasets whereby 2013 referred to as existing while restricted areas for development labeled constraints.

This research is geared towards using Remote Sensing and GIS approach in monitoring the physical expansion of urban development in Bwari Area Council, Abuja and future prediction using Cellular Automata and Markov Chain Model. The specific objectives of this research are to:

i. examine the land cover map of the study area between 1986, 2003 and 2020,
ii. evaluate the changes in the Land cover classes of the study area,
iii. examine the pattern and direction of physical expansion of Built up in the study area,
iv. predict the future urban expansion for the next 30 years.

MATERIALS AND METHODS

Study Area

Bwari is located in the North-Eastern part of Federal Capital Territory, Abuja. It is located between latitude 9°5'00''N to 9°25'0''N and longitude 7°10'0''E to 7°35' 0''E as shown in the figure below. Bwari is approximately 15 kilometer north of Abuja city and 25 kilometers north east of suleja, in Niger state. It covers a total of about 2,300 square kilometers, and lies in the north – eastern part of the Federal Capital Territory (FCDA, 2004). The northern expressway of Abuja is the boundary between Abuja Municipal Area council and the Bwari Area Council. Sub-regionally, the area is surrounded by over twenty (20) minor settlements: Sabongari, Zango, Kuchiko, Kuduru, Zuma,

Kogo and Ushafaare the immediate settlements of the urban area while others are farther away from the township.

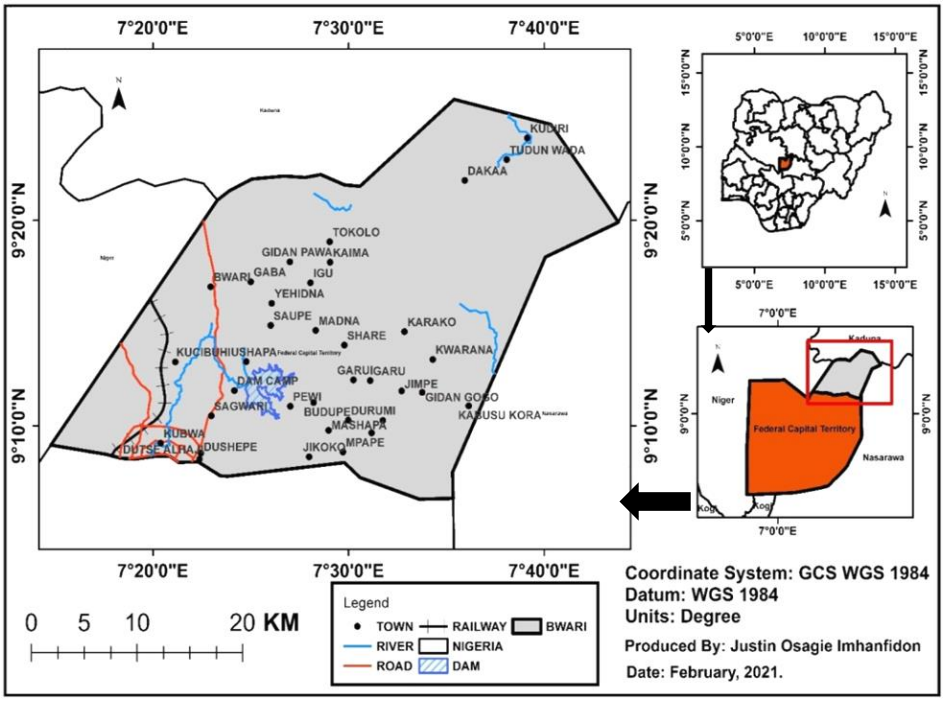


Figure 1: Location of the Study Area

Source: Author, 2021

Data Requirement

In this study, both the primary and secondary data were used. The table below shows the specific dataset used.

Table 1: Specifications of Dataset

SN	DATA	PATH/ROW	YEAR	FORMAT	SCALE/ RESOLUTION	SOURCE
1.	GPS coordinates point of geographic features		2020	Table	±3m accuracy	Field Work
2.	Landsat Satellite TM	189/053 189/054	1986	Raster	30m	https://glovis.usgs.gov
3	Landsat Satellite ETM+	189/053 189/054	2003	Raster	30m	https://glovis.usgs.gov
4.	Landsat Satellite OLI	189/053 189/054	2020	Raster	30m	https://glovis.usgs.gov

Source: Author, 2021

METHOD OF DATA ANALYSIS

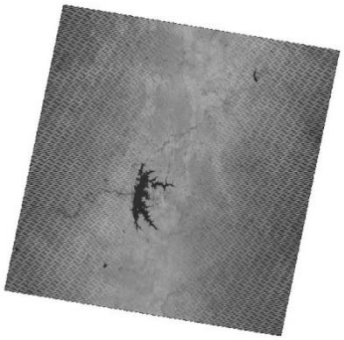
Pre-Processing of Dataset

These include radiometric correction and geometric correction. It involves the correction of Landsat images through Lines tripping removal, Cloud removal, Geo-registered to the Universal Transverse Mercator, mosaicking of images scenes and clipping the images using the shapefile of Bwari Area Council. The shapefile of the study area was used to clip from the mosaicked images.

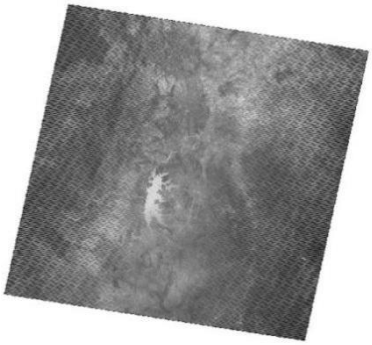
This is because the mosaicked area is larger than the Area of interest (AOI) and it helps in defining accurately the study area.

Lines tripping Removal:

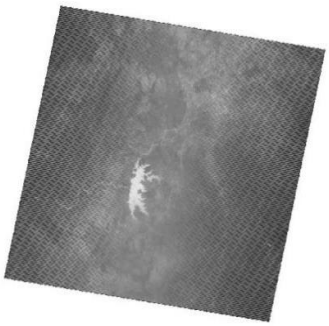
For the removal of the lines tripping on the Landsat images each Band of 4, 3, and 2 of the different Landsat images of 189/053 and 189/054 were subjected to several processes using the Focal analysis tool on Erdas Imagine 2015.



a. BAND 4



b. BAND 3



c. BAND 2

Figure 2: Landsat 2003 (189/053) band 432 with Lines tripping

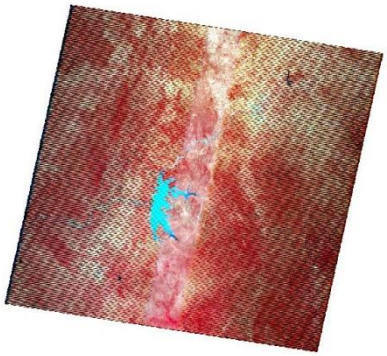
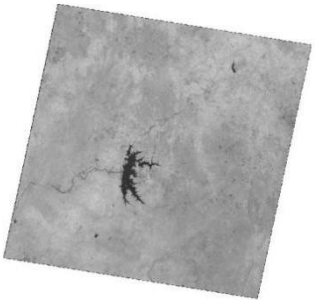
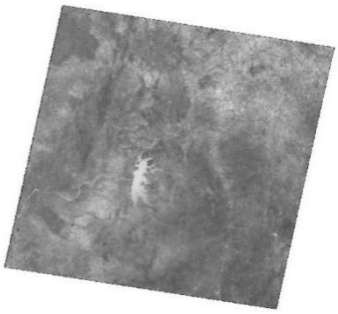


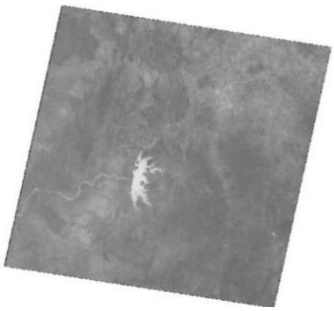
Figure 3: Landsat 2003 (189/053) False colour Composite images with Lines tripping



Band 4



Band 3



Band 2

Figure 4: Corrected Landsat 2003 (189/053) band 432

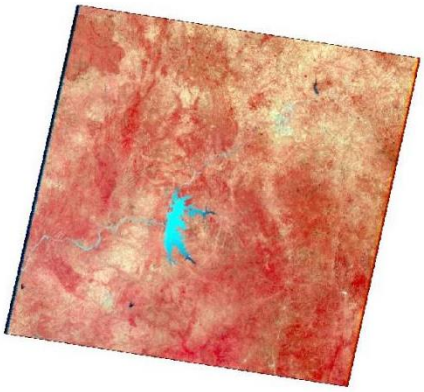
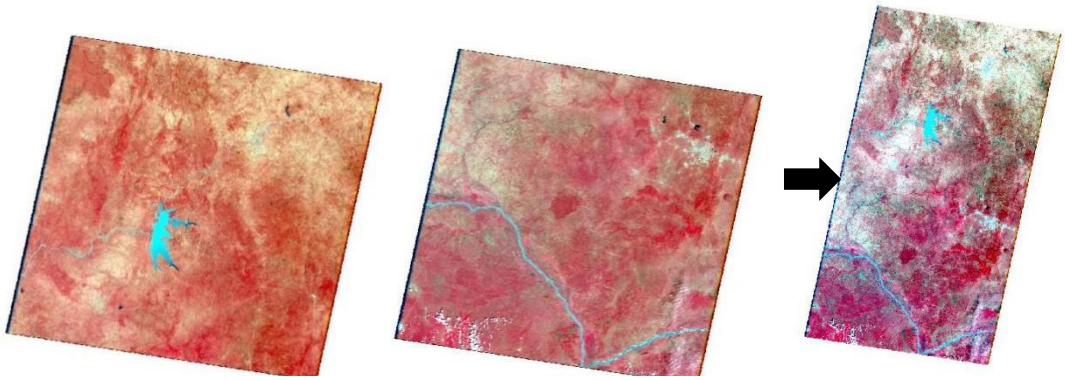


Figure 5: Corrected Landsat 2003(189/053) False colour Composite images

Mosaicking:

This is the combination or merging of two or more images together. The process was achieved using Mosaic Pro on Erdas imagine 2015.

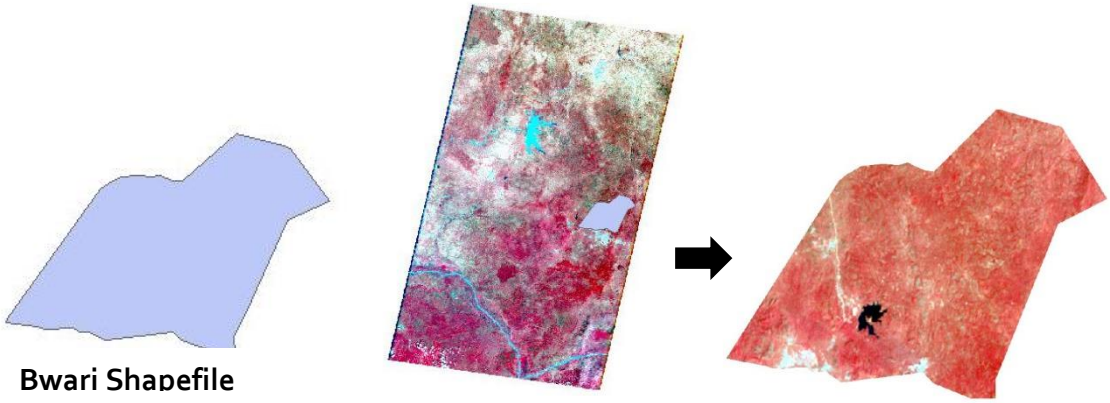


a. Landsat 2003 (189/053) **b. Landsat 2003 (189/054)** **c. Mosaicked Landsat Image**

Figure 6: Mosaicked image of two different scenes

Subset of the Study Area:

This procedure is used to only get the portions of huge files that are relevant for a given task. Additionally, Erdas Imagine 2015 was used to execute the subset of the study region.



a. Bwari Shapefile

b. Landsat 2003 overlaid with Bwari

c. Clipped images of Bwari, Abuja

Figure 7: Subset of the Study a

Image Enhancement

Image enhancement is done to improve the contrast between various features, making it easier to identify features and then classify them. For good visual interpretation, Histogram Equalization on Erdas Imagine 2015 Software was performed on the satellite imageries. In order to achieve the best results, a band combination of 4,3,2 (for Red, Green, and Blue) was chosen for the Landsat TM and ETM images and 5,4,3 for OLI photos. It is appropriate for urban use for defining vegetation, water, and land boundaries.

Image Classification

According to Campbell and Wynn (2011), image classification is the process of categorizing pixels into relevant informative classes. In order for pixels in the same class to have similar qualities, remote sensing classification entails grouping the pixels of an image into a manageable number of classes. There are two different kinds of classification techniques: supervised classification and unsupervised classification.

The supervised classification technique was used in this study. The supervised classification system uses "training" sites of known targets to detect spectrally comparable regions on an image, and it then applies those spectral signatures to other areas of unknown targets (Mather and Koch, 2011).

Accuracy Assessment

In order to evaluate various image processing techniques for picture classification, accuracy assessment is thought to be a crucial step (Foody, 2002; Lu and Weng, 2005). To determine the degree of agreement or disagreement, the classification's final result is compared to the real world or other trustworthy sources. To evaluate the classification's accuracy, Erdas Imagine 2015 employed the Error Matrix Approaches. The Kappa Index of Agreement (KIA), user accuracy, producer accuracy, and overall accuracy are the four factors used by the error matrix to evaluate accuracy.

Change Detection

The following variables were computed on ArcGIS 10.8 to assess the degree of growth and rate of change in the Land cover classes in the study area.

Built-up Extraction

The thematic map of Built-up was retrieved, layered, and examined using ArcGIS 10.8 in order to determine the pattern and direction of expansion within the study area.

Prediction Model

To predict the future expansion for the next 30 years, the hybrid of Cellular Automata and Markov Chain (Ca-Markov) models was adopted.

Markov Chain Model:

The Markov model process describes the likelihood that one state will change into another. It describes the state of a system at time 2 that can be anticipated from the state of the system at time 1. This would then provide a transition probability to describe the possibility of a pixel of a given class changing to any other class in the ensuing state. This distinction enables it to function in the process of changing land cover, but the model is unable to generate a two-dimensional spatial surface (Guan et al. 2011). The Markov module in the Idrisi Terrset software was used to

implement the Markov Chain analysis. In a unique stochastic process known as a Markov Chain, the result of each experiment depends only on the result of the experiment that came before it. As a result, the system's subsequent state depends only on its current state and not on its past states (a system at time 2 can be predicted by the state of the system at time 1). A transition likelihood matrix and a file for transition areas were created using the changes in land cover patterns between the two known dates. According to Eastman (2009), a transition probability is the possibility that a land cover will either change or stay the same in the future.

To create two transition matrices for all of the LC categories, time series LC maps from 1986, 2003, and 2020 were divided into two time periods (1986-2003 and 2003-2020). According to Weng (2002), the Markov approach is used to forecast changes in stochastic processes that depend on their past states at time t and are expressed as conditional probabilities, such as state S at time t + 1. Any future state Xt+1, given the past states X0, X1…, Xt-1and the present state Xt, is only dependent on its prior state, according to the conditional distribution of a Markov chain. A transition probability matrix from state i to j is represented by a Markov chain with n states (S1, S2…, Sn) and Pij. Consequently, the matrix can solve the prediction.

$$S^{(t+1)} = S^{(t)} * P_{ij} \quad \text{..... (1)}$$

Where, $S^{(t+1)}$, $S^{(t)}$are the states at times t and t+1, respectively, and P_{ij} is the transition probability matrix.

Cellular Automata:

To produce a spatial distribution, the cellular automata (CA) method develops a "spatially-explicit weighting factor." The fundamental components of a cellular automaton are state, cell, neighborhood, transition rule, and discrete time (White and Engelen 1997). The transition rule uses the conventional neighbor function; the cell is a land cover category cell, where land cover category is a state. Unless it is 0, the neighborhood filter returns a value of 1 when it entirely fits the existing class. The suitability pixel adjacent to the contiguous region of the same categories is then reweighted by multiplying the neighborhood filter by the final suitability potential maps (Guan, Inohae, Su, Nagaie, and Hokao, 2011). In this case, the neighborhood designates the cell that is affected by the possible change, and the transition rule aids in moving the cell.

Cellular Automata analysis in Idrisi Terrset is carried out via the CA-Markov module. A cellular automata method that is especially tailored to the setting of predictive land cover change modeling is provided in this module (Eastman, 2009). The land cover map (y) from which changes should be projected, the transitions areas file created by Markov from analysis of that image (y) and an earlier one (x), and a collection of suitability images are all inputs to the CA-Markov module. These images express how suitable a pixel is for each of the land cover types under consideration. The land cover is then redistributed iteratively until it reaches the Markov module's projected area totals. An expression for a cellular automaton as expressed by Liu (2015), a discrete dynamic function, is

$$t+1_{DPij} = f(t_{sij}, t_{Nij}) \quad \text{.....(2)}$$

where the probability surface is represented by t + 1Dpij, the development suitability surface is represented by tSij, and the neighborhood effect is represented by tNij.

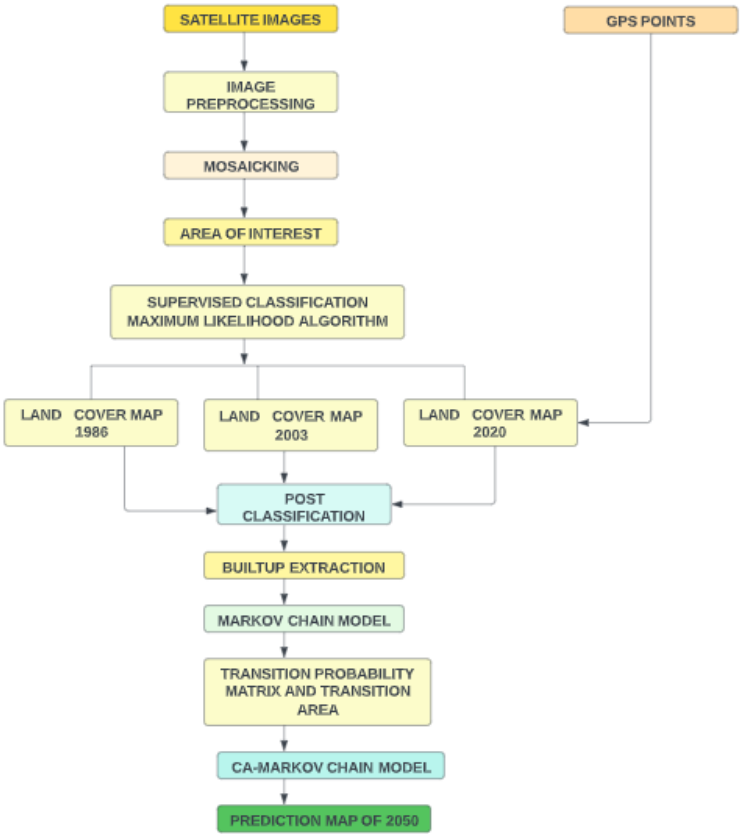


Figure 8: Flow chart Methodology.

RESULTS AND DISCUSSION

OBJECTIVE 1. Land Cover Map of the Study Area between 1986, 2003 and 2020.

Figure 9 to 11 below shows the land cover map of Bwari Area Council, Abuja for the year 1986, 2003 and 2020 respectively. From the classified satellites imageries, five land cover classes were extracted and these include Vegetation, Built-up, Bare surface, Water body and Rock outcrop. The classification revealed the area coverage for each of the Land cover classes (Table 2). In 1986, Built-up area covers 6.73km² (0.64%) in the study area and this shows that early settlement started in Bwari town as shown in Figure 9. Vegetation occupies 511.34km² (48.80%), Rock outcrop occupies 464.70km² (44.35%), Bare surface covers 58.8km² (5.61%) and Waterbody covers 6.12km² (0.58%) which is the least land cover coverage in the study area. In 2003, Built-up area covers 17.20km² (1.64%) which shows more rise in Built-up as shown in Figure 10. Vegetation occupies 646.19km² (61.67%), Rock outcrop occupies 362.18km² (34.56%), Bare surface covers 15.42km² (1.47%) and Water body covers 6.70km² (0.63%). In 2020, Built-up area covers 63.91km² (6.10%) and this shows a significant rise in urban expansion from the earliest years. Vegetation occupies 310.01km²(29.58%), Rock outcrop occupies 452.62km² (43.20%), Bare surface covers 213.38km² (20.36%) and Water body covers 7.77km² (0.74%).

Where the probability surface is represented by t + 1Dpij, the development suitability surface is represented by tSij, and the neighborhood effect is represented by tNij.Table 3 lists the land cover classes of the research area's overall accuracy, kappa statistics, producer accuracy, and user accuracy for 1986, 2003, and 2020, respectively. For the three time periods of 1986, 2003, and 2020, the categorization accuracy indicated an overall accuracy of 95.8%, 99.9%, and 99%,

respectively. The subsequent analysis and change detection were likewise thought to have a respectable overall accuracy from this. The accuracy of different land cover classes among users varied from 68.9% to 100%, and that of producers varied from 95.1% to 100%. For each classed map, the aggregate Kappa index was generated in order to assess the precision of the findings. The Kappa statistics for the three time periods of 1986, 2003, and 2020 were 0.89, 0.99, and 0.98, respectively. The three periods' Kappa coefficients exhibit nearly complete agreement on the kappa scale.

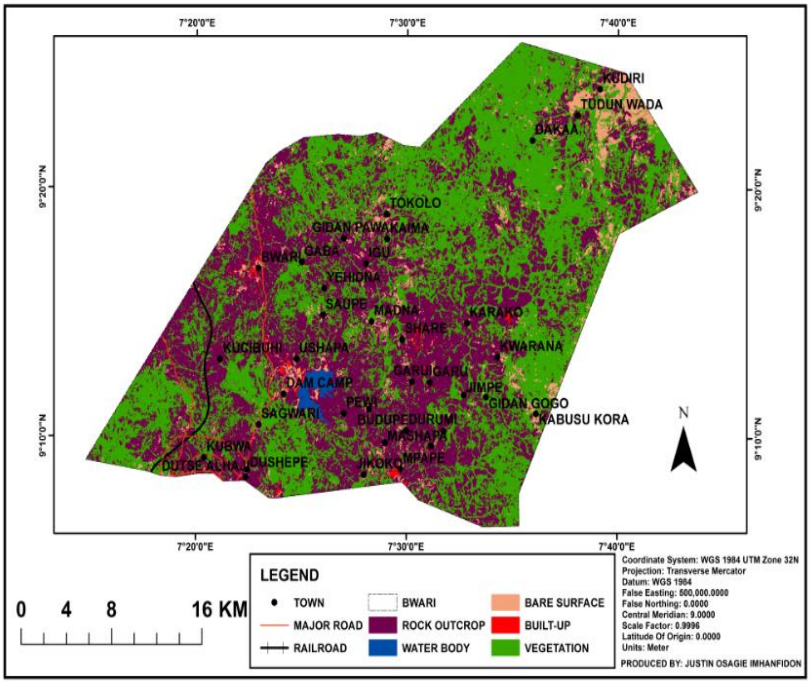


Figure 9: Land Cover Map of Bwari Area Council, Abuja (Landsat TM 1986)

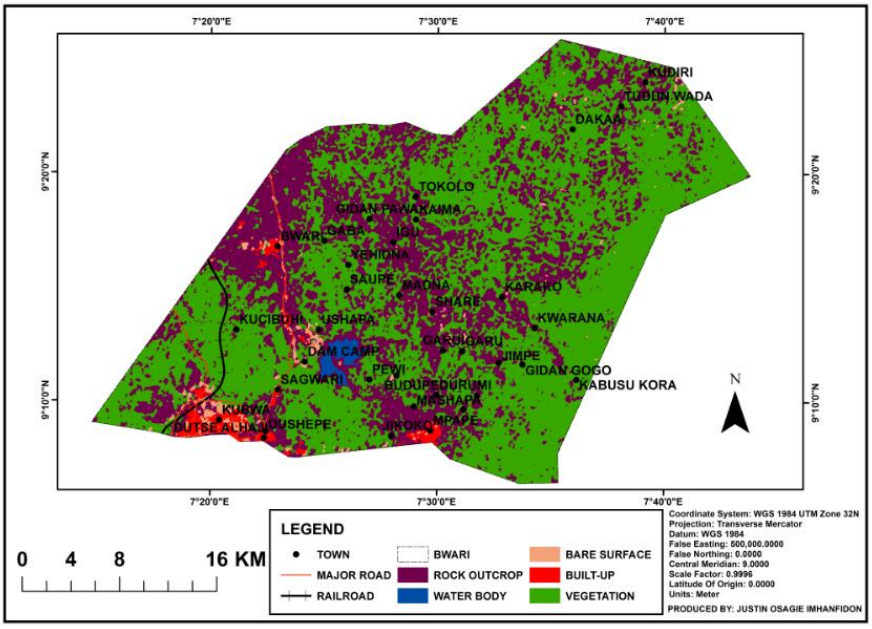


Figure 10: Land Cover Map of Bwari Area Council, Abuja (Landsat Etm+ 2003)

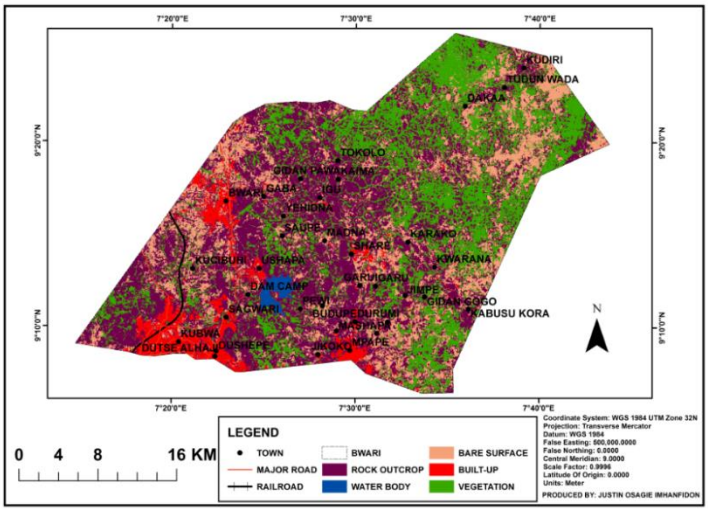


Figure 11: Land Cover Map of Bwari Area Council, Abuja (Landsat OLI, 2020)

Table 2: Area covered by the Land cover classes from 1986, 2003 and 2020

Land Cover Classes	1986		2003		2020	
	Area Covered (Km²)	Area Covered%	Area Covered (Km²)	Area Covered %	Area Covered (Km²)	Area Covered %
Built-Up	6.73	0.64	17.20	1.64	63.91	6.10
Vegetation	511.34	48.80	646.19	61.67	310.01	29.58
Rock Outcrop	464.70	44.35	362.18	34.56	452.62	43.20
Water Body	6.12	0.58	6.70	0.63	7.77	0.74
Bare Surface	58.8	5.61	15.42	1.47	213.38	20.36
Total	1047.69	100	1047.69	100	1047.69	100

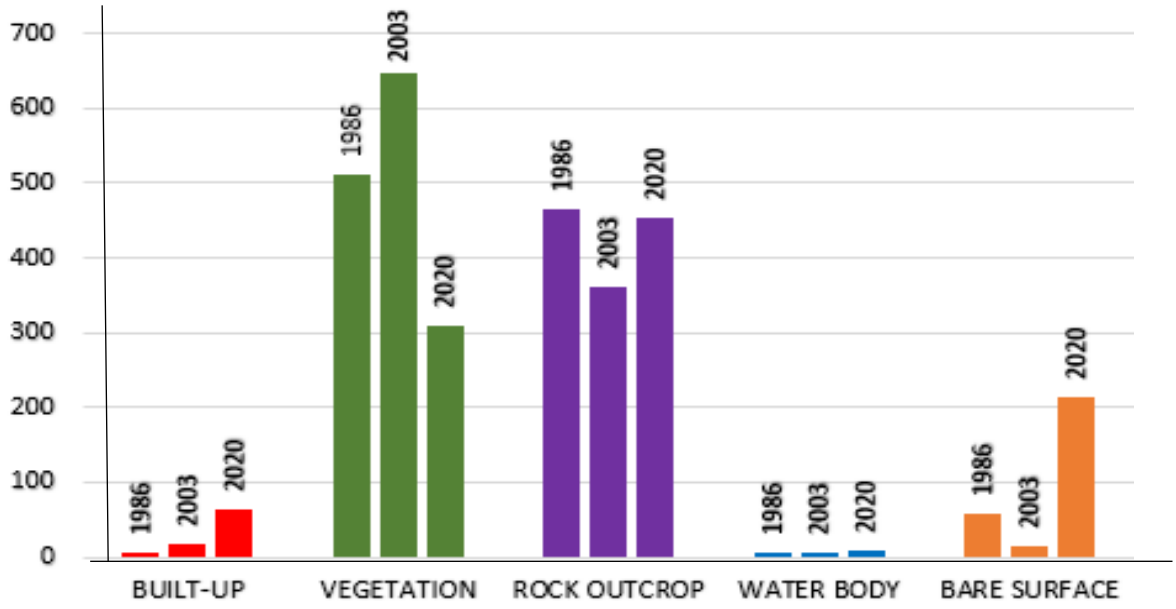


Chart 1: Comparison of Land cover Classes in Bwari and Its Environs (1986, 2003 and 2020)

Table 3: The Overall Accuracy, Kappa Statistics, Producer and User Accuracy of Land cover classes in Bwari Area Council, Abuja (1986, 2003, and 2020).

Land Cover Classes	1986		2003		2020	
	Producer Accuracy	User Accuracy	Producer Accuracy	User Accuracy	Producer Accuracy	User Accuracy
Built-Up	100	100	100	100	99.6	98.5
Vegetation	95.1	99.8	99.9	99.9	100	100
Rock Outcrop	97.2	77.9	99.9	100	99.5	97.0
Bare Surface	99.1	68.9	100	99.4	98.5	99.9
Water Body	99.7	77.3	100	100	98.3	100
Overall Accuracy	95.8%		99.9%		99.0	
Kappa Statistics	0.89		0.99		0.98	

OBJECTIVE 2. The Extent of Changes in Land Cover between 1986, 2003 and 2020.

Table 4 displays the change detection analysis of the land cover classes in Bwari Area Council, Abuja (1986, 2003, and 2020) during a 34-year period. Chart 2 displays the percentage trend in the study area's land cover change. The outcome showed a considerable shift in built-up from +10.47Km2 (+3.58%) to +46.71Km2 (+6.94%) and climbs to +57.18Km2 (+13.3%) accordingly between the years 1986 and 2003, 2003 and 2020, 1986 and 2020. The steady increase in built-up could be as a result of numerous factors such as population increase due to migration, and socio-economic status (such as creation of the Bwari Area Council, Proximity to the Central Area, General Hospital, Joint Admission and Matriculation Board Office, Usman Dam, Law School, Dorben Polytechnic and Veritas Catholic University). As Vegetation increases between 1986 and 2003 by +134.85Km² (+46.21%), there was also a reduction in both Rock outcrop and Bare surface to -102.52Km² (-35.13%) and -43.38Km² (-14.86%) respectively as shown in Table 4. Between 2003 and 2020, Vegetation reduces to -336.18Km² (-50%) while Rock outcrop and Bare surface increases to +90.44Km² (+13.45%) and +197.96Km² (+29.44) respectively. From the earlier year to the later year (1986 and 2020), Vegetation also reduces to -201.33 (-47.16%), Rock outcrop had a slight reduction to -12.02Km² (-2.83%) while Bare surface increases to +154.58Km² (+36.21%). Water body had a slight increase throughout the period of years (1986, 2003, and 2020) from +0.58Km² (+0.19%) to +1.07Km² (+0.1%) and 1.65Km² (+0.38%) respectively. The dredging at the Usman Dam to meet the portable water demand of the Federal Capital Territory may have led to a minor rise in the size of the water body.

Table 4: Specific Land cover changes for Bwari Area Council, Abuja in 1986, 2003 and 2020

Land Cover Classes	1986 and 2003		2003 and 2020		1986 and 2020	
	Area Covered (Km²)	Area Covered%	Area Covered (Km²)	Area Covered %	Area Covered (Km²)	Area Covered %
Built-Up	+10.47	+3.58	+46.71	+6.94	+57.18	+13.3
Vegetation	+134.85	+46.21	-336.18	-50	-201.33	-47.16
Rock Outcrop	-102.52	-35.13	+90.44	+13.45	-12.08	-2.83
Water Body	+0.58	+0.19	+1.07	+0.1	+1.65	+0.38
Bare Surface	-43.38	-14.86	+197.96	+29.44	+154.58	+36.21

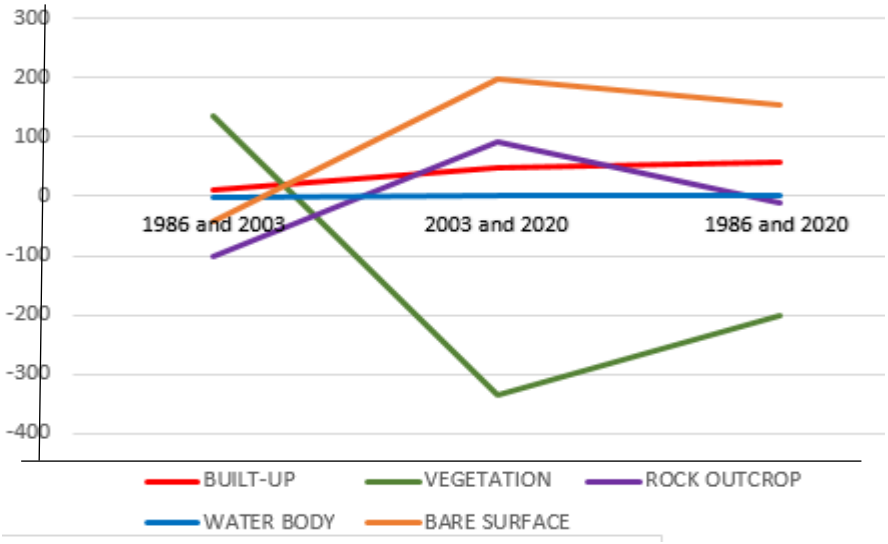


Chart 2: Percentage Trend in Land cover change of Bwari Area Council, Abuja (1986, 2003 and 2020)

OBJECTIVES 3. Built-up Extraction Showing the Pattern and Direction of Expansion

To easily visualize the amount of urban expansion within the research area, the built-up areas from each of the epochs were extracted from the identified imageries and superimposed (Figure 12 and chart 3). Table 5 displays the area occupied by buildings in 1986, 2003, and 2020, accordingly. It shows that the area occupied by buildings was 6.73 km2, 17.20 km2, and 63.91 km2 in 1986, 2003, and 2020, respectively. This graph demonstrates major alterations in populated areas over time. The outcome shows linear development of built-up along the road and adjacent to the rail track, as well as a leap frog kind of development within the research area. The research region has also seen a significant rate of urban expansion heading out from Bwari town and towards the southern and southern-eastern axes (Kubwa, Dutse Alhaji, and Ushepe, etc.).

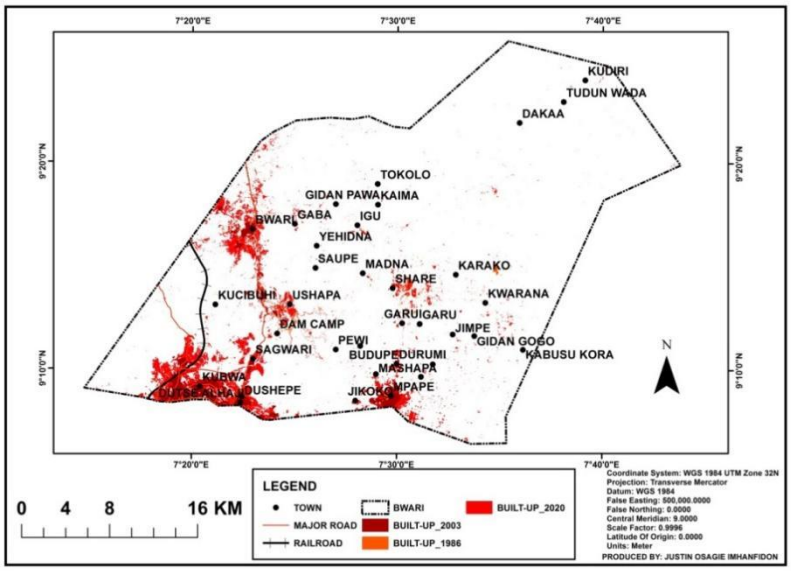


Figure 12: The Growth Extent in Built-up Between 1986, 2003 and 2020.

Table 5: Area Covered by Built-up between 1986, 2003 and 2020.

YEAR	AREA COVERED KM²
BUILT-UP_ 1986	6.73
BUILT-UP_ 2003	17.20
BUILT-UP_ 2020	63.91

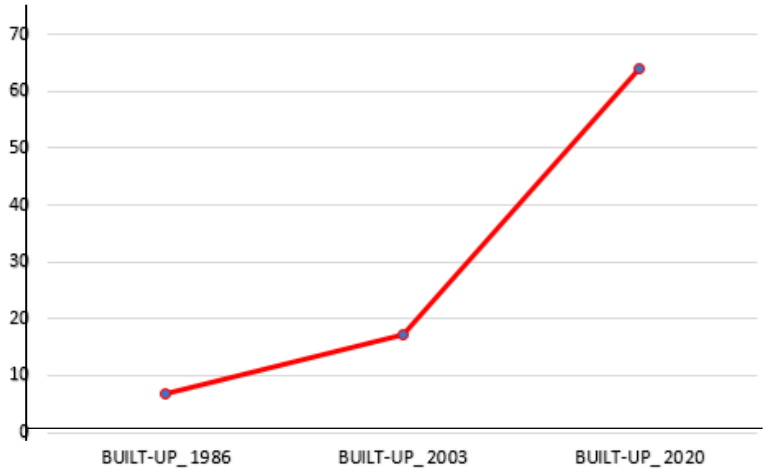


Chart 3: The Growth Extent in Built-up Between 1986, 2003 and 2020.

OBJECTIVE 4. To Predict the Future Urban Expansion for the Next 30 years.

The CA-Markov prediction model is really built upon the transition probability matrix that was produced by the Markov model that was run using the Idrisi Terrset software. Through pairwise analysis of the images of the land cover, the Markov chain model generates the transition probability matrix as a stochastic model (Table 6). Figure 13 shows the predicted 2050 land cover distribution map of 30 years period and chart 4 presents the comparison of Land cover Changes in Bwari Area Council, Abuja (1986, 2003, 2020 and 2050). The result revealed that built-up will increase to 97.25km (9.28%) which also showed more of infill development within Bwari town, Kubwa, Mpape and Dutse Alhaji as shown in Figure 13. Vegetation and Rock outcrop will reduce to 247.70Km² (23.64%) and 446.31Km² (42.60%) respectively while Bare surface increases to 247.99Km² (23.67%). Water body will maintain a steady increase to 8.44Km² (0.81%).

Table 6: The transition probability matrix of Bwari, 2050

Land cover classes	Vegetation	Built-up	Bare surface	Water body	Rock outcrop
Vegetation	0.4642	0.0203	0.1614	0.0000	0.3541
Built-up	0.0325	0.5076	0.1793	0.0140	0.2667
Bare surface	0.1339	0.0945	0.4228	0.0005	0.3483
Water body	0.0002	0.0010	0.0000	0.9952	0.0036
Rock outcrop	0.1616	0.0842	0.2125	0.0028	0.5389

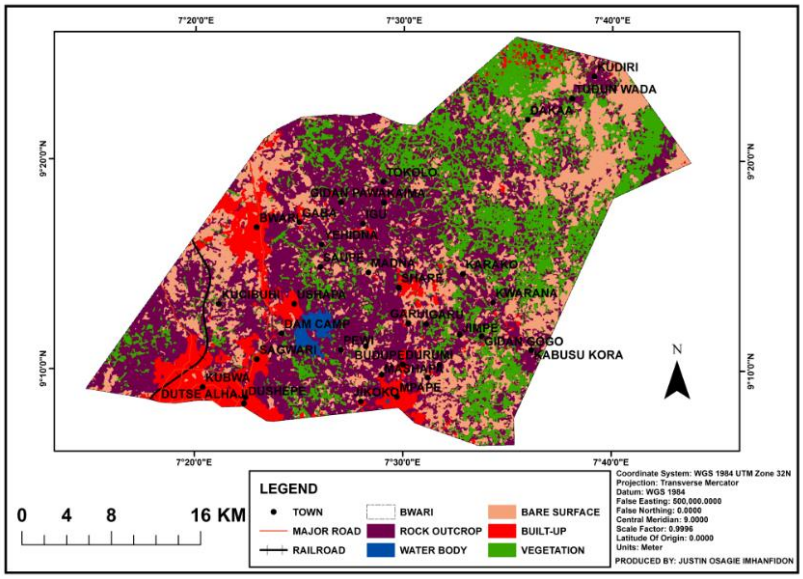


Figure 13: Predicted 2050 Land Cover Distribution in Bwari Area Council, Abuja

Table 7: Area covered by the Land cover classes from 1986, 2003, 2020 and 2050.

Land Cover Classes	1986		2003		2020		2050	
	Area Covered (Km^2)	Area Covered%	Area Covered (Km^2)	Area Covered %	Area Covered (Km^2)	Area Covered %	Area Covered (Km^2)	Area Covered %
Built-Up	6.73	0.64	17.20	1.64	63.91	6.10	97.25	9.28
Vegetation	511.34	48.80	646.19	61.67	310.01	29.58	247.70	23.64
Rock Outcrop	464.70	44.35	362.18	34.56	452.62	43.20	446.31	42.60
Water Body	6.12	0.58	6.70	0.63	7.77	0.74	8.44	0.81
Bare Surface	58.8	5.61	15.42	1.47	213.38	20.36	247.99	23.67
Total	1047.69	100	1047.69	100	1047.69	100	1047.69	100

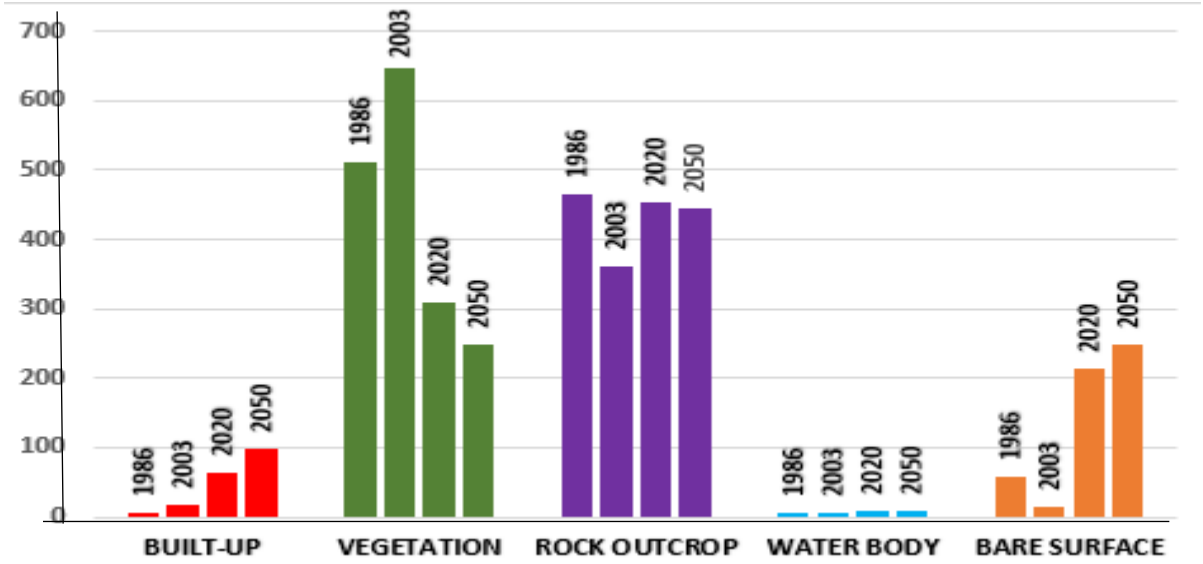


Chart 4: Comparison of Land Cover Changes in Bwari and Its Environs (1986, 2003, 2020 `and 2050)

CONCLUSION

Based on the aforementioned findings, the study has demonstrated the value of using space-based technology in place of the conventional approach to monitor and predict changes in the physical expansion of urban growth through time. Additionally, it has shown a map of the research area's land cover during a 34-year period, evaluated changes to the study area's land cover classes, looked at the pattern and direction of built-up area growth, and forecasted future urban growth for the following 30 years. It is stated that for efficient land management and sustainable urban planning, it is crucial to comprehend how an area's spatial pattern of urban expansion has changed over time. Urban dynamics modeling is an important method for estimating growth rates and understanding the implications that growth may have in the future.

RECOMMENDATIONS

From the following findings discovered in this study, it is therefore recommended that

1. There is need to create more awareness in acquiring the needed and necessary information and knowledge about the use of Geospatial technologies in spatial planning which should be of great value to Decision makers, Town Planners and managers of the urban environment.
2. The local planning authority in the study area has to strengthen its local government monitoring efforts in regard to the rates of change found in this research, particularly development near the Usman Dam and on the periphery.
3. To better their development planning, city planners and the Developmental Control Agency should adapt their usage of GIS and remote sensing data with good spatial resolution.
4. The study has given decision-makers data from various eras within the study period to aid in future planning and implementations for the expanding town in order to avoid unanticipated developments and to provide reliable data for monitoring and assessments of the environment's ability to sustain development.
5. This study has identified land cover changes that occurred over the study periods that require urgent management attention in order to execute the necessary environmental policies for development and the sustainability of land resources.

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Traditional Medicinal Plants and Liver Disease

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Abstract:
According to the World Health Organization, the global prevalence of liver cirrhosis ranges from 4.5% - 9.5% of the general population. Hence, estimated the > 50 million world population suffers from chronic liver disease. During 2001, the estimated worldwide mortality from cirrhosis was 771000 people, ranking 14th and 10th leading cause of death in developed countries like China, India, the U.S., Australia and the United Kingdom. Hepatocellular carcinoma, or cancer in the liver, is the 2nd most common cause of death due to malignancy in the world. At the turn of the 20th century, folk medicine was viewed as a practice used by poverty-stricken communities and quacks. The prevalence of folk medicine in certain areas of the world varies according to cultural norms. Some modern medicine is based on plant phytochemicals that have been used in folk medicine. Choice of plant species may be a crucial issue for the final word success of the investigation. Random choice provides some hint, targeted assortment supported chemotaxonomic relationships and ethno- medical data derived from ancient drugs are also possible to yield pharmacologically active compounds. Although advances in trendy medicines are important, there remains an ever-increasing demand for herbal medicines. Effective and potent herbal medicines need analysis by customary scientific strategies thus being valid for the treatment of diseases. Drug-induced liver toxicity is a major ill health that challenges healthcare professionals, the pharmaceutical trade, and drug regulatory agencies. The inhibition of atom generation will function facile model for evaluating the activity of hepatoprotective agents.

INTRODUCTION

The liver is the very important part of our body responsible for the maximum metabolic and secretary activities and therefore appears to be a sensitive target site for substances modulating biotransformation. The liver is also associated with detoxification from exogenous and endogenous challenges like xenobiotics, drugs, viral infections and chronic alcoholism. The period and intensity of the pharmacological response to drugs is influenced by their metabolic rate and hence substances capable of modifying drug metabolism would be able to change the result of drug therapy. During all such exposures to the above-mentioned challenges, if the usual defensive mechanisms of the liver are overpowered, the effect is liver damage. Liver injury or liver dysfunction is a major health problem that challenges not only medical professionals but also pharmaceutical companies and drug regulatory authorities. Liver cell injury caused by various toxic chemicals like certain antibiotics, chemotherapeutic agents, carbon tetrachloride, thioacetamide, excessive alcohol consumption and microbes.

Herbal medicines have been applied for the treatment of liver disorders for a lengthy period. Many herbal preparations are available in the market and therefore present review is aimed at compiling the data on promising phytochemicals from medicinal plants that have been tested in hepatotoxicity models using modern scientific Systems. Most ethnobotanical knowledge has existed in the world since ancient times. The Dictionary of World folk-medicine and ethno botany

includes more than 2532 plants. Even though early (4500-1500 BC) origins and a long history of usage in the last two centuries. The aim of the present article is to put the spotlight on some important medicinal plants that have ingredients effect on liver disease, and mechanism of this effect to cause the remedy of liver disease.

Nemours medicinal plants are mostly used in the traditional system of medicine for the treatment of liver disorder.

ETHANO MEDICINE OF MEDICINAL PLANTS

Ethno pharmacology can be an important element for developing nation's medical and economic system, Third World governments are being encouraged to seek a synthesis between modern and traditional medicine. Even though developing countries are providing many of the raw materials that considered column of drug manufacturing, in spite of tremendous strides in modern medicine, there are hardly any drugs that stimulate liver function, offer protection to the liver from damage or help regeneration of hepatic cell.

MEDICINAL PLANTS USED FOR LIVER DISEASE

India is the largest producer of medicinal plants and is rightly called the (Botanical Garden of the World). The medicinal plants have very important place in the health and vitality of human beings as well as animals. As per the WHO estimates, about three quarters of the world's population currently use herbs and other traditional medicines to cure various diseases, including liver disorders. Hence, several phytomedicines (medicinal plants or herbal drugs) are now used for the prevention and treatment of various liver disorders. Although experimental studies have been conducted on a number of these plants and their formulations, however, only some plants have clearly shown the hepatogenic / hepatoprotective effects against liver diseases or hepatotoxicity caused by variety of hepatotoxic agents such as chemicals, drugs, pollutants, and infections from parasites, bacteria or viruses (e.g., hepatitis A, B and C), etc. Indeed, to obtain satisfactory herbal drugs for treating severe liver diseases, the medicinal plants must be evaluated systematically for properties like antiviral activity (Hepatitis B, Hepatitis C, etc.), antihepatotoxicity activity (antioxidants and others), stimulation of liver regeneration and choleretic activity. A combination of different herbal extracts / fractions is likely to provide desired activities to cure severe liver diseases. The medicinal plants contain several phytochemicals which possess strong antioxidant property, leading to antihepatotoxic activity, (Govind, 2014).

Ecballium elaterium (EE) and Virus

Ecballium elaterium (EE) is one of the cucurbitaceous family. It is known as a squirting cucumber. It is abundant in North Africa and South- West Europe and the Mediterranean countries (Greige-Gerges et al., 2007). It grows in Egypt in north Sinai and El-Dabaa (Saker et al, 2012). In Jordan, it is founded in many places, including the waysides and cultured areas (Salhab, 2013). The fruits of the plant contain black seeds and juice. It has been known as a natural remedy for the treatment of several diseases (Raikhlin-Eisenkraft and Bentur, 2000). It has been used as a traditional medicine to treat rhino sinusitis (Uslu et al., 2006). EE also has antimicrobial and anticancer activities (Abbassi et al., 2014).

Alternative medicine is used for the treatment of several diseases worldwide. Numerous publications, about the complications of different plant usage for different treatment goals are present in literature. Ecbalium elaterium belongs to Cucurbitaceae family, takes place in alternative medicine because of cytotoxic, analgesic and purgative effects of the bioactive

materials included. (Salhab, 2013 and Satar et al., 2001). The plant's juice is used as diluted nose drip for the treatment of rinosinusitis in the community. Uvula edema is a life-threatening condition that occurs as a result of several reasons such as trauma, infection and allergic reactions (Alcoceba, 2010). In this paper, a severe uvula edema case, after using E. Elaterium for sinusitis treatment is presented.

Stephen et al., 2017, published that derivatives or component of Ecballium elaterium (A. Richard, "Squirting" or "Jumping" Cucumber, family Curcurbitacea have been used as a natural medicine in Mediterranean and African countries for centuries. The described actions of this herb include: antihepatotoxicity, the prevention of hepatitis induced liver cirrhosis and the treatment of jaundice in rats or humans, the effective management of sinusitis or nasal obstruction and reversal of tissue edema in mice. The crude juice of Ecballium elaterium (Ee) has been used most often in herbal medicinal practice, but it is often toxic. Reports of variable toxicity exist with crude concentrates of Ee, including: has included antifertility effects in female mice, cytotoxicity, and occasional deaths from poisoning. In contrast, water-distilled fractions of Ee juice given at approximate homeopathic dilutions 1x (LD times) are considered safe with retention of efficacy for several designated uses (vide infra). Ecballium elaterium has been widely used as a treatment for Hepatitis C (viral infection (HCV) in Egypt.

This use of Ee in treating liver disease is deeply rooted in Egyptian folklore medicine. The interest in Ee has been reactivated largely as a consequence of the emerging epidemic of Hepatitis C virus infection (HCV) in Middle Eastern countries, especially Egypt. Hepatitis C virus infection produces an indolent disease or diathesis that accounts for a large proportion of all patients with chronic liver disease. Hepatitis C is anticipated to cause major global increases in morbidity and mortality in the future.

Current treatments for HCV possess major disadvantages and limitations. While PEGylated interferon alpha combined with ribavirin are preferred treatments for HCV, these interventions are expensive, difficult to tolerate and limited in safety and effectiveness. Interferon/ribavirin treatments have unpredictable outcomes13 in patients with HCV.

Hepatitis C virus infection is a recalcitrant disorder that afflicts tens of millions of individuals worldwide. The emergence of HCV in third world countries cannot be impacted readily by expensive, high-technology approaches, such as those that utilize interferon and antiviral drugs (ribavirin). These treatments require skilled administration and extensive monitoring. In addition, these management strategies are not portable and they are often prohibitively expensive. Any alternative, low-cost intervention for HCV, with even partial effects on the clinical course of HCV, would represent a major breakthrough in therapeutics. This article describes the ethnobotanical discovery of derivatives of Ee as a potentially-viable, natural treatment for HCV and other disorders.

Glycyrrhizin

Felix and (2015), cited that Glycyrrhizin is extracted from liquorice root (*Glycyrrhiza glabra)* and comprises glycyrrhetic acid, flavonoids, hydroxycoumarins, and beta-sitosterol as the major constituents. In experimental models, glycyrrhizin alleviates toxic liver injury, possibly through antioxidant properties (Li et al., 2014). Before the advent of potent virostatics, an intravenous preparation (Stronger Neo-Minophagen C) containing glycyrrhizin, cysteine, and glycine was an established treatment for chronic hepatitis in Japan. Numerous studies, mostly from Asia, tested

glycyrrhizin formulations in various chronic liver diseases. Most trials were open label or pilot studies; only a few were placebo controlled (Stickel and Schuppan 2007). Efficacy was limited to improvements of serum liver enzyme levels, whereas no effect on viral markers was recorded. Retrospective data show a significant reduction of the risk for development of HCC in patients with hepatitis C virus (HCV). Potential negative side effects are hypokalemia, sodium retention, worsening of ascites, and hypertension caused by aldosterone-like activities. Glycyrrhizin is currently not recommended because of the lack of compelling evidence and the availability of better alternatives.

Phyllanthus amarus

Phyllanthus contains phyllantins, hypophyllanthins, and several polyphenols for which data indicate an interference with the hepatitis B virus (HBV) life cycle. Clinical trials with *phyllanthus* species in patients with chronic HBV infection were recently reviewed in a Cochrane analysis (Xia et al., 2011). In total, 16 trials with 1326 patients were included of which 15 trials tested *Phyllanthus* in combination with other antivirals, whereas 1 trial tested against placebo. The combined results showed that *Phyllanthus* species had a favorable effect on HBV DNA levels and hepatitis B e antigen seroconversion when given together with conventional antivirals. A second Cochrane metaanalysis examined five clinical trials comparing *Phyllanthus* species with antiviral drugs (lamivudine, interferon-alpha, and thymosin) in patients with HBV and found no superior effect from phyllanthus (Xia et al., 2013). No trials with entecavir or tenofovir have been conducted yet. Altogether, *Phyllanthus* could be an interesting candidate for further testing in rigorously designed trials with clear endpoints.

Silymarin

Silybum marianum (Milk thistle) has been used to treat liver diseases since the 16th century. Its major constituents are the flavonoids silibinin, silidianin, silichristin, and isosilibinin of which silibinin is the biologically most active compound and used for standardisation of pharmaceutical products (Wagner et al., 1976). The pharmacological profile of silymarin has been well defined and hepatoprotective properties of silymarin were investigated both *in vitro* and *in vivo*. Experimental studies demonstrated antioxidant and free radical scavenging properties, improvement of the antioxidative defence by prevention of glutathione depletion, and antifibrotic activity.

A number of well-designed experimental studies suggest that silymarin might exert beneficial effects in chronic liver diseases through antifibrotic properties. For example, silymarin interferes with leukotriene formation in Kupffer cell cultures and may thereby inhibit hepatic stellate cell (HSC) activation, which is a crucial event in fibrogenesis (Dehmlow et al., 1996). In addition, silymarin at 10^{-4} mol/l blocked the proliferation of HSC cultures and their transformation to myofibroblasts (Fuchs et al., 1997). Experimental models included fibrosis induced by carbon tetrachloride (CCl_4) and secondary biliary fibrosis, while results from CCl_4-induced rat liver fibrosis are controversial, likely due to the inhomogeneity of the model, dosing during gavage of the free radical inducer CCl_4 and low numbers of animals. Mourelle et al. found that silymarin dosed at 50 mg/kg body weight reduced fibrosis by 30% as measured by relative collagen content (per g of liver) (Mourelle et al., 1989), which could not be confirmed by others (Hall et al., 1994) In a study by Boigk et al. in representative groups of 20 rats in which secondary biliary fibrosis was induced following complete bile duct occlusion, silymarin at 50 mg/kg/day reduced total (per liver) and relative (per g of liver) hepatic collagen content by 35% which was mirrored by decreased serum levels of the aminoterminal propeptide of procollagen type III (PIIINP), a surrogate marker of

hepatic fibrogenesis (Boigk et al., 1997). Silymarin prevented further progression when fibrosis was advanced, a situation encountered in many patients. Furthermore, the number of activated HSCs was markedly reduced (Boigk et al., 1998) and transcription of hepatic procollagen type I and TIMP-1 mRNA was decreased by 50% (Jia et al., 1998). However, compared to the recommended dose for patients (400–450 mg daily) the applied dose of silymarin was eight-fold higher, and hepatic levels were likely further increased due to retarded biliary secretion in this model of secondary biliary fibrosis.

CONCLUSION

Medicinal herbal drugs have gained importance and recognition in recent years as a result of their safety, effectuality and value effectiveness. From this review study, it is clear that the medicinal plants play a significant role against on various diseases. Different medicinal herbs and plants extracts have potent hepatoprotective activity in various animal models. The hepatoprotective activity is probably due to the presence of flavonoids, phenolic compounds, polyphenols etc in all few herbal plants. The results of this study indicate that extracts of leaves and plants extracts of some medicinal plant have good potentials for use in hepatic disease.

The predicted mechanism of action of various plant extracts may be attributed to antioxidant properties and the presence of flavonoids, to increase the reduced level of blood glutathione in experimental animal models, to increase total proteins, to inhibit lipid peroxidation and increase in the antioxidant enzymatic activity, to decrease the hepatic marker enzymes (AST, ALT, ALP, and arginase) and total bilirubin in plasma, to enhance antioxidative enzymes, including SOD, GPx, CAT and GST, to decrease MDA level, SGOT, SGPT etc.

Clinical studies analyzing the efficacy of herbals in the treatment of liver diseases provided only moderate evidence. Future efforts will have to implement extensive methodological improvements to separate the real therapeutic value from unfounded hopes. Rigorous scientific testing along the principles of evidence-based medicine is required for herbal medicine to become more than a fashionable trend.

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Measurement and Analysis of Regional Disparities in Rural Revitalization in China

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Abstract:
Rural revitalization is an essential component of China's national rejuvenation. This paper focuses on the period from 2012 to 2021 and investigates various provinces in China to establish an indicator system that aligns with the current stage of rural revitalization in China. By utilizing the entropy method, Dagum's Gini coefficient, and the obstacle degree model, this study analyzes the development level of rural revitalization and the obstacles faced by different provinces in China. The research findings reveal an imbalance in regional development, with the eastern regions being more advanced while the western and northeastern regions lag behind, except for rural areas in the northeast. However, the disparities between the eastern, central, and western regions are gradually narrowing. The primary challenge faced by rural areas in China at the current stage lies in cultivating a healthy rural cultural civility. It is crucial to address the existing problems based on the practical circumstances to achieve comprehensive rural revitalization and sustainable, modern development.

Keywords: Rural revitalization, Indicator system, Entropy method, Dagum's Gini coefficient, Obstacle degree

INTRODUCTION

In October 2022, the 20th National Congress of the Communist Party of China was held in Beijing, where it proposed the comprehensive promotion of rural revitalization during the "14th Five-Year Plan" period. The goal is to vigorously promote the prosperity of rural industries, the livable ecology, rural cultural civility, effective governance, and improved living conditions. Since the 19th National Congress of the Communist Party of China in 2017, the strategy of rural revitalization has greatly improved agriculture, rural areas, and the well-being of farmers. According to statistical data, the national grain production in 2021 reached 682.85 million tons, an increase of approximately 19.5% compared to 2011. The per capita disposable income of rural residents reached 18,931 yuan, about 2.7 times that of 2011. China has a large rural population, and rural areas encompass vast territories. In order to achieve the great rejuvenation of the Chinese nation and accomplish the "Two Centenary Goals," it is necessary to promote rural development, comprehensively advance rural revitalization, and achieve rural modernization at the current stage.

Rural revitalization is currently a prominent research topic in the academic field, primarily focusing on three research areas. Firstly, theoretical research on rural revitalization explores the development trajectory. Liu Zhaoshuai (2022) suggests that rural revitalization will facilitate agricultural modernization and accelerate the construction of a socialist modernized country with distinct Chinese characteristics. Huang Chengwei (2022) conducts theoretical research on the development direction of rural revitalization from ten perspectives, including the theoretical logic of the Communist Party of China's work on agriculture, rural areas, and farmers, the theoretical

background of rural revitalization strategies, and the new advancements in the theory of the three rural issues in the contemporary era, providing a theoretical foundation for the development of rural revitalization. Secondly, research is conducted on the integration of inclusive finance, common prosperity, and rural revitalization. Ren Haijun (2021) employs the DEA model and panel Tobit model to study the measurement of inclusive finance. The results indicate that the overall level of comprehensive efficiency in digital inclusive finance is relatively low in western regions. During the research period, the total factor productivity of digital inclusive finance did not improve production efficiency primarily due to constraints in technological progress. Liao Chengzhong (2022), guided by the principle of common prosperity, concludes that the high-quality promotion of comprehensive rural revitalization necessitates paths such as market collaboration, digital collaboration, organizational collaboration, and institutional collaboration. Thirdly, research is conducted on the overall or partial assessment of rural revitalization. Xu Xue (2022), utilizing Dagum's Gini coefficient and Kernel density estimation, discovers that the overall level of rural revitalization in China is relatively low. Additionally, there are notable regional disparities in the level of rural revitalization, with some provinces exhibiting higher levels, although the differences between regions are decreasing. Zhang Hong (2021), based on measurements of rural revitalization in Shaanxi Province, concludes that the comprehensive level of high-quality rural development in Shaanxi Province is relatively balanced, but there is room for improvement. In terms of specific regions, the central Shaanxi plain performs the best, followed by the northern part of Shaanxi, while the southern part lags behind. Wang Zhizhang (2020) demonstrates that preliminary interaction has been achieved between poverty alleviation and rural revitalization in western regions, but the linkage mechanism needs to be optimized based on actual conditions. Wang Qing (2022), utilizing Dagum's Gini coefficient and Kernel density estimation as research methods, concludes that enhancing the level of rural revitalization in central and western regions can effectively narrow regional disparities, thereby promoting the coordinated development of rural revitalization.

The existing research literature holds great significance and value for reference. From the existing literature, it is evident that experts and scholars have conducted extensive research on regional aspects, and the research on overall rural revitalization in China has gradually increased in recent years. However, overall research on the development of rural revitalization in China remains relatively limited. Moreover, there is a lack of literature specifically focused on measuring the overall level of rural revitalization in China, as well as the study of obstacles influencing its development. Therefore, this paper takes all 30 provinces in China as the research objects and establishes a suitable indicator system for rural revitalization in the current stage of Chinese rural areas. By utilizing Dagum's Gini coefficient and the obstacle degree model, this study analyzes the development level of rural revitalization in China from 2012 to 2021 and examines the obstacles affecting its development. The findings have valuable implications for the comprehensive revitalization of rural areas in China.

RESEARCH DESIGN

Establishment of an Indicator System

The rural revitalization strategy encompasses five aspects: thriving industries, livable ecology, rural cultural civility, effective governance, and improved living conditions. These aspects provide practical development requirements for promoting the construction of new rural areas in China. Therefore, this paper constructs an indicator system based on these five aspects. Thriving industries represent the level of rural industrial development. Drawing on the research of Wang Qing (2022), Lu Fengying (2022), and Zhang Wang (2022), this study selects four tertiary indicators

to assess this aspect. Livable ecology mainly refers to the ecological environment of rural areas, including the natural environment and living environment. Taking inspiration from the studies of Xu Xue (2022), Lu Fengying (2022), Ma Changfa (2022), and Lv Chengchao (2021), three tertiary indicators are adopted to assess the natural environment and living environment. Rural cultural civility reflects the degree of cultural development in rural areas and are an important aspect of modern civilization construction. Based on the research of Luo Chunna (2020), Zhang Lin (2022), and Zhang Qi (2022), five tertiary indicators are utilized to measure the progress in this dimension. Effective governance is an important aspect of rural revitalization and embodies the leadership capabilities in rural areas. Referring to the studies of Zhang Wang (2022), Niu Wenhao (2021), Liu Yanan (2022), and Yang Shengqiang (2022), four tertiary indicators are employed. Improved living conditions represent the primary objective of rural revitalization and are primarily manifested in income, expenditure, and livelihood security. With reference to the research conducted by Lü Chengchao, Yang Suchang, Yang Awei, and Wu Jiuxing, this article employs six tertiary indicators to assess the progress made in this dimension.

Table 1: The Indicator System for Rural Revitalization Level

Primary Indicator	Secondary Indicator	Tertiary Indicator	Indicator Attribute	Weight
Thriving industries	Agricultural production capacity	Agricultural machinery power per unit area (kW/hectare)	Positive	0.044
		Proportion of effective irrigated area (%)	Positive	0.016
	Agricultural production level	Per capita output value of agriculture, forestry, animal husbandry, and fisheries (RMB)	Positive	0.034
		Proportion of added value of the primary industry (%)	Positive	0.036
Livable ecology	Natural environment level	Intensity of chemical fertilizer application (kg/ha)	Negative	0.003
		Intensity of pesticide application (kg/ha)	Negative	0.008
		Green coverage rate (%)	Positive	0.035
	Living environment level	Toilet coverage rate (%)	Positive	0.018
		Sewage treatment rate (%)	Positive	0.133
		Tap water coverage rate (%)	Positive	0.014
Rural cultural civility	Culture and entertainment expenditures	Proportion of rural residents' expenditure on education, culture and entertainment (%)	Positive	0.026
	Education quality	Proportion of full-time teachers in rural compulsory education schools with bachelor degree or above (%)	Positive	0.021
	Public culture construction	Number of rural cultural stations (units)	Positive	0.059
	Social security	Number of pension institutions (houses)	Positive	0.084
		Average village clinic staff per 1,000 rural population (persons)	Positive	0.078

Effective governance	Comprehensive governance level	Proportion of village committee members with bachelor degree or above (%)	Positive	0.116
		Proportion of village committees in total autonomous organizations (%)	Positive	0.009
		The percentage of "dual roles of director and secretary"	Positive	0.061
	Effectiveness of rural governance	Proportion of rural residents with minimum subsistence allowances (%)	Negative	0.012
Improved living conditions	Income level	Per capita disposable income of rural residents (RMB)	Positive	0.039
		Income gap ratio between urban and rural residents	Negative	0.013
	Consumption level	Engel coefficient (%)	Negative	0.001
		Per capita consumption expenditure of rural residents (RMB)	Positive	0.039
	Livelihood level	Housing area per capita (square meter/person)	Positive	0.037
		Per capita road area (square meter/person)	Positive	0.064

Data Description

The research period of this study spans from 2012 to 2021, and the research subjects are 30 provinces in China (excluding Tibet, which has severe data shortages). The following points provide an explanation of the data: For individual years with missing data, this study uses interpolation methods to fill in the missing values. All data in this study are sourced from various publications, including "China Statistical Yearbook," "China Rural Statistical Yearbook," "China Civil Affairs Statistical Yearbook," "China Urban and Rural Construction Statistical Yearbook," "China Tertiary Industry Statistical Yearbook," as well as the statistical yearbooks of each province and the EPS database.

RESEARCH METHODS

Entropy Method

Due to the differences in the dimensional scale and magnitude of the data, this study first standardizes the data and then uses the entropy method to calculate the development indexes and comprehensive indexes of various subsystems in rural revitalization.

Standardization process. The formulas are as follows:

$$\text{Positive Indicators: } x'_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \quad (1)$$

$$\text{Negative Indicators: } x'_{ij} = \frac{\max(x_j) - x_{ij}}{\max(x_j) - \min(x_j)} \quad (2)$$

In Formula 1 and Formula 2: $\min(x_j)$ represents the minimum value of the j-th indicator; $\max(x_j)$ represents the maximum value of the j-th indicator. x'_{ij} represents the standardized data of each indicator after standardization.

Entropy weighting method is used to calculate the entropy value. The specific formula is as follows: Calculate the information entropy of the j-th indicator

$$e_j = -K\sum_{i=1}^{m} y_{ij}\ln y_{ij} \quad (3)$$

In (3), K is a constant, and $K = \frac{1}{\ln m}$

Calculating the entropy weight

$$W_j = \frac{1-e_j}{\sum_{i=1}^{m}(1-e_j)} \quad (4)$$

Calculating the comprehensive scores for each province. The formula is as follows:

$$U_i = \sum_{j=1}^{m} W_j * x'_{ij} \quad (5)$$

Dagum Gini Coefficient Decomposition Model

First, calculate the overall Gini coefficient:

$$G = \frac{1}{2n^2\mu}\sum_{j=1}^{k}\sum_{h=1}^{k}\sum_{h=1}^{n_i}\sum_{r=1}^{n_j}\left|y_{ih} - y_{jr}\right| \quad (6)$$

In Formula 6, the overall region is divided into four regions: Eastern, Central, Western, and Northeastern regions, denoted as $k = 4$. y_{ih} and y_{jr} respectively represent the composite index of rural revitalization level for any province within $i(j)$ region (where the values of j and h take values from 1 to k). G represents the overall Gini coefficient. μ represents the average value of the composite index of rural revitalization, n indicating the number of provinces, while n_i and n_j respectively represent the number of regions within the group.

The Gini coefficient is composed of three components: the contribution G_w of within-region disparities, the net contribution G_{nb} of between-region disparities, and the inter-group hypervariable density G_t. The net contribution G_{nb} of between-region disparities and the inter-group hypervariable density combined reflect the overall absorption of inequality between regions, i.e., $G_{gb} = G_{nb} + G_t$. These three components satisfy the following relationship: $G = G_w + G_{nb} + G_t$. The Gini coefficient G_{ii} within each region and the contribution G_w of within-region disparities,

Gini coefficient G_{ii} within regions:

$$G_{ii} = \frac{1}{2n_i^2\mu_i}\left(\sum_{h=1}^{n_i}\sum_{r=1}^{n_i}\left|y_{ih} - y_{jr}\right|\right) \quad (7)$$

Contribution G_w of within regions disparities:

$$G_w = \sum_{i=1}^{k} G_{iij}\gamma_i s_i \quad (8)$$

In (8),

$$\gamma_j = \frac{n_i}{n}, S_j = \frac{\gamma_i \mu_i}{\mu}$$

Gini coefficient G_{ij} between regions：

$$G_{ij} = \frac{1}{n_i n_j (\mu_i + \mu_j)} \left(\sum_{i=1}^{n_i} \sum_{r=1}^{n_j} |y_{ji} - y_{hr}| \right) \quad (9)$$

Net contribution G_{nb} of disparity between regions：

$$G_{nb} = \sum_{i=2}^{k} \sum_{j=1}^{i-1} (\gamma_j s_i + \gamma_i s_j) G_{ij} D_{ij} \quad (10)$$

In Formula 10,

$$D_{ij} = (d_{ij} - p_{ij}) / (d_{ij} + p_{ij}),$$

where i and j represent the relative disparity between two groups of rural revitalization levels, d_{ij} represents the interpolation of the composite index of rural revitalization level between regions i and j. When $\mu_i > \mu_j$, the d_{ij} equation and p_{ij} equation are as follows:

$$d_{ij} = \int_0^{\infty} \int_0^{y} (y - x) f_i(x) dx f_i(y) dy \quad (11)$$

$$p_{ij} = \int_0^{\infty} \int_0^{y} (y - x) f_i(x) dx f_i(y) dy \quad (12)$$

Inter-group hypervariable density G_t:

$$G_t = \sum_{i=2}^{k} \sum_{j=1}^{i-1} (\gamma_j s_i + \gamma_i s_j) G_{ij} (1 - D_{ij}) \quad (13)$$

Obstacle Degree Model

Determining factor contribution and indicator deviation:

$$W_j = F * I \quad (14)$$

$$V_j = 1 - x'_{ij} \quad (15)$$

In Formula 14, F represents the weight of the primary indicator, and I represent the weight of the tertiary indicator.

Determining the obstacle degree h_j of the jth evaluation indicator to rural revitalization:

$$h_j = \frac{w_j \times V_j}{\sum_{j=1}^{m} W_j \times V_j} \quad (16)$$

ANALYSIS OF EMPIRICAL RESULTS

Analysis of Rural Revitalization Composite Index

Table 2: Composite Index of Rural Revitalization in Chinese Provinces

	Provinces and Cities	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Eastern Provinces	Beijing	0.335	0.344	0.390	0.388	0.414	0.345	0.388	0.432	0.432	0.454
	Tianjin	0.264	0.261	0.259	0.270	0.260	0.261	0.347	0.398	0.410	0.419
	Hebei	0.243	0.254	0.247	0.253	0.254	0.242	0.255	0.289	0.304	0.317
	Shanghai	0.397	0.421	0.444	0.448	0.443	0.441	0.451	0.495	0.491	0.500
	Jiangsu	0.325	0.349	0.344	0.375	0.393	0.393	0.421	0.463	0.475	0.477
	Zhejiang	0.378	0.393	0.417	0.426	0.416	0.423	0.406	0.410	0.429	0.466
	Fujian	0.235	0.250	0.264	0.274	0.287	0.308	0.326	0.382	0.421	0.428
	Shandong	0.380	0.383	0.384	0.382	0.383	0.367	0.387	0.392	0.415	0.423
	Guangdong	0.262	0.268	0.261	0.284	0.294	0.294	0.372	0.384	0.428	0.446
	Hainan	0.213	0.222	0.233	0.260	0.265	0.281	0.284	0.291	0.280	0.294
	Average	0.303	0.315	0.324	0.336	0.350	0.357	0.364	0.394	0.413	0.423
Central Provinces	Shanxi	0.237	0.247	0.251	0.264	0.264	0.238	0.247	0.249	0.264	0.268
	Anhui	0.251	0.261	0.254	0.230	0.249	0.265	0.325	0.376	0.405	0.426
	Jiangxi	0.236	0.250	0.229	0.246	0.254	0.256	0.295	0.342	0.358	0.385
	Henan	0.326	0.332	0.344	0.344	0.313	0.300	0.317	0.346	0.392	0.412
	Hubei	0.263	0.272	0.273	0.309	0.312	0.332	0.359	0.409	0.418	0.422
	Hunan	0.297	0.303	0.307	0.302	0.321	0.317	0.337	0.355	0.399	0.411
	Average	0.268	0.277	0.276	0.283	0.286	0.285	0.313	0.346	0.379	0.388
Western Provinces	Inner Mongolia	0.165	0.173	0.175	0.202	0.208	0.223	0.250	0.254	0.264	0.286
	Guangxi	0.194	0.204	0.214	0.206	0.217	0.221	0.252	0.252	0.271	0.283
	chongqing	0.201	0.211	0.196	0.216	0.218	0.243	0.297	0.333	0.357	0.371
	Sichuan	0.293	0.304	0.305	0.307	0.309	0.302	0.342	0.343	0.352	0.356
	Guizhou	0.156	0.167	0.173	0.180	0.207	0.211	0.266	0.277	0.301	0.333
	Yunnan	0.187	0.189	0.189	0.214	0.211	0.218	0.255	0.266	0.294	0.329
	Shaanxi	0.156	0.163	0.167	0.181	0.184	0.186	0.202	0.213	0.280	0.287
	Gansu	0.165	0.170	0.173	0.187	0.196	0.186	0.204	0.228	0.241	0.305
	Qinghai	0.148	0.158	0.165	0.181	0.185	0.197	0.195	0.211	0.229	0.250
	Ningxia	0.186	0.189	0.195	0.227	0.246	0.237	0.255	0.262	0.295	0.306
	Xinjiang	0.236	0.254	0.262	0.280	0.274	0.284	0.277	0.306	0.328	0.355
	Aerage	0.199	0.198	0.201	0.220	0.233	0.228	0.254	0.269	0.293	0.313
northeastern provinces	Liaoning	0.236	0.228	0.241	0.246	0.247	0.237	0.239	0.239	0.247	0.261
	Jilin	0.197	0.207	0.202	0.227	0.205	0.215	0.238	0.248	0.254	0.283
	Heilongjiang	0.212	0.219	0.230	0.245	0.243	0.233	0.233	0.238	0.262	0.287
	Average	0.215	0.218	0.224	0.240	0.231	0.228	0.237	0.242	0.255	0.277

According to Table 2, it can be observed that from a national perspective, the overall level of rural revitalization has been continuously increasing, especially after 2017 when the rural revitalization policy was announced. The rural areas across the country have been experiencing an upward trend in development.

From the perspective of the four major regions, the current situation reveals the following: the rural areas in the eastern region outperform those in the central region, which in turn outperform the rural areas in the western and northeastern regions. The development of the eastern region has increased from 0.303 in 2012 to 0.423 in 2021, with a growth rate of 39.6% and an average annual growth rate of 3.77%. Furthermore, from 2018 to 2021, there was a growth rate of 16.2%, with an average annual growth rate of 5.13%. This indicates a significant acceleration in growth after the release of the rural revitalization policy. The central region experienced a growth rate of

44.8% from 2012 to 2021, with an average annual growth rate of 4.2%. In the period from 2018 to 2021, the growth rate was 23.9%, with an average annual growth rate of 7.42%. The western region witnessed a growth rate of 57.3% from 2012 to 2021, with an average annual growth rate of 51.6%. From 2018 to 2021, the annual growth rate was 7.2%. The northeastern region saw a growth rate of 28.8% from 2012 to 2021, with an average annual growth rate of 2.86%. The average annual growth rate from 2018 to 2021 was 5.34%. All regions have exhibited faster development speeds after 2018. The western region, with the highest average annual growth rate, is likely due to the following reasons:

- first, the current stage of development in the western rural areas is relatively lagging, resulting in a higher growth rate compared to other regions;
- second, the support of strategies such as the Western Development and rural revitalization has contributed to the rapid development of rural areas in the western region.

From the provincial perspective, Beijing, Shanghai, Jiangsu, and Zhejiang have consistently been at the forefront of rural revitalization development. In 2021, their composite indices all exceeded 4.5.

In the eastern region, Hebei and Hainan provinces are lagging behind in terms of development. Anhui, Jiangxi, Henan, Hubei, and Hunan, located in the central region, have relatively balanced development in rural areas, with composite indices around 0.4. Shanxi's rural areas are relatively underdeveloped. The rural areas in Chongqing, Sichuan, and Ningxia are in a prioritized position within the western region. Compared to rural areas in other provinces across the country, their development is relatively moderate. The remaining western provinces are relatively underdeveloped, with composite indices below 0.35 in 2021. In the northeastern region, rural areas in Liaoning have experienced relatively stable development, while Jilin and Heilongjiang have shown faster development. However, their overall composite indices still lag behind those of most rural areas.

Analysis of Dagum Gini Coefficient Results

Table 3: Dagum Gini Coefficient Results

	Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Overall Gini coefficient	0.147	0.154	0.160	0.148	0.147	0.132	0.128	0.136	0.131	0.115
Within-region Gini coefficient	Eastern region	0.120	0.120	0.129	0.117	0.125	0.112	0.071	0.086	0.081	0.079
	Central region	0.066	0.060	0.077	0.078	0.057	0.067	0.062	0.073	0.081	0.065
	Western region	0.112	0.109	0.102	0.108	0.086	0.085	0.089	0.092	0.788	0.064
	Northeast China	0.040	0.021	0.039	0.018	0.040	0.021	0.006	0.009	0.013	0.021
Between-region Gini coefficient	East-Central	0.113	0.112	0.129	0.128	0.132	0.116	0.105	0.102	0.096	0.087
	East-West	0.220	0.237	0.245	0.223	0.227	0.197	0.196	0.195	0.180	0.157
	East-Northeast	0.173	0.182	0.183	0.168	0.203	0.190	0.227	0.239	0.238	0.208

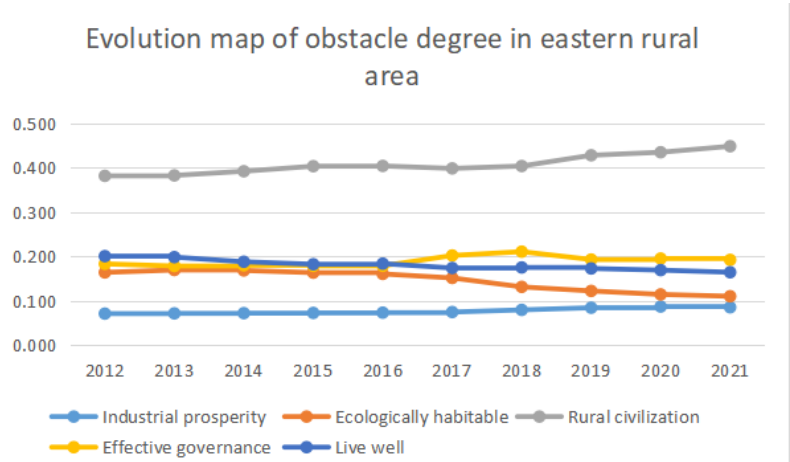
	Central-West	0.162	0.179	0.174	0.154	0.135	0.125	0.121	0.142	0.145	0.126
	Central-Northeast	0.110	0.120	0.107	0.089	0.104	0.110	0.139	0.178	0.196	0.172
	West-Northeast	0.098	0.101	0.106	0.101	0.077	0.064	0.076	0.079	0.083	0.072
Contribution values of each component	Within-region disparity contribution	0.031	0.031	0.032	0.031	0.029	0.027	0.022	0.025	0.023	0.021
	Between-region disparity contribution	0.099	0.108	0.112	0.099	0.106	0.092	0.098	0.100	0.094	0.082
	Hypervariable density	0.017	0.015	0.016	0.018	0.011	0.013	0.008	0.011	0.014	0.013

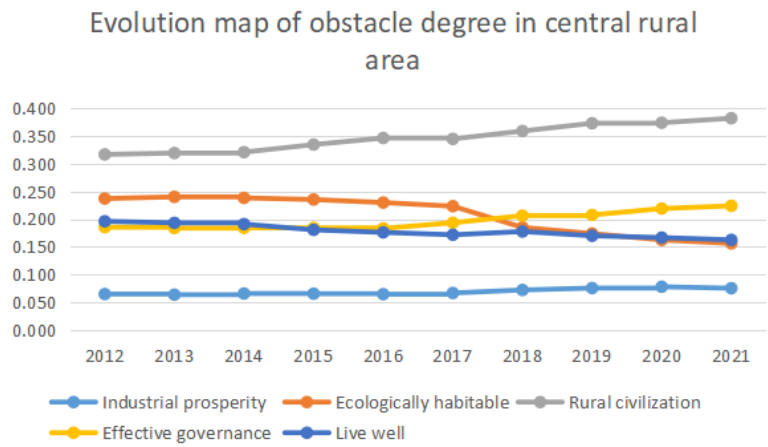
According to Table 3, the overall Gini coefficient shows an upward trend from 2012 to 2014, followed by a decrease from 0.16 in 2014 to 0.115 in 2021, representing a decrease of 21.768%. The decline is particularly pronounced in the years 2019-2021, indicating that the rural regional disparities in China have been gradually narrowing since 2014, and the pace of reduction has accelerated with the implementation of the rural revitalization strategy. During the study period, except for the central region, the Gini coefficients within the other three regions exhibit a fluctuating downward trend. Although there are occasional increases in certain years, overall, there is a decreasing trend, indicating a gradual reduction in internal disparities within these three rural regions. The Gini coefficient within the central region fluctuates in a wave-like pattern, with a significant decrease observed in the years 2019-2021. This may be attributed to the fact that the actual effects of the rural revitalization strategy vary slightly among different areas in the central region.

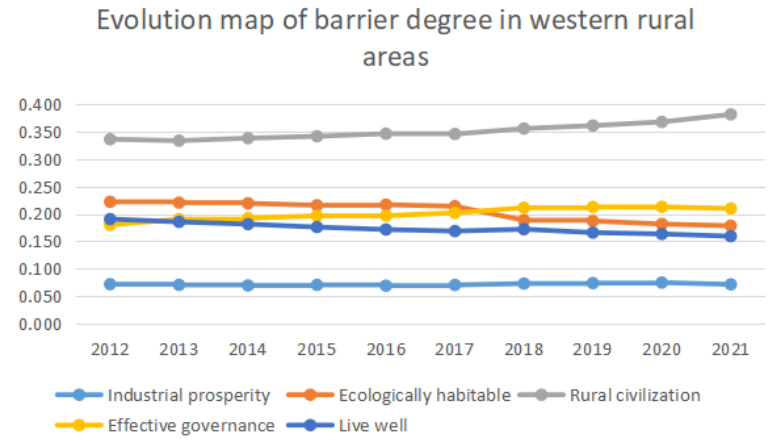
The Gini coefficient between regions represents the degree of disparity in rural revitalization levels between two regions. The development of the eastern and central regions, as well as the western and northeastern rural areas, shows relatively close proximity. Except for the northeastern rural region, the degree of regional disparities is gradually decreasing in the eastern, central, and western rural regions. The most significant reduction in disparities is observed between the eastern and western rural regions.

On the other hand, the disparities between the northeastern rural region and the other three regions are gradually increasing. This may be attributed to the slower development pace in the northeastern rural region and slight variations in development speeds, resulting in a more pronounced gap compared to the other three regions. The contribution values of different components represent the contribution of the main factors causing regional disparities. During the study period, the within-region disparity contribution, between-region disparity contribution, and hypervariable density contribution all showed a decreasing trend. In terms of proportions, the within-region disparity contribution rate was 21.302% in 2012 and decreased to 18.103% in 2021. The between-region disparity contribution rate was 67.5% in 2012 and increased to 70.69% in 2021. The hypervariable density contribution rate was 11.199% in 2012 and remained at 11.207% in 2021. The changes in these three components during the study period showed slight fluctuations. Currently, the main source of differences lies in the between-region disparities, specifically the disparities among the eastern, central, western, and northeastern regions, which are the main factors contributing to the uneven level of rural revitalization in China.

Analysis of Obstacle Degrees







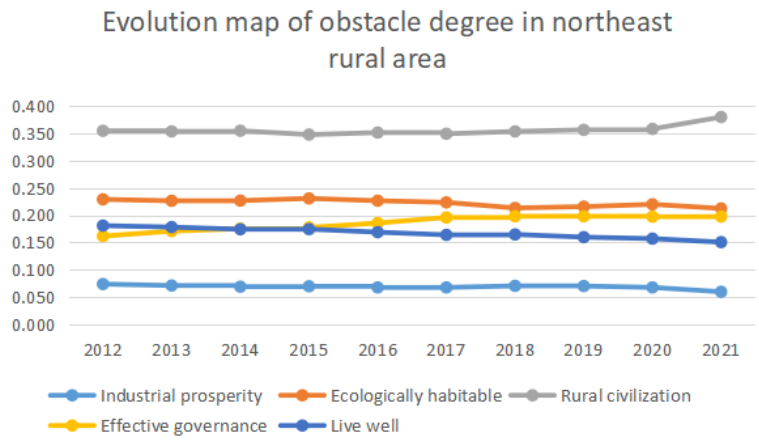


Figure 1: Analysis of Obstacle Degrees in Different Regions

Based on Figure 1, it can be observed that the common obstacle factor for rural areas nationwide is rural cultural civility, with the highest obstacle degree index. In the eastern rural areas, the obstacle degrees of the criteria layers, from highest to lowest, are rural cultural civility, effective governance, improved living conditions, livable ecology, and thriving industries. The obstacle degree for rural cultural civility increased from 0.382 in 2012 to 0.449 in 2021, indicating that the issue of rural culture and civility has not been effectively resolved. In 2021, among all the obstacle degrees, only rural cultural civility exceeded 20% and remained at a moderately high obstacle degree. In the central rural areas in 2021, the obstacle degrees, from highest to lowest, were rural cultural civility, effective governance, improved living conditions, livable ecology, and thriving industries. Significant improvements were observed in the criteria layers of improved living conditions and livable ecology within the research period. In 2021, both rural cultural civility and effective governance exceeded 20% in terms of obstacle degrees. In the western rural areas in 2021, the obstacle degrees, from highest to lowest, were rural cultural civility, effective governance, livable ecology, improved living conditions, and thriving industries. Except for rural cultural civility, the obstacle degrees of the other four criteria layers in the western rural areas either decreased or showed no significant changes from 2012 to 2021. With the exception of thriving industries, obstacle degrees for rural cultural civility, effective governance, livable ecology, and improved living conditions all exceeded 15%. In the northeastern rural areas in 2021, the obstacle degrees, from highest to lowest, were rural cultural civility, livable ecology, effective governance, improved living conditions, and thriving industries. During the period from 2012 to 2021, there were improvements in thriving industries and improved living conditions. However, obstacle degrees for rural cultural civility and effective governance showed an increasing trend.

CONCLUSIONS AND RECOMMENDATIONS

This study focuses on the period from 2012 to 2021 and examines 30 provinces across China as the research subjects. By considering factors such as data availability, representativeness of indicators, and rationality, a composite index system for rural revitalization is established. The entropy method, Dagum's Gini decomposition, and the obstacle degree model are employed to analyze the development level of rural revitalization and obstacle degrees affecting it in different regions of China over the past decade. The following conclusions can be drawn:

- The development of rural areas in China exhibits an imbalance, with the eastern regions showing good development status, while the western and northeastern regions lag behind, which is consistent with the findings of existing literature. The main contradiction in China's current stage lies in the uneven development among different regions. It is necessary to

pay more attention to the development of rural areas in the western and northeastern regions and address their weaknesses in order to achieve comprehensive rural revitalization.

- The overall gap in rural revitalization in China is continuously narrowing, and the disparities among different regions are also decreasing. However, regional disparities still remain the primary contradiction causing differences in the level of rural revitalization. Therefore, it is necessary to focus on the development of underdeveloped regions, particularly the rural areas in the northeast and western regions.
- In rural areas across China, there are issues related to rural cultural civility, while other minor issues vary across different regions. At this stage, it is crucial to address the problems related to rural cultural civility, which represents the most significant shortcomings, in order to promote better rural development. In the central rural areas, attention should also be given to rural governance issues. In the western and northeastern rural areas, apart from addressing rural cultural civility, it is important to draw lessons from relevant domestic and international experiences and focus on the development of other aspects. By considering their own specific circumstances, efforts should be made to develop rural economies and achieve sustainable and modern rural development.

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Speech Recognition and Transcription for Hearing Impairments

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Abstract:
The realm of speech recognition and transcription, driven by the urgency to enhance communication inclusivity, particularly for individuals with hearing impairments. Guided by an agile methodology, we embark on a journey to forge a transformative system that seamlessly transmutes spoken language into text, effectively bridging the chasm between audible discourse and digital understanding. Our approach orchestrates a symphony of hardware, software, and models, with Python as the chosen programming language weaving an ensemble of libraries including PyAudio, Librosa, NumPy, DeepSpeech, NLTK, and LanguageTool. Rigorous testing traversing accents, languages, and real-world auditory environments showcases the system's adaptability, and the interplay of hardware and software yields swift and accurate transcriptions, promising heightened communication inclusivity. As this symphony culminates, we assert that our creation transcends a technological artifact, echoing innovation's harmonious anthem. By catalyzing communication through spoken word-to-text conversion, our system becomes a bridge that deepens interaction and comprehension. This project epitomizes the transformative prowess of technology, underlining its potential to nurture communication inclusivity and bridge the gap between audible and digital realms.

Keywords: Speech recognition, Transcription, Hearing impairment, Background noise, Speech distortions, Language models

INTRODUCTION

Speech is an essential means of communication, allowing people to convey their thoughts, ideas, and emotions and others. Speech recognition and transcription are technologies that convert spoken language into written text. Speech recognition is the process of converting spoken words into text using machine learning algorithms that analyze audio signals and identify patterns in speech [1]. Transcription, on the other hand, is the process of converting audio recordings into written documents. It involves manually transcribing the audio recordings or using automated transcription software.

However, for individuals with hearing impairments, speech recognition and transcription can be a challenging task. Hearing impairments can vary in severity, from mild to profound, and can be caused by a range of factors, including genetic disorders, noise exposure, infections, and aging. According to the World Health Organization, around 430 million people worldwide have disabling hearing loss, with the majority of cases occurring in low- and middle-income countries [2]. Speech recognition and transcription technologies have the potential to make communication more accessible to people with disabilities, including those with hearing impairments. By converting

spoken language into written text, these technologies can help individuals with hearing impairments communicate more effectively in a variety of settings.

Speech recognition and transcription are key areas of research in the field of natural language processing (NLP). They involve the development of algorithms and systems that can automatically transcribe spoken language into text, allowing for easier access and analysis of spoken communication, some of these methods include Hidden Markov Models (HMM), Speaker Diarization (SD), Dynamic Time Warping (DTW) and Deep Neural Network [3].

Speech recognition technology has been around for several decades, but it has only recently become widely available and accurate enough to be used in everyday applications. This is due in large part to advances in machine learning and deep learning, which have enabled speech recognition systems to learn from large amounts of data and improve their accuracy over time.

Speech recognition systems typically consist of three main components: acoustic modeling, language modeling, and decoding. Acoustic modeling involves converting the raw audio signal into a series of features that can be used to identify speech sounds. Language modeling involves predicting the most likely sequence of words given the acoustic features. Decoding involves selecting the most likely sequence of words based on the acoustic and language models [3].

There are several challenges associated with developing accurate and robust speech recognition systems. One of the biggest challenges is dealing with variability in speech, including differences in accents, dialects, and speaking styles. Speech recognition systems must be able to recognize a wide range of speech patterns and adapt to new speakers and environments.

Another challenge is dealing with background noise and other sources of acoustic interference. Noise can make it difficult for speech recognition systems to distinguish between speech sounds and other sounds in the environment. This is particularly problematic in noisy environments such as factories, airports, and train stations. Other challenges are out-of-vocabulary words, Homophones, Data privacy and security and limited training data, 2020).

Despite these challenges, speech recognition and transcription have a wide range of applications, from dictation software and virtual assistants to automated closed captioning and language translation. They are also increasingly being used in industries such as healthcare and finance, where accurate transcription of spoken communication is critical.

In recent years, there has been a growing interest in developing more advanced speech recognition systems that can understand not just the words being spoken, but also the intent and meaning behind them. This involves developing systems that can recognize and interpret aspects of speech such as tone, emotion, and sarcasm.

There are also ongoing efforts to make speech recognition and transcription more accessible for people with disabilities, including those with hearing impairments. This involves developing real-time captioning and transcription systems that can provide accurate and timely text-based representations of spoken communication.

Speech recognition and transcription are important areas of research in the field of natural language processing. Despite the challenges associated with developing accurate and robust

systems, advances in machine learning and deep learning are enabling the development of more accurate and versatile speech recognition systems. Ongoing research in this area is likely to lead to further improvements in the performance and usability of these systems, enabling a wide range of applications in areas such as healthcare, finance, and accessibility [4].

RELATED WORKS

Overview of Automatic Speech Recognition (ASR) Systems

Automatic Speech Recognition (ASR) systems are technologies designed to convert spoken language into written text or other symbolic representations. ASR systems have undergone significant advancements in recent years, enabling their application in various domains such as transcription services, voice assistants, call center automation, and language translation. ASR systems generally consist of the following key components:

- Acoustic Analysis: Acoustic analysis of speech is the study of the acoustical characteristics of speech, both normal and abnormal speech [5]. This stage involves capturing and analyzing the acoustic properties of spoken language. The input audio signal is typically divided into small segments known as frames, which are further processed to extract relevant acoustic features such as Mel-frequency cepstral coefficients (MFCCs).
- Language Modeling: Language modeling is the process of predicting the likelihood of word sequences or phrases in a given language. Language models help ASR systems to make informed decisions about which words or phrases are more likely to occur in a particular context. Statistical language models, n-gram models, and more recently, neural network-based models, are commonly used for this [6]

Acoustic Modeling, responsible for mapping acoustic features obtained from the input speech signal to corresponding linguistic units, such as phonemes, sub word units, or whole words. Hidden Markov Models (HMMs) have traditionally been used for acoustic modeling, but more advanced techniques, such as deep neural networks (DNNs) and recurrent neural networks (RNNs), have shown superior performance in recent years [7].

Decoding and Alignment: In the decoding stage, the ASR system searches for the most likely sequence of words or symbols that best match the acoustic and language models. Beam search algorithms or Viterbi decoding techniques are commonly used to explore different word combinations and determine the most probable output sequence. Alignment techniques may also be employed to align the recognized text with the input audio, providing a more accurate transcription.

ASR systems require training on large amounts of labeled speech data to improve their performance. This training involves optimizing the acoustic and language models using supervised learning techniques. Additionally, adaptation methods, such as speaker adaptation or domain adaptation, can be employed to enhance the system's performance for specific speakers or specialized domains [8].

It is important to note that the development of automatic speech recognition systems has primarily focused on a subset of the approximately 7,300 languages spoken worldwide. Prominent examples include Russian, Portuguese, Chinese, Vietnamese, Japanese, Spanish, Filipino, Arabic, English, Bengali, Tamil, Malayalam, Sinhala, and Hindi. English has received the most extensive attention in terms of speech recognition research and development [9].

ASR systems have made significant progress in recent years, thanks to advancements in machine learning, deep learning, and data availability. However, challenges still exist, especially in handling noisy environments, speech variations, and languages with limited resources. Ongoing research focuses on developing more robust, accurate, and versatile ASR systems that can operate effectively in various real-world scenarios. Alex Acero's research has focused on advancing speech recognition technology, particularly in noise-robust speech recognition, language modeling, and machine learning techniques [10].

Kumar et al, [11] identified a visual speech recognition technique using cutting edge deep learning models. They proposed a novel technique by fusion the results from audio and visual speech. This study proposes a new deep learning-based audio-visual speech recognition model for efficient lip reading. In this paper, an effort has been made to improve the performance of the system significantly by achieving a lowered word error rate of about 6.59% for ASR system and accuracy of about 95% using lip reading model.

An automatic system that translates the speech to Indian Sign Language using Avatar (SISLA) that works in three phases was presented [12]. The first phase includes the speech recognition (SR) of isolated words for English, Hindi and Punjabi in speaker independent environment while the second phase translates the source language into Indian Sign Language (ISL) and HamNoSys based 3D avatar represents the ISL gestures. The four major implementation modules for SISLA include: requirement analysis, data collection, technical development and evaluation. The multi-lingual feature makes the system more efficient. The training and testing speech sample files for English (12,660, 4218), Hindi (12,610, 4211) and Punjabi (12,600, 4193) have been used to train and test the SR models. Empirical results of automatic machine translation show that the proposed trained models have achieved the minimum accuracy of 91%, 89% and 89% for English, Punjabi and Hindi respectively.

The performance of personalized automatic speech recognition (ASR) for recognizing disordered speech using small amounts of per-speaker adaptation data was presented [13]. Personalized models for 195 individuals with different types and severities of speech impairment with training sets ranging in size from <1 minute to 18-20 minutes of speech data were trained. Word error rate (WER) thresholds were selected to determine Success Percentage (the percentage of personalized models reaching the target WER) in different application scenarios. For the home automation scenario, 79% of speakers reached the target WER with 18-20 minutes of speech; but even with only 3-4 minutes of speech, 63% of speakers reached the target WER. Further evaluation found similar improvement on test sets with conversational and out-of-domain, unprompted phrases. The results demonstrate that with only a few minutes of recordings, individuals with disordered speech could benefit from personalized ASR.

WESPER [14], a zero- shot, and real time whisper to normal speech conversion mechanism based on self-supervised learning was presented. It consisted of a speech- to- unit (STU) encoder that generates hidden speech units that are common to both whispered and normal speech and a unit-to- speech (UTS) decoder. The conversion is user-independent, so requires no paired dataset for both whispered and normal text. The effectiveness of the system to perform speech reconstruction for those with hearing disabilities was confirmed [15] explored the incorporation of the humanoid robot Pepper in improving learning experience. Pepper can capture the audio of a person; however, there is no guarantee of accuracy of the recorded audio due to various factors. the limitations of Pepper's speech recognition system with the aim of observing the effect of

distance, age, gender, and the complexity of statements was investigated. Experiment with eight persons including five females and three males who spoke provided statements at different distance was conducted as classification were done using different statistical scores. Pepper was integrated with a speech-to-text recognition tool, Whisper, which transcribes speech into text that can be displayed on Pepper's screen using its service. The purpose of the study which was to develop a system where the humanoid robot Pepper and the speech-to-text recognition tool Whisper act in synergy to bridge the gap between verbal and visual communication in education was achieved.

[16] Fontan, L., Cretin-Maitenaz, T., & Füllgrabe, C. (2020). Predicting speech perception in older listeners with sensorineural hearing loss using automatic speech recognition. *Trends in hearing*, *24*, 2331216520914769

Fontan *et al*. [16] on their work Predicting speech perception in older listeners with sensorineural hearing loss using automatic speech recognition provided a proof of concept that the speech intelligibility in quiet of unaided older hearing-impaired (OHI) listeners can be predicted by automatic speech recognition (ASR). Twenty-four OHI listeners completed three speech-identification tasks using speech materials of varying linguistic complexity and predictability (i.e., logatoms, words, and sentences). An ASR system was first trained on different speech materials and then used to recognize the same speech stimuli presented to the listeners but processed to mimic some of the perceptual consequences of age-related hearing loss experienced by each of the listeners: the elevation of hearing thresholds (by linear filtering), the loss of frequency selectivity (by spectrally smearing), and loudness recruitment (by raising the amplitude envelope to a power).

Independently of the size of the lexicon used in the ASR system, strong to very strong correlations were observed between human and machine intelligibility scores. However, large root-mean-square errors (RMSEs) were observed for all conditions. The simulation of frequency selectivity loss had a negative impact on the strength of the correlation and the RMSE. Highest correlations and smallest RMSEs were found for logatoms, suggesting that the prediction system reflects mostly the functioning of the peripheral part of the auditory system. In the case of sentences, the prediction of human intelligibility was significantly improved by taking into account cognitive performance. This study demonstrates for the first time that ASR, even when trained on intact independent speech material, can be used to estimate trends in speech intelligibility of OHI listeners.

A platform that uses sign language to facilitate communication among students and tutors while providing sign language learning materials, practicing opportunities and Q&A sessions was presented [17]. The system has a low light enhancement module to enhance the videos uploaded by the tutor, module to convert the uploaded videos to American Sign Language and it also converts the questions asked via sign language to text.

SYSTEM MODEL AND FRAMEWORK

In the pivotal phase of system design and implementation, we embark on the journey of transforming our vision of seamless and accurate speech recognition and transcription into a tangible reality. Our design and implementation endeavors are intricately woven with several instrumental components:

As we venture deeper into this, each of these components will be dissected and showcased in its respective section. We will uncover how they harmoniously converge to create a powerful, user-friendly, and accurate speech recognition and transcription system. Our journey encompasses not only the technical aspects but also the user experience and the real-world impact of our system. Together, let us unveil the art and science of transforming spoken words into written text with precision and finesse.

At its core, our system embodies a high-level architecture that prioritizes user-friendliness and efficiency. Gradio takes center stage as the interface connecting users with the system's powerful capabilities. Users can effortlessly interact with the system via this intuitive interface. Gradio facilitates the exchange of data and commands between users and the system's backend components.

The success of our system hinges on the seamless interconnection of its various components. Each component plays a distinct role and collaborates with others to achieve our project's objectives. Here, we explore the intricate relationships and data exchange mechanisms between these components.

Visual representations are invaluable for understanding the flow of data within our system. Data flow diagrams provide a clear depiction of how audio inputs are processed and transformed into transcriptions. These diagrams serve as a visual roadmap for comprehending the journey of data through our system's architecture.

The CommonVoice dataset serves as a cornerstone of our speech recognition and transcription system. Developed by the Mozilla Foundation, CommonVoice is a vast, multilingual dataset containing thousands of hours of diverse, user-contributed audio recordings and their corresponding transcriptions. This section outlines how we leverage this invaluable resource to train, validate, and enhance the accuracy of our system's transcription capabilities.

Dataset Overview

The CommonVoice dataset encompasses a wide range of languages, accents, and speech styles, making it an ideal choice for training a robust speech recognition model. It includes audio samples from a diverse set of contributors, ensuring that our system is adaptable to various linguistic nuances and accents.

With the CommonVoice dataset preprocessed and split, we proceed to train our speech recognition model using techniques such as transfer learning and fine-tuning. Validation is conducted at regular intervals to monitor the model's progress and ensure it converges to accurate transcriptions.

```
training_args = Seq2SeqTrainingArguments(
    output_dir="./whisper-small-dv",  # name on the HF Hub
    per_device_train_batch_size=16,
    gradient_accumulation_steps=1,  # increase by 2x for every 2x decrease in batch size
    learning_rate=1e-5,
    lr_scheduler_type="constant_with_warmup",
    warmup_steps=50,
    max_steps=500,  # increase to 4000 if you have your own GPU or a Colab paid plan
```

Evaluation with CommonVoice

```
# Evaluation with Jiwer
wer_metric = load("wer")
wer = wer_metric.compute(references=[reference], predictions=[prediction])
```

After training, we evaluate our model's performance using the CommonVoice test dataset. Metrics like Word Error Rate (WER) calculated with tools like Jiwer help quantify the accuracy of our transcriptions. To keep our model up-to-date and adaptable to evolving languages and accents, we periodically update our dataset with new contributions from CommonVoice. This ensures that our system remains relevant and continues to deliver accurate transcriptions.

CommonVoice dataset is a critical asset in our speech recognition and transcription system. Its diversity and size provide a solid foundation for training a robust model, and meticulous preprocessing ensures that the data is compatible with our architecture. This section highlights the importance of data handling and management in achieving accurate and adaptable speech recognition capabilities.

Transcription Engine Implementation

The heart of our speech recognition and transcription system lies in the Transcription Engine, a sophisticated component responsible for converting spoken words into written text with remarkable accuracy. This section delves into the architecture, functionality, and implementation details of this pivotal component.

The Transcription Engine is intricately designed to seamlessly integrate various technologies and libraries, including Gradio, Hugging Face Transformers, and the CommonVoice dataset. Its architecture is built for flexibility, scalability, and real-time responsiveness.

The Transcription Engine accommodates two primary input sources:

1. Microphone Input: Users can provide real-time audio input via their device's microphone. Gradio facilitates this interaction, capturing audio and passing it to the transcription engine for processing.

2. Audio File Upload: Users also have the option to upload pre-recorded audio files. This is particularly useful for transcribing audio content stored on local devices or cloud repositories.

Model Integration and Real-Time Transcription

Hugging Face Transformers plays a pivotal role in the Transcription Engine by providing access to state-of-the-art automatic speech recognition (ASR) models. These models are fine-tuned and optimized for transcribing audio data into text.

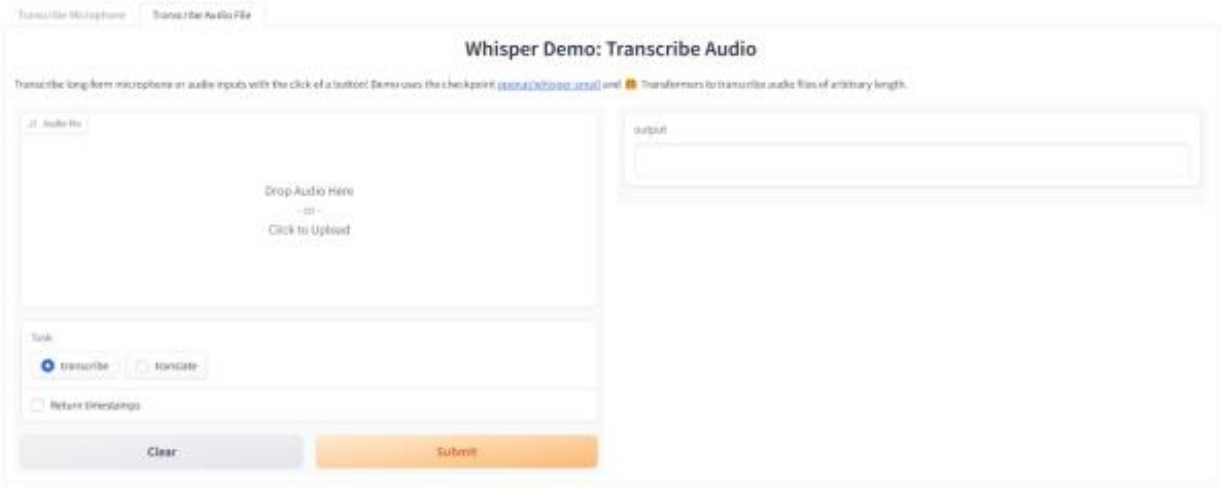
Data preprocessing is a critical part of the transcription process. Audio data from both input sources undergoes a series of transformations, including format conversion and feature extraction, to prepare it for model input. The Transcription Engine ensures that audio inputs are appropriately preprocessed to optimize transcription accuracy.

The engine is designed to provide real-time transcriptions, making it ideal for various applications, including live captioning, voice assistants, and more. This real-time capability is facilitated by chunking the audio input into manageable segments and processing them sequentially.

Output:

The Transcription Engine produces transcriptions as its primary output. Depending on the user's preference, these transcriptions can include additional information, such as timestamps for individual chunks of text. The final transcriptions are presented to the user via the Gradio interface.

Implementation Details:



The Transcription Engine is implemented using a combination of Python libraries and tools.

Here are the key implementation details:

- Gradio serves as the user interface for interacting with the Transcription Engine. It provides an intuitive and user-friendly way to input audio data, specify transcription tasks, and receive real-time transcriptions. The engine leverages Gradio's capabilities to create a seamless user experience. Hugging Face Transformers provides the core ASR models used for transcription. These models are loaded into the engine, fine-tuned as needed, and seamlessly integrated into the transcription pipeline.
- The Transcription Engine employs data preprocessing techniques, such as audio format conversion and feature extraction, to prepare audio data for transcription. These preprocessing steps are essential to ensure that audio inputs are in a suitable format for the ASR models.
- Real-time transcription is achieved by chunking the audio input into segments of manageable duration. Each chunk is sequentially processed by the ASR model, and the resulting text is stitched together to form the final transcription.
- The primary output of the Transcription Engine is the transcription itself. Users have the option to specify additional information, such as timestamps for individual chunks of text. The transcriptions are presented to the user in real time via the Gradio interface.

RESULTS AND EVALUATIONS

The journey from concept to execution has been guided by the pursuit of accurate transcription and efficient communication. The system's accuracy rates underscore its capability to convert spoken words into written text with remarkable precision. We subjected it to a diverse array of speech inputs, reflecting various accents, speech patterns, and background noises.

The results reveal that our system consistently achieved high accuracy. Our system displayed impressive adaptability, accurately transcribing speech with different accents, from American English to British English and beyond. Even in challenging auditory environments with background noise, our system's accuracy remained robust, demonstrating its noise filtering and processing capabilities.

The performance metrics of our system speak to its efficiency and responsiveness.

By analyzing processing speed and latency, we gain insights into its real-time capabilities:

- Processing Speed: Our system exhibits commendable processing speed, converting audio to text swiftly. This attribute is crucial in real-time applications where efficiency is paramount.
- Latency: The minimal latency observed in our system ensures that the transcriptions are almost instantaneous, enabling seamless communication in scenarios that demand quick response times.

The accuracy rates and performance metrics collectively underscore the potency of our system in accurately transcribing speech while maintaining real-time capabilities. These findings validate our endeavor to bridge the gap between spoken language and digital understanding.

Our journey from conceptualization to the implementation of the speech recognition and transcription system has been a transformative one, extending beyond technology to encompass insights that reach deeper into communication and accessibility: As researchers, our pursuit extended beyond code and algorithms to explore the profound impact of our system on communication. Delving into the intricacies of hearing impairment enlightened us to the immense significance of accurate speech recognition. We realized that our system could serve as a bridge, breaking barriers for individuals with hearing impairments and enabling seamless communication in their daily lives. The insights gained from understanding the challenges faced by those with hearing impairments reinforced our commitment to creating a system that not only converted spoken words into text but also played a pivotal role in fostering inclusivity. Through this understanding, we developed an appreciation for the power of technology to enhance human connection, allowing those with hearing impairments to actively engage in conversations that would have otherwise been challenging.

Our speech recognition and transcription system journey were not solely about technological advancement; it was about empowerment, communication, and understanding. It was about appreciating the potential of technology to bridge gaps, fostering inclusivity, and enhancing human experiences.

CONCLUSIONS

The evolution from inception to implementation has yielded a speech recognition and transcription system that transcends the realm of technology. The exceptional accuracy and real-time responsiveness showcased by the system unveil its potential to reshape the landscape of communication and accessibility. This innovative solution serves as a unifying bridge, dismantling barriers between spoken language and its digital interpretation, especially for those with hearing impairments.

The harmonious interplay of hardware, software, and models has yielded a transformative solution with implications spanning diverse domains. The project has illuminated technology's ability to foster profound connections and enable meaningful engagements, enriching inclusivity and empathy.

Rather than signifying an endpoint, this juncture marks a new beginning in the continuum of advancement. Embracing adaptability and perpetual learning, the path ahead involves refining and extending the system's capabilities. By harnessing sophisticated language models, exploring

expansive datasets, and augmenting user experience, we pave the way for further strides within the realm of speech recognition and transcription.

Amid the dynamic evolution of technology and the perpetual evolution of human interaction, this system stands as an embodiment of the potential inherent in innovation – the potential to enrich lives, facilitate connections, and bridge the divide between spoken discourse and its digital manifestation.

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Illicit Financial Flow and Revenue Generation in Nigeria

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Abstract:
The cost of debt servicing in Nigeria is on the rise and takes an increasing portion of the public revenue generated. A report by the Global Financial Integrity shows how countries in Sub-Sahara Africa loses capital illegally of which Nigeria is not excluded. Hence, this study examines the influence of illicit financial flow on revenue generation in Nigeria. The ex-post facto research design was used and secondary data was collected from the 2021 report of the Global Financial Integrity and the National Bureau of Statistics in Nigeria. The data was covered over a time span which ranged from 2005 to 2018. The simple regression model was used to examine the influence of illicit financial flow on revenue generation in Nigeria. The result shows that illicit financial flow has an inverse influence on oil revenue in Nigeria and a positive influence on non-oil revenue in Nigeria. it was concluded from the study that illicit financial flow has a significant influence on revenue generation in Nigeria. It is recommended that the Federal government set up measures to prevent illicit financial flow in Nigeria.

Keywords: Illicit financial flow, non-oil revenue, Oil revenue, Resource curse

INTRODUCTION

Illicit financial flow is a global phenomenon, a 2021 report by Global Financial Integrity (GFI) shows how countries across the globe lose funds to capital flight. Capital flight whether carried out legally or not have a negative consequence which ranges from loss in the potential for economic growth, loss in tax revenue and potential commercial activities.

Bawa and Ogwiji (2020) pointed out that illicit financial flow is not a new phenomenon specially to developing countries. Erik (2015) pointed out that developing countries have lost huge sums of United States Dollars to illicit financial flow. GFI (2021) reported that about one trillion United States Dollars is lost annually from developing countries. They further show that these funds are linked to terrorist financing which are taken from the economy through corrupt practices, money laundering, profit shifting and tax evasion schemes amongst others. GFI (2021) pointed out that tax havens, shell companies, transfer pricing, false invoicing are some of the schemes adopted to facilitate the illicit financial flow out of developing countries. Capital flight is seemingly different from capital outflow which can be described as the outflow of capital from within the country to foreign countries. This occurs as a result of customers within a country patronizing goods that are outside the country. However, capital flight on the other hand is the sudden loss in funds which are in substantial amounts to foreign countries. Capital flight can be carried out legally and illegally. Illicit financial flow is an illegal route of capital flight.

Capital flight is usually triggered by unstable political system in a country, high level of unfavorable business environment which include high level of inflation, low level of domestic interest rate amongst others. All these culminate and also weaken the value of the currency of such an economy which also triggers capital flight. The loss of capital especially through the illicit

flow of finances has a negative effect on any country and the effect ranges from loss in potential tax revenue, a decrease in purchasing power for consumers, loss in capital which slows down other commercial or productive activities in such an economy and ultimately hampers the economic growth of the economy (History, 2023). An examination of the revenue generation from oil activities shows that the Nigerian oil sector has increased output and activities compared to when oil was first discovered in commercial quantities in 1978, however, the country is still characterized by low literacy rate, inadequate power supply, non-functional refineries, untapped potentials in the agricultural, manufacturing and mining activities, insecurity amongst others (Joseph & Omodero, 2019). Non-oil revenue is driven basically by tax revenue as tax revenue has been identified as one of the major sources of revenue to any government (Audu, 2020). Nigeria is not exempted from this, however, Audu (2020) showed how Nigeria has had a low tax to gross domestic product (GDP) performance between 2015 to 2021 which is pointed out as poor compared to Nigeria's pairs in the Sub-Saharan Africa which have an average tax to GDP of 18%. This result suggests that the level of economic activities is still low which leads to less tax revenue or it can also be depicted that there exist possible revenue leakages which have made the tax to GDP ratio in Nigeria low. Even though the 2022 report of the National Bureau of Statistics (NBS), shows that Nigeria has a tax to GDP ratio of 10.68%, this is still below the average of similar countries like Nigeria in the Sub-Saharan African region. This is also weak compared to the average of 30% of the top five economies in the world (G5). According to data from the World Bank, Nigeria currently is classified as a developing country hence; the issue of illicit financial flow is not alien to Nigeria. Nigeria suffers from illicit financial flow also as reported by the Global Financial Integrity (GFI) in 2021. Various authors have shown empirically how Nigeria economic growth has been hampered as a result of illicit financial flow (Bawa & Ogwiji, 2022; Joseph & Omodero, 2019; Ogbonnaya & Ogechukwu, 2017). While some others have shown how Nigeria suffers from loss in tax revenue as a result of illicit financial flow (Combes *et al.,* 2021; Thiao, 2020; Onogwu, 2019).

Babatope and Audu (2020) showed how economic growth in Nigeria has been performing below expectation and showed empirically a link between accountability and economic growth. Illicit financial flow represents the level of transparency in any economy as countries with quality regulatory system might be less prone to illicit financial flow. On the other hand, Audu (2020) showed how Nigeria tax revenue has also been below the average of developed economies in the world and also below the average of similar African countries. These indices all point to the abysmal economic performance of the Nigerian economy. Studies that considered illicit financial flow influence on revenue examined it from tax revenue perspective (Combes *et al.,* 2021; Thiao, 2020; Onogwu, 2019). However, in Nigeria, government revenue does not emanate from only tax revenue but other forms of revenue. Hence, this study is intended to examine government revenue holistically. Therefore, the main objective of this study is to examine the influence of illicit financial flow on revenue generation in Nigeria. The remaining part of this study covers the theoretical framework on which this study is built, the methodology which explains how the data was gotten and processed, the results and discussion of findings, the conclusion and recommendations.

THEORETICAL FRAMEWORK

This study is hinged on the theory of resource curse theory. The resource curse theory origin can be traced first to Richard Auty in the year 1993. The theory explains that countries that have abundance of natural resources are unable to tap the potential to achieve economic prosperity. The theory is built on the assumption that leaders of such countries utilize the resources for their

own selfish purpose rather than for the economic prosperity of their country (Ross, 1999). Some proponents opposed the logic of the resource curse theory stating the economic growth is a function of the value of exports and therefore economic growth is a function on the development of the industrialization and not necessarily the existence of natural resources (Brunnschweiler & Bulte, 2008). In addition, others stated that countries economic performances are a reflection of their economic policies which either promotes commerce and makes it possible for investors both within and outside the country are well motivated to invest in the country (Dunning, 2008). On the other hand, Sachs and Warner (1995) showed empirical evidence that showed how indeed countries rich in natural resources actually perform lower than those with minimal resources. Hence, validating the resource-based theory postulation.

This theory is considered suitable for this study as Nigeria is a country endowed with natural resources such as crude-oil, large expanse of fertile land for agricultural activities, iron-ore, coal, minerals, human resource amongst others. Yet, the country seems to be performing below expectation. Based on this theory, this can be attributed to leadership challenges that prevent the right utilization of the resources which has affected the development of its industrialization and has not encouraged investors to pull in their capital and let such capital remain which leads to the capital flight such as illicit financial flow and hence revenue that should have been taxed are not available and the revenue generated seems to be below expectation. Hence, the need for this study which is to examine the influence on illicit financial flow on revenue generated in Nigeria.

EMPIRICAL REVIEW

Bawa and Ogwiji (2022) examined the impact of illicit financial flow on the level of economic growth in Nigeria. *Ex-post facto* research design and secondary data was gathered from the CBN bulletin and from the EFCC for a period ranging from 2010 to 2019. It was shown from the study illicit financial flow stopped by the EFCC has a positive but insignificant influence on the level of economic growth in Nigeria.

Combes *et al.* (2021) examined the influence of illicit financial flow on tax revenue of Financial Action Task Force countries. *Ex-post facto* research design was used in the study. It was pointed out from their study that illicit financial flow has a significant impact on indirect tax revenue and not a significant impact on direct tax revenue of Financial Action Task Force countries.

Thiao (2020) assessed the influence of illicit financial flow on the level of government revenue in selected West African countries. *Ex-post facto* research method was used and secondary data was collected over a period range from 1996 to 2013. It was pointed out from the study that illicit financial flow has a negative significant influence on the level of government revenue of selected West African countries.

Onogwu (2019) assessed the trend of illicit financial flow and its influence on economic development in Nigeria. Qualitative research method was used in this study and literature were reviewed. It was revealed from the study that illicit financial flows have significantly deprived Nigeria of development funds.

Joseph and Omodero (2019) evaluated the influence of illicit financial flows on the growth of the Nigerian economy. *Ex-post facto* research design was used and secondary data over a period range from 2005 to 2018. The outcome of their study showed that illegal commercial activities have an inverse influence on the level of economic growth in Nigeria.

Ogbonnaya and Ogechukwu (2017) assessed the effect of illicit financial flow on economic growth level in Nigeria. *Ex-post facto* research design was used and secondary data from 1980 to 2015 was used in the study. Their study showed that illicit financial flow has a significant influence on the level of economic growth and development in Nigeria.

Gap in the Study

From the review of existing related literature, it is revealed that there is paucity of studies in this direction, this might be due to the difficulty in obtaining data on illicit financial flow (Joseph & Omodero, 2019). In addition, studies in Nigeria related to the theme of this study examined how illicit financial flow influenced economic growth. Hence, this study is intended to fill a methodological gap by using public revenue generated as an economic performance proxy rather than gross domestic product. Hence, the below hypotheses are tested in this study which are:

- H_o1: Illicit financial flow does not have any significant influence on oil revenue in Nigeria.
- H_o2: Illicit financial flow does not have any significant influence on non-oil revenue in Nigeria

METHODOLOGY

The quantitative research method was adopted for this study. The *ex-post facto* research design was used in this study as it allowed the examination of past events. The geographical boundary of this study is Nigeria and secondary data was gathered over a fourteen-year time frame spanning from 2005 to 2018 based on the availability of data collected. The simple regression method is used to carry out the inferential analysis in this study. The regression model is used as it allows the examination of the influence of the independent variable (illicit financial flow) on the dependent variable (revenue generated). The T-test was used to test the significance of the result at a set rate of 5%. The breakdown of the regression model is depicted below:

$$Y=f(X)$$

Revenue = f (Illicit financial flow).

Mathematically, this can be written as shown below:

$$ORV = \beta_o + \beta_{1IFF} + e \quad \text{.....i}$$

$$NRV = \beta_o + \beta_{1IFF} + e \quad \text{.....ii}$$

Where,
ORV = Oil Revenue (Dependent Variable)
NRV = Non-Oil Revenue (Dependent Variable)
β_o = Intercept where independent variable is zero
β_{1IFF} = Illicit financial flow (Independent Variable)
e = error term

DATA ANALYSIS AND DISCUSSION OF FINDINGS

The result of the hypotheses tested is displayed in this section.

- Hypothesis One: Illicit financial flow does not have any significant influence on oil revenue in Nigeria.

Table 1: Regression Result on Hypothesis One

Estimation Techniques	**Regression Result**			
Dependent Variable: ORV	**Coeff.**	**Std. Err**	**T-Stat**	**Prob**
Constant	6752.957	728.423	9.271	0.000
IFF	-0.318	0.145	-2.191	0.049
Adjusted R^2	0.226			
F-Stat	$F_{(1, 14)}$ = 4.80 (0.049)			

Source: Researchers Computation (2023)

Table 1 reveals that illicit financial flow has an inverse influence on oil revenue. It further shows that illicit financial flow has a significant influence on oil revenue. This means that the higher the level of illicit financial flow out of Nigeria, the lower the level of oil revenue generated. The result also shows that illicit financial flow explains about twenty-seven percent of what happens in oil revenue in Nigeria.

- Hypothesis Two: Illicit financial flow does not have any significant influence on non-oil revenue in Nigeria

Table 2: Regression on Hypothesis Two

Estimation Techniques	**Regression Result**			
Dependent Variable: NRV	**Coeff.**	**Std. Err**	**T-Stat**	**Prob**
Constant	1431.011	394.530	3.627	0.003
IFF	0.210	0.079	2.670	0.020
Adjusted R^2	0.320			
F-Stat	$F_{(1\ 14)}$ = 7.13 (0.020)			

Source: Researchers Computation (2023)

Table 2 shows that illicit financial revenue explains about thirty-two percent approximately of non-oil revenue in Nigeria. the result further reveals that illicit financial flow has a positive influence on the level of non-oil revenue in Nigeria. The result also shows that this is significant. Therefore, in summary, the result shows that the higher the level of illicit financial flow out of Nigeria, the higher the level of non-oil revenue in Nigeria.

Discussion of Findings

The result on hypothesis one shows that illicit financial flow has a significant inverse influence inverse influence on oil revenue in Nigeria. This is in line with the result of Theo (2020) who opined that illicit financial flow has a negative influence on government revenue among West African countries. Similarly, Onogwu (2019) opined that illicit financial flow has rubbed the Nigerian government of funds that would have been used in developing the country. These arguments are in line with the resource curse theory which explains how policies are not favorable such that investors look for either legal (capital flight) or illegal (illicit financial flow) of withdrawing their funds from the system and thereby impacting negatively on the economic performance of the country.

On the other hand, the result on hypothesis two shows illicit financial flow has a significant positive influence on non-oil revenue in Nigeria. This is in variance with the position of Thia (2020) who pointed out that illicit financial flow has an inverse influence on government revenue. The result from this study in view of non-oil revenue shows that the more the illicit financial revenue, the more the non-oil revenue. A possible reason for this could be that these funds are brought in

to undertake commercial activities which are non-oil related and are then taken out. This suggests that the Nigerian economy can easily attract foreign investments which generates revenue activities but some of these funds are taken out. Therefore, to tap fully from the investments brought in, as predicted by the resource curse theory, policies that will encourage investors to retain their funds in the Nigerian economy needs to be promulgated so that Nigeria can fully tap from foreign investment and local investment working within the economy and as such, public revenue will be higher.

CONCLUSION AND RECOMMENDATION

The focus of this study is to examine the influence of illicit financial flow on revenue generation in Nigeria. the result from this study shows that illicit financial flow has an inverse influence on oil revenue generation in Nigeria. It also shows that illicit financial flow does have a positive influence on non-oil revenue generation in Nigeria. In conclusion, the study shows that illicit financial flow does have a significant influence on revenue generation in Nigeria. Based on the results from this study, it is recommended that the federal government should ensure that all loopholes that lead to illegal leakage of revenue out of Nigeria should be sealed. This can be achieved by reviewing laws and mechanisms such as fund transfers that allow for movement of funds over the shores of Nigeria and regulate their activities so as to curb the illicit flow of revenue out of Nigeria in order to enhance revenue generated from oil revenue. In addition, the federal government needs to create an environment that encourages investors to channel their fund into Nigeria and adequately reward them such that they don't create mediums to move their revenue out of the country in order to boost non-oil revenue.

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Appendix

Appendix I: Raw data extracted

	Illicit financial flow (a)	Oil revenue (b)	Non-oil revenue (b)
Year	N' Million	N' Million	N' Million
2005	2359.2	4762.4	785.1
2006	2363	5287.6	677.5
2007	2100.26	4462.9	1264.6
2008	2692.35	6530.6	1336
2009	4167.72	3191.9	1652.7
2010	2480.37	5396.1	1907.6
2011	1551.66	8879	2237.9
2012	791.16	8026	2628.8
2013	4213.57	6809.2	2950.6
2014	2414.37	6793.8	3275
2015	4277.17	3830.1	3082.4
2016	8350.06	2693.9	2922.5
2017	10464.2	4109.7	3335.1
2018	9051.48	5545.8	4005.9

Source: (a) GFI (2021), (b) NBS (2021)

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I Don't Really Feel Prepared for This Now That We're Talking About It: What is Educating for College and Career Readiness in an Urban District?

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Abstract:
The purpose of this qualitative study is to better understand how urban high schools prepare their students of color (SoC) for "college and career readiness" through asking the following: What does educating for "college and career readiness" look like? How are students being educated for "college and career readiness", and how do students learn about and interpret "college and career readiness?" With these central questions and responses from two Greenwood City School District (GCSD)* principals and nine GCSD students, we learn the focus within the "college and career readiness" paradigm is largely dedicated to student's college preparation and occupational exposure, but not much in the way of introducing challenging aspects of tomorrow's occupational landscape including neoliberalism, globalization, automation, and workplace discrimination. This study concludes with recommendations that education practitioners critically deconstruct the language used to imply sufficiency of the college degree in yielding reliable, secure employment for students of color, as well as encourage more transparency with students pertaining to what likely lies ahead in the workplace of tomorrow.

INTRODUCTION

At present, there appears to be a disconnect from what students of color learn pertaining to the college degree and what it yields, from the realities most will likely experience as entrants into the workforce. The purpose of this study is to better understand how urban high schools prepare their students for college and career readiness through asking the following questions: *What does educate for "college and career readiness" look like? How do administrators whose charge it is to ensure students are being educated for "college and career" readiness understand "college and career" readiness?* and, *how do students learn about and interpret "college and career readiness?"* With these guiding questions and responses from study participants, the hope is that we can begin to critically deconstruct the language used to imply sufficiency of the college degree for students of color, as well as prompt education practitioners to be more transparent with students with information about what likely lies ahead in the workplace of tomorrow…

There are seminal moments in the lives of educator-researchers like anyone else, that force us into moments of introspection. Some may be reflections of our own experience, or those we've witnessed in the lives of others. Three moments situate the motivation initiating this research topic. The first of which was my nearing college graduation which many assume to be a time for celebration. However, it was a time filled with frequent sleepless nights and elevated anxiety as I became increasingly aware that I had no career prospects upon completing college. I thought I did all the things Black students are told to do by family and society if we wanted to be "successful" as adults. I went to an "elite" private school (on scholarship) for high school; presumably, the right school. I graduated from college with a GPA above 3.0 and participated in

extracurricular activities like playing intercollegiate sports, volunteering in local service organizations like the NAACP and Habitat for Humanities, and yet the occupational opportunities I believed would be there based on what I understood from public messaging and family, were not. Upon further reflection, I recognized that I was not an anomaly as this phenomenon seemed to be more common even within my immediate circle than I noticed before. A close family member, a Black woman, attended public schools in a suburban school district, again, presumably the "right schools", graduated from a well-regarded university in Philadelphia with a degree in finance, and struggled to find meaningful employment for over a decade after her graduation.

There were more examples.
A younger Black guy I knew from high school resided in a neighboring city known for its violence and concentrated poverty. With a scholarship similar to the one I received, he graduated from the same "elite" private high school one year after me, then graduated with a bachelor's degree in science from a small Catholic liberal-arts college in Baltimore majoring in computer technology. His first job out of college was working for his hometown school district in the Information Technology (IT) department, and after a few years, experienced his entire department being abolished as the district, under state takeover, sought to privatize IT services. The company the district contracted with offered him his job back, albeit with less pay and less comparative benefits but also with more job insecurity. Conversely, his path from our "elite" private high school to the small Catholic liberal arts college is the same academic path a classmate of mine took; only her family was rich, and she was white. Not surprisingly, upon graduation, she had no problem securing employment in her family's booming healthcare business and earning a handsome salary along with it. To reiterate: the younger Black man that I knew not only attended the "right" schools, but also graduated college with a STEM degree - still, he struggled in securing reliable employment. On the other hand, a white wealthy classmate took the same educational path, and was thriving financially and occupationally while he struggled.

As I continued to reflect, I remembered two student athletes from my days teaching in city high schools. One graduated from a well-regarded university in central New Jersey with a degree in economics. Upon graduating, his first foray into the labor market was to sell Herbalife nutrition supplements. Another attended a small Catholic university in New York, and graduated with a degree in finance. Her first job out of college was working as a bank-teller, and upon leaving that job, began working in social services - neither job she obtained required a college degree. Neither job offered a salary. Neither job offered benefits. Neither job offered job security. The examples were all around me that at least some part of the messaging that a college degree results in a "good job" are incomplete. *If gaining more formal education was the answer, the "great equalizer", what explained the divergent occupational and economic realities between the wealthy white classmate I had, and the young Black man that I know? What explained the difficulty my sister, like the recent Black college graduates that came through our school district, and many other educated Black college graduates experienced in finding adequate employment?*

As previously discussed in *Unpacking the Shortcomings of "College and Career Readiness" as an Educative Approach in Urban Schools in Preparation for Tomorrow's Economy* (Benson & Owens, 2022) [1], Leah Z. Owens and I explored the contradictory nature of educating masses of students for "college and career readiness" in a neoliberal economy whose primary function is profit maximization by accessing cheap labor through globalization, automation, computerization and increased usage of artificial intelligence. These combined and complementary approaches serve to reduce domestic labor costs and ultimately reduce human participation in the domestic

workforce, all while the American citizenry becomes more formally educated. Additionally, we attempted to convey that student of color who progress through schools that purport to educate students for "college and career readiness", in addition to having to contend with all the burdens future jobseekers will face, students of color who (are also more formally educated than ever), will additionally have to navigate persistent occupational discrimination in hiring, and at work. We concluded our article arguing that though many of today's high schools claim to yield "college and career" ready students, failure to present students with the realities of tomorrow's occupational landscape leaves them unprepared for what likely awaits, and possibly leaves students of color in a heightened position of vulnerability if the topic of racial and ethnic discrimination in employment is left unexplored. Here, I attempt to pick up where Owens and I left off by inquiring how urban schools educate their primarily Black and Latino student body for "college and career readiness".

First, I will provide a brief review of "college and career readiness" within a neoliberal economy, before shifting focus to the pervasive nature of occupational discrimination endured by Black job seekers, specifically formally educated Black jobseekers. From there, I'll present the Greenwood City School District* (GCSD) as the central unit of analysis for this qualitative study and standpoint theory as its theoretical grounding. Toward the article's conclusion, I will present findings, and conclude with a discussion of the research's shortcomings and suggestions for possible further inquiry on this topic.

COLLEGE AND CAREER READINESS IN A NEOLIBERAL ECONOMY

Voluminous research has been dedicated to defining, celebrating, and critiquing neoliberalism by economists and sociologists far more knowledgeable about its details than I can cover in this brief explainer of neoliberalism. Quickly, neoliberalism is an approach by governments, powerful corporations, and the wealthy working in coordination to: shrink the state or severely weaken government power, concentrate private wealth and corporate power, allow markets to operate with minimal government intervention, privatize public services, and placing primacy of individuals over the collective. In response to progressive gains achieved in the civil rights and environment rights movements of the 1960s, Louis Powell's penned "Attack on the American Free Enterprise System" (1971) [2] to the United States Chamber of Commerce imploring business, among other things, to take a more active role in influencing laws in corporation's favor and promoting citizen's valorization of capitalism (Mayer, 2016). With Powell's subsequent appointment to the Supreme Court in 1976, business interests have been using the apparatus of government to bend politics and policy in business' favor for nearly five decades (Gertsle, 2022) [3]. As neoliberalism gained primacy as America's prevailing governance and economic structure, it was Reagan during the 1980s who cemented neoliberalism as the dominant ideology in America for decades after.

In 1983, the Reagan administration issued *A Nation at Risk* (ANAR) [4], a report on the state of American public education, with recommendations to apply a business-friendly approach by standardizing curriculum and initiating more standardized testing. The report concluded that America was losing out economically to foreign nations because our public education systems were woefully inadequate which, in their conclusion, constituted a national security risk. Further, a the time of ANAR's publishing, the US was coming out of a time of high unemployment, high inflation, gasoline rationing, shrinking value of the dollar, less jobs paying a livable wage, widespread offshoring, domestic urban deindustrialization and automation, reduced corporate regulations and oversight, and slashed taxation of corporations and the wealthy. These collective

actions resulted in exploding wealth and wage inequality, deepened job losses across sectors, and reduced union affiliation - all emblematic of neoliberalism, and yet through ANAR, American schools bore the blame for the nation's economic condition and growing career precarity. In that NAR tied matters of national security and a precarious economy, the general public was overwhelmingly receptive of its message. This report was unique in its explicit linking of public schooling and America's macroeconomic condition.

Since ANAR's publishing, the landscape of American public education has been steadily shaped by corporate influence situated within a neoliberal economy. The expectations of private business are given primacy over the public responsibility of educating the collective for personal development and contribution within a democratic society. Subsequent bipartisan federal education policies like *No Child Left Behind* (2001) [5] and *Race to the Top* (2009) [6] placed great emphasis on students, regardless of race and income background, becoming "career and college ready" and employing mandatory implementation of standardized testing to prove students' preparedness and schools' effectiveness in doing so.

Formed in 1988, the original Commission on Skills of the American Workforce, was a consultancy charged with "formulating an agenda for American education based on an analysis of the implications of changes within the international economy and seek, wherever possible, to accomplish that agenda through policy change and development of the resources for educators who would need to carry it out." In 2010, the New Commission on Skills of the American Workforce, following decades of globalization and offshoring, like ANAR two decades prior, lamented "the decline of education in America" warning that it would precipitate a prolonged loss of ground to international countries vying for similar jobs and industries and a correlating loss of America's standard of living. The Commission called for:

- greater efficiency of education resources and funding
- recruit students from the upper academic echelons to college who specifically intend to become teachers
- increased standardization in curriculum and course offerings relating to the current global economy and restricting course options
- create more high performing schools in every district
- increase the availability of early childhood education
- give greater support to America's most needy students
- re-engage adults educationally and in skills development for the new economy (National Center on Education and the Economy, 2010)

The modern call for "college and career readiness" is posited as a means to boost academic proficiency, with college attainment being the means by which students gain access to occupational opportunities. "The thrust of these reports suggests that the education sector, especially public-funded education, and the job candidates themselves should be responsible for producing skills that employers want (Cappelli, 2015, p. 252)" [7]. Calls for increased education since the 1980s ignores the reality that capitalism demands a robust underclass, regardless of one's educational attainment, and particularly for the historically marginalized, the increase in education has not coincided with substantive advancement occupationally or in wealth. Additionally, the contention that earning a bachelor's degree as the benchmark separating those with economic and occupational opportunities, and those without, reinforces the concept of a meritocratic America where we are all equally positioned to achieve future success based on our work ethic.

In 2012, the Educational Policy Improvement Center, defined a college and career ready student as someone who can "qualify for and succeed in entry level, credit bearing college courses leading to a bachelor's degree or certificate, or career pathway-oriented training programs without the need for remedial or developmental coursework". EPIC's components of a college and career readiness curriculum included:

- building cognitive strategies including hypothesizing, analyzing, synthesizing, and problem solving;
- building students' existing skills and techniques through goal setting, self-awareness, and motivation;
- strengthening content knowledge by focusing on core subjects and their applications within students' desired career trajectory;
- growing transition knowledge and skills which enables students to navigate life between high school and college or their chosen career path

The Career Readiness Partner Council (CRPC), consisting of business leaders, education groups, issued *Building Blocks for Change: What it Means to be Career Ready* (2012) [8] calling for more alignment between education systems and the business community so that students can be better prepared for careers. CRPC's report concluded that both improved communication and greater partnership between policymakers, high school staff, industry leaders, post-secondary institutions, parents, and work to increase students' academic and technical knowledge as well as bolster employability knowledge and workplace skills and attitudes (Career Readiness Partner Council, 2012) [9].

To the contrary, Cappelli writes, "Very little evidence is consistent with the complaints about a skills shortage, and a wide range of evidence suggests the complaints are not warranted. Indeed, a reasonable conclusion is that overeducation remains the persistent and even growing condition of the US labor force with respect to skills (Cappelli, 2015, p. 251) [10]. Additionally, Sahlberg suggests the universal "college and career readiness" in response to globalization is not only potentially harmful to America's students. but also, is antithetical to the realities of tomorrow's economy (Sahlberg, 2011) [11]. He argues American public education, dominated by assessments, curriculum standardization, increased implementation of technology-based curriculum and personalized learning, runs counter to the emerging realities in tomorrow's workplaces as they become more collaborative and reliant on communal problem solving. Perhaps more concerning is the critique that the "college and career readiness" approach ignores the operational reality of global capitalism that seeks to maximize profits through reducing production and labor costs. As Backer shared, "about 3.5 M students will graduate from high school during the 2016–2017 school year" with most attending at least some college after and during that same year; "1.01 M associate's degrees, 1.9 M bachelor's, 800,000 master's, and 181,000 doctoral degrees will be awarded", but continues, "having a degree will do nothing to protect against the sometimes violent and unpredictable patterns of market activity in a capitalist economy" (Backer, 2016, p. 3) [12].

According to *EducationData*, in 2020, 2.038M American college students graduated with a bachelor's degree on top of the 1.98M and 1.92M who earned the same degree in 2018 and 2016, respectively. The 64.7% rise in earned bachelor's degrees since 2000 and 15% rise in graduation rates in public institutions since 2010, indicates American students are adding to their human capital through degree accumulation (Hanson, 2022) [13]. Though a common assumption to explain the difficulty college graduates have in landing post-graduate employment

commensurate with their education is that students majored in "soft sciences" that are not marketable, the most common major among college graduates since 1980 has been business, followed by healthcare-related majors, and STEM majors making up 18.3% of bachelor's degrees conferred in 2020 (Hanson, 2022). With the increase in domestic automation, computerization, and growth of artificial intelligence, coupled with offshoring due to international trade agreements like NAFTA (1994), CAFTA (2004) and the Trans-Pacific Partnership (2016) (Oldenski, 2012) [14], the sustained erosion of stable, good-paying domestic jobs has continued for nearly fifty years.

Corporate efforts to access cheaper labor is not confined to the blue-collar sector but also is apparent in the white-collar technology sector as well. Lakes points out that a tech worker in Silicon Valley earned on average $78,000 in 2013, whereas someone in India is paid $8000 to do similar (Lakes, 2008) [15]. Since 2013, IBM has employed more workers in India than the United States as the average pay for a worker in India is about $17,000 compared to $100,000 for a similarly positioned American worker. Similarly, software developers in San Francisco and Seattle are paid on average $109,167 dollars per year, while a software developer in India is paid roughly a third of that rate at $38,229 (Ahmed, 2020) [16]. The trend of IBM offshoring tech jobs out of America and into lower cost, less regulated nations like Mexico, the Philippines and China, like many large corporations, serves to maximize corporate profits (Goel, 2017) [17]. High-skilled workers in information technology are increasingly subject to offshoring (Mithas & Lucas, 2010) [18] with labor cost cited as the cause behind the relocation of nearly three million white-collar jobs since 2002 on top of the 5.7M jobs lost in manufacturing since 1998 - most of those jobs lost to developing nations (Scott et al., 2022) [19]. As the bulk of good-paying, white-collar jobs and their correlating benefits become less available, the occupational outlook in America is increasingly relying on the creation of low-paid service sector work for which no college degree is required. Industries like food service, health care, and maintenance are the preeminent growth industries for the next generation of American workers as such jobs are not subject to a similar threat of outsourcing (Oldenski, 2012) [20].

This is just a snapshot of the occupational future in America, again, even as more Americans accumulate more formal education and postsecondary credentials. The call for schools to educate students for "college and career readiness" for tomorrow's economy, while ignoring the competing reality of neoliberal economics placing primacy of maximizing corporate profits through accessing cheap labor (human or computerized), while Americans garner more formal education seems, at least, problematic if not potentially catastrophic. In the next section, I will explore the discriminatory workplace realities for Black jobseekers and workers, including those who earn college degrees.

RACIAL DISCRIMINATION IN HIRING

Over the last twenty-five years, unemployment for blacks has remained roughly double that of whites (Levine, 2012) [21]. According to a 2019 report by the Economic Policy Institute, as of late 2018, black unemployment sat at 6.5%, and Latino unemployment at 4.5%, with white unemployment half that of blacks at 3.1% (Williams & Wilson, 2019) [22]. In the Fall of 2021, black men had jobless rates of 7.3% compared to 3.4% of white men (Aranti, 2021) [23]. Irrespective of education, even as America experiences moments of economic prosperity or recession, black unemployment remains consistently double that of white unemployment, and has so since 1971 (Wilson & Darity, 2022) [24]. Structural changes within the American economy during the post-industrial period transitioned urban job markets from industry-based to service-based, leading to

a correlating concentration of male joblessness within urban areas. The shift from blue-collar to white-collar work coincided with the precipitous decline of unionized urban manufacturing work that required little formal education, to the modern occupational landscape where more jobs within city centers are service sector jobs that require post-secondary education. This shift in domestic work negatively impacted men of all racial backgrounds, but urban unemployment disproportionately impacted urban black men (D'Amico & Maxwell, 1995) [25]. As of 2010, nearly 50% of all black men of working age in urban areas were unemployed and the rolls of working black men have persistently lagged behind white men since 1980 (Levine, 2012; Kromer, 2009) [26].

Popular arguments sought to explain chronic male unemployment within the black community. The *skills-mismatch* theory asserted that the erosion of blue-collar manufacturing jobs, where higher levels of formal education was not a requirement for employment, black men who typically did not receive as many years of formal education as their white counterparts, were at a competitive disadvantage when competing for service sector jobs (Skinner, 2001) [27]. Another argument put forth regarding black male joblessness within cities is that once readily available factory jobs in urban areas relocated to residential suburbs, rural states and overseas resulting in geographic inaccessibility to potential employment (Bosworth et al., 1997) [28]. The *spatial mismatch* theory argued that the suburbanization of the manufacturing sector along with residential segregation in suburban areas, physically kept urban minorities from industry jobs, thus benefiting their white counterparts in employment availability and occupational opportunity. Skinner (1995) [29] suggests that central city Black men experience informational and transportation disadvantages preventing access to entry-level manufacturing and service sector work that has relocated to the suburbs. Brecher (1977) [30] however, argued against such theories as early as the late 1970s concluding the disparity in skills training or formal education does not account for the high levels of black male unemployment, but discrimination is the dominant factor in persistent black male joblessness.

Subsequent research suggests the lack of access through social networks is an additional barrier contributing to unemployment and underemployment among Black jobseekers. Positing that employment or access is itself a privilege, and such a privilege is often kept in white circles among other white people, with black people not being part of those networks, it follows that employment opportunities will be missed (DiTomasso, 2013) [31]. Where simply referencing a job to an acquaintance or a neighbor, ensuring submitted resumes are viewed by decision makers, or "putting in a good word" for a family member, most races have little substantive interracial interactions with one another which negatively impacts potential employment opportunities for non-whites specifically. As DiTomasso reported an estimated 70% of the jobs study participants acquired over their lifetimes came with the help of family and friends, Pedulla & Pager (2019) [32] found that roughly half of acquired jobs are discovered through informal mechanisms including friends, family, neighbors. And while black jobseekers, like other ethnicities do consult their social networks for job prospects, a positive return is comparatively less likely in that black workers are overrepresented in lower wage, entry level positions, and are often not staffed in positions that can help black job seekers in successful securing a job opportunity (Pedulla & Pager, 2019; Wingfield, 2014) [33, 34].

Additionally, black jobseekers experience "high employment disadvantage" specifically because of race compared to other racial demographics with black men experiencing the highest frequency of direct racial discrimination in the job market (Qullian et al., 2017) [35]. Black

employees are perceived as "less productive", "lazy", "dishonest", and "belligerent", especially if their job application indicates they reside in a poor neighborhood (Pager et al., 2019) [36]. One study indicated that once Black men removed references to their race on their resume, they were twice as likely to be interviewed (Arantani, 2021) [37]. Indeed, Quillian, et al. (2017) [38] found that even when accounting for education, gender, and study methodologies, white jobseekers get 36% more callbacks than black applicants, and 25% more callbacks than Latino job seekers, indicating very little progress has been made in leveling the playing field in occupational attainment. Across industries and occupations, applicants with "white names" receive 50% more callbacks for interviews than names that sound black (Bertrand & Mullainathan, 2004) [39]. Such entrenched discrimination is consequential: fewer callbacks mean fewer job opportunities, fewer job offers, fewer job options, and less leverage in negotiations. Additionally, black employees, both men, and women, typically are the "last to be hired" and "first to be fired" from their jobs in economic downturns, further contributing to lingering rates of comparative black unemployment (Nelson & Tyrell, 2016) [40].

Where common explanations for the persistent disparity in employment rates between blacks and whites are a presumed comparative lack of formal education or higher likelihood of possessing a criminal record, a 2005 Princeton study showed that black men in New York City with a high school diploma and no criminal record, were less likely to receive a second phone call from a prospective employer than a white man who had just left prison (Pager et al., 2009) [41]. Similarly, Alexander et al. (2004) found that in western Baltimore, "at age 28, 54% of white men with a criminal record were employed full time making an average of $20 an hour; among black men with similar records, just 33% were employed by 28, making just over $10 an hour, or half that of their white peers". Black and Latino women are employed at higher rates than black and Latino men, yet are also more likely to work for wages at or below minimum wage (National Partnership for Women and Families, 2022) [42]. White women earn about 82 cents for every dollar a white man makes, black men earn an average of 73 cents for every dollar a white man earns; black women earn 67 cents, and Latino men and women 69 cents and 58 cents, respectively. In hourly wages, pay disparities still exist, with white men earning $21 per hour, as black men earn $15, and Latino men earn $14 per hour (Patten, 2016) [43]. Overall, in 2019 Black workers earned nearly 25% less hourly than white hourly workers, a larger disparity than existed in the late 1970s when the pay disparity was 16.4% less (Wilson and Darity, 2022).

Contrary to the meritocratic platitude of education being the "great equalizer", educational attainment for Black job seekers is an insufficient antidote against employment discrimination. In 2018, the Economic Policy Institute found that the legacy of employment discrimination persists at roughly the same levels as 1968 despite nearly "90 percent of younger African Americans (ages 25 to 29) graduating from high school, compared with just over half in 1968." The Education Data Initiative (2022) [44] reported that Black college attendance increased 33% from 1976 to 2022, while white college enrollment fell by 24% over the same period. Additionally, Black college attendance and graduation rates were at all-time highs (Jones et al, 2018) [45] prior to the COVID-19 pandemic. "College graduation rates for African Americans increased 500% with 26% of African Americans over 25 possessing a college degree, where in 1972, only 5.1% possessed a college degree" (Wilson & Darity, 2022, p. 6) [46]. Paradoxically, according to a survey conducted by the Pew Research Center in 2016, experiences of workplace discrimination based on race *worsen* and are more frequent the more formally educated black people become (Anderson, 2019) [47]. Black women, the most educated subgroup in America, have increased rates of both college

enrollment and graduation over the last three decades, yet black women make up only "8% of private sector jobs and 1.5% of private sector leadership positions" (Anderson, 2019, p. 1) [48].

The surge in both black men's and women's attendance in post-secondary institutions is not without consequence. Due to the lack of generational wealth to help fund college and a comparative lack of parental college exposure, thus navigational knowledge of the financial aid process from family members, black students finish college with the most debt, $53,000 on average as nearly 87% of black students use loans to pay for college (Hale, 2023) [49]. The higher amount of student debt, coupled with pay disparities based on race and gender, leaves black graduates in a uniquely disadvantaged position economically following their college education. Additionally, black students who pursue college degrees not only accumulate more debt by their 30s, but also are more likely to have far less net worth and lower homeownership rates than white Americans who only possess a high school diploma (Ensign & Shifflett, 2022) [50]. For black students who graduate with a bachelor's degree, such educational attainment neither mitigates wealth gaps nor provides the similar economic stability when compared to their white counterparts (Scott-Clayton & Li, 2018) [51]. A report conducted by the Insight Center for Community and Economic Development, conveys that households where the primary breadwinner is white and not college educated, still have more wealth than households where the primary earner is black with a bachelor's degree (Hamilton et al, 2015) [52].

Perhaps most concerning of all, is despite black students increasingly taking steps to add to their personal human capital reasoning that it will position them to secure gainful employment and mitigate the effects of persistent racial discrimination, black college graduates, like all black jobseekers, are still twice as likely to be unemployed a year after graduation as their white counterparts (Morrison, 2020) [53]. Moreover, across every level of educational attainment, black jobseekers have a higher rate of unemployment with black degree holders having unemployment rates similar to whites who possess only a high school diploma (Wilson, 2015; Williams & Wilson, 2019) [54,55]. Finally, black college graduates who are fortunate enough to secure employment are significantly more likely to be "overeducated"; working in hourly part-time employment, or be underemployed, working in a position where a degree was not required to begin with (Jones & Schmitt, 2014) [56].

The sustained focus on "college and career readiness" isolated as a supply-side issue (the available pool of domestic jobseekers) versus a demand issue (the desire to hire eligible domestic employees) is generally risky as it ignores corporations' profit maximization approaches including limiting labor costs by accessing cheap labor.

For America's current students of color who will be jobseekers tomorrow however, the aforementioned does not represent the only hurdle they will confront occupationally, as they will also contend with the lingering legacy of discrimination in employment. The contemporary nationwide approach of educating for "college and career readiness" does not account for the specific realities today's students of color will face upon attempting to enter the work world. For the purpose of this study, I want to better understand how two urban schools that claim to educate for "college and career readiness" and attended exclusively by students of color, explores information pertaining to the neoliberal occupational landscape of the future and racial discrimination in work - two issue students attending these school will likely face in their near future.

THE GREENWOOD (NJ) CONTEXT*

Greenwood is a northeastern, postindustrial city with a population of nearly 72,400, 30% of whom are under 18. Greenwood is nearly entirely composed of black and Latino residents, 42.9% to 52.8% respectively. (US Census, 2021) [57]. It is one of the most impoverished cities in an otherwise affluent northeastern state; and one of the poorest cities in America with a poverty rate of nearly 40% and median income of $21,191.

Greenwood City School District*

The Greenwood City School District (GCSD) is a public school district that serves students in pre-kindergarten through twelfth grade. Due to the general low economic status of the city, the State supports over 91% of GCSD's budget due to decades of poverty rendering the city unable to financially support its public schools. All GCSD students qualify for free breakfast and lunch.

GCSD is under state takeover resulting from 23 of 26 of its schools being deemed "failing" due to low graduation rates, poor performance on state assessments, and poor scores in the state evaluation which assesses District administrative and fiscal operations. In 2015, nearly 15,00 total students were enrolled in GCSD. Today, with about 4,500 students attending nine city charter schools, 5,500 attending thirteen state-imposed corporate operated charter schools, only 6,300 students attend GCSD's seventeen schools. In 2023, with GCSD enrollment lower than it has ever been due to continuous citywide population decline amounting to nearly 3,000 residents over the past eight years, GCSD has had to contend with political machinations and budget crunches (resulting from enrollment crises and fiscal mismanagement) since 2013, forcing the district to close schools, decrease curricular services and lay off staff.

From 2016 to the present, GCSD began promoting their vision of educating students for "college and career readiness" and that District schools would produce "college and career" ready students. Such verbiage could be found on the District's Mission Statement on their website, as well as within individual school buildings. Amidst consistent change and churn among central office staff, building administration, and educators, GCSD high schools were charged with preparing students for their futures beyond graduation, presumably going to college, or entering the workforce. But does "college and career readiness" *actually* mean functionally to administrators who are charged with yielding college and career ready students? And what does "college and career readiness" mean to students who are supposed to be prepared for both?

Application of Standpoint Theory

Standpoint theory, which is the descriptive framework for this study, seeks to platform the voices, interpretations, and critiques of marginalized populations pertaining to how dominant groups exert authority upon them (Barnett, 2009; Creedon & Cramer, 2007; Collins, 1990) [58, 59, 60]. Beginning in the 1970's standpoint theory was, primarily, exhibited in feminist studies, particularly Black feminist, and Hispanic feminist research (Harding, 2009; Hartsock, 1997) [61, 62], standpoint theory purposes to amplify the perspectives of any non-dominant group whose views are disregarded or muted, yet are grounded in the lived experiences of members of a marginalized group.

Though it is common perception among school staff and parents that principals are the decision-makers in their respective buildings due the internal school-based hierarchy, principals are, however, akin to middle managers who take directives from district administrators above and ensure such demands are implemented within their buildings. While principals do sit atop the

professional hierarchy inside schools, when it comes to decision making and direction setting, they are more akin to objects than subjects. Similarly, students within school buildings are low on the school hierarchy. District and school-based policies, curriculum, staffing is among a litany of decisions that are determined above them, which they have little agency in deciding. As such, though neither constituency holds a similar station of official power within schools, neither are all-powerful either. Both are subject to the vision and decisions of others with more official power, and the authority to make decisions for which both constituencies must navigate.

Following a call to participate sent to GCPS's six high school principals, I received two responses. For this qualitative study, I interviewed two GCPS principals and nine Black and Latino upperclassmen in their buildings. The semi-structured interviews took place between December 2022 and January 2023. During the interviews, I took and recorded notes manually, in addition to audio-recording the interview. The interviews were transcribed through and coded for analysis.

In focusing on GCSD's principals and students, two constituencies whose perspectives and realities often go ignored by the larger public and policymakers, I seek to better understand: *How do two urban schools go about educating students for college and career readiness? What does educating for college and career readiness look like from the perspective of building principals, the schools' leaders, and how do students experience education from a college and career readiness framework?*

DATA GATHERING

Individual Interviews

I employed purposeful sampling for individual interviews of two GCPS principals. Each interview lasted 1 to 1.5 hours. Individual interviewing was employed to glean in-depth, and introspective interpretations of participants' conceptions and perspectives (Creswell, 2009) [63]. Ryan et al. (2009) [64] suggest interviews provide access to subjects' perceptions, interpretations, and experiences within a specific context. During the interview, I took and recorded notes manually, in addition to voice recording the interview which was subsequently transcribed and coded for analysis. Finally, after the coding process, I developed memos that explicitly connected common themes; then I used the collection of codes and emergent themes that addressed my initial research questions and developed conclusions based on the data set.

Mr. Shawn Johnson** is a principal at Parkside High School. He's been in current post since 2008. Johnson, Black man in his mid-40s, was a resident of Greenwood and attended GCPS from elementary school through high school. He started off as an employee in GCPS as an English teacher in 2002. Ms. Karen McNally* is a principal at Science Arts High School. She's been the principal at Science Arts since 2017, and prior to that a vice principal in GCPS since 2013. A white woman in her mid-40s, McNally is a resident of a neighboring town.

Focus Group Interviews

I used a purposeful sampling of nine GCSD students for a focus group interview. I employed the focus group setting to interview numerous study participants at once, retrieve more data, and with the assumption that a less rigid structure would create a more conversational atmosphere among participants and allow for the collection of a "shared understanding about a phenomenon" (Creswell, 2009; p. 226). The duration of the focus group interview was 55 minutes. During the interview I used a semi-structured interview protocol asking a few prescripted questions of the

group while taking notes and also using an audio recorder to capture the conversation accurately. Data in the form of note-taking and audio recording were collected and transcribed.

The nine students interviewed: Nadine, Manny, Jamir, Alexis, Brene', Nikki, Juan, Cynthia, Brian are all GCPS students attending Parkside or Science Arts High Schools. They are either in the 11th or 12th grades and have varying levels of academic achievement with their GPAs ranging from 1.3 to 4.0. The students interviewed have varying aspirations following high school with some expressing a desire to attend college immediately after graduation, with others planning to begin careers in the military or in the workforce. It was intentional to select a student population that represents a cross-section of recorded academic achievement as well as postsecondary plans. Among student participants, there were four males and five females, and five Black students, three Latino students (two Puerto Rican, one Mexican-American), and one student who is both Black and Puerto Rican.

Following the coding process, I developed memos that explicitly connected common themes. I, then, used the collection of codes and emergent themes that addressed my initial research questions to develop conclusions based on the data set. The unit of analysis and data will be the views and perspectives of the two GCPS principals and nine students.

FINDINGS

Following individual interviews, coding and searching for emergent themes, applying standpoint theory for which to interpret data, the following themes emerged: for GCPS administrators, preparation of students for "college and career readiness" occurs within their school by ensuring students get a quality education; are qualified to progress beyond high school either in work, the military, or college; and providing there with students opportunities to participate in internships and "exposures" (bringing in outside presenters to discuss varying occupations).

From the student's perspective, their understanding of being educated for "college and career readiness" in their respective schools, focused primarily on being prepared to graduate high school and go on to college or enter the military. Additionally, students roundly believed that getting a "good" education was needed in order to get a job, and believed going to college would get them a "good job".

Finally, students recognized their principals and staff to be dedicated to their academic success and progression, but not substantively exploring matters of the modern work-world like globalization, artificial intelligence, automation, or discrimination. Students had an awareness of the terms artificial intelligence, automation and discrimination, but that was through non-school based exposure like conversation with family and friends of "seeing something on TV, as their schools did not explicitly explore such concepts pertaining to career preparation.

Principal's Perspective

Both GCPS principals interviewed were administrators at small magnet high schools within the district, with one school enrolling 140 students from 9th to 12th grade, and the other school enrolling 130. Both principals are deeply invested in the progress of their school as an institution, and the success of their students. Additionally, both principals are well-regarded in the Greenwood community, by District administrators, and by students and parents. The reputation of these schools in providing quality education seems to be well-earned and, largely, without dispute. In that, finding out how such building leaders of schools who are instrumental in

providing an atmosphere of learning within a District touting "college and career" readiness as a goal, interviewing such leaders who have proven to be skilled in their mission seemed to be the best place to go.

When asked: *How do you see your role as the principal of your building?*
Principal McNally responded: I see my role as the instructional leader as my first and foremost priority, and a problem solver so that I can clear the path for high quality instruction to take place for our students so that they can have the best quality education they can have… Also, as an instructional leader, I'm in constant communication with my staff so they know my expectations, checking over lesson plans at night, over the weekends… During the week I try to do as many walkthroughs and be as visible as possible, even if it's not an official observation, I just think it's important to know how our staff and students are progressing… also, ensuring that staff are keeping up with the pacing guide, and keeping student learning at the forefront of my and our staff's mission.

Principal Johnson replied: My primary responsibility is to preserve the academic integrity of the building…to make sure students here have the academic and social experience they deserve and expect and to certainly keep everybody and every student safe… where everyone whether student or adults feel safe and valued and appreciated. So, to that like you saw today, I'm often all over the place… making sure that classrooms have rigorous instruction happening, making sure the hallways are clear and calm and making sure the environment is prime for learning…making sure everyone is on task… I am the school's instructional leader and with that comes many hats. I'm the instructional leader, the organizational leader, so I am responsible for ensuring they are meeting the requirements, they've acquired the standards, all of the objectives in order to satisfy the state's expectation for graduation, primarily.

In focusing on the day-to-day responsibilities of their role, both principal Johnson and McNally indicate their primary focus is dedicated to the administration of their buildings and ensuring quality education is delivered by staff and received by students. This is understandable given the expectations embedded in their job description, as well as the central metrics for principal's effectiveness: ensuring buildings are orderly thereby yielding an environment where learning can take place; making sure teachers are teaching rigorous instruction aligned with state standards; and verifying student learning.

As I am aware that there may be some widely accepted assumptions within public education that are commonly accepted by the broader public and, likely, influential within a principal's responsibilities, I asked: *Are there any academic edicts, accepted truths, or phraseology that you disagree with but are nonetheless influential in your practice?"*

McNally responded: I'm sure there are a lot of things out there. Like for an achievement gap, I mean we certainly have to close the achievement gap as fast as possible which is why I challenge our teachers to make sure our kids master what we're teaching them…so by law, we have to align with the grade-level standards and the pacing guide, and then differentiate instruction which is why we have block scheduling here so teachers have time to work in small groups, work with individuals to make sure students get the attention and help that they need to be successful academically… We even provide tutoring for students after school to help the students in need… It really is important for us to close the achievement gap so students can be ready for the world.

I believe the principal is the secret sauce behind any successful school. So if you have the right person in the position, you can turn a school around. I don't believe schools should be failing and I don't believe we should be failing any kid…by any means. Regarding standardized tests, I do believe we should have a metric of assessing student progress comparatively, and we need some kind of metric to measure teacher effectiveness in their role. If I have a teacher working with a student for ten months, I expect to see progress that would illustrate ten months of growth. I expect kids to be moving and learning… but to your questions, I just kind of get caught up in the day to day…making sure students are learning, making sure teachers are teaching. But by no means do I 'drink the Kool-Aid' because I form my opinion regarding the 'achievement gap' and 'failing schools', but I keep my personal views on those things specifically to myself as I have a job to do.

Principal Johnson replied: Yeah absolutely… Like the adherence to testing. And not just this district, but the country as a whole is ensuring that students are "proficient" in quotes, in literacy and mathematics… and that's where most of the resources are placed and, though literacy and mathematics are important, important to me and probably important to you, our children, and to the future of the country… but there's a lot more to education than just literacy and mathematics. We live and work in a city that's hurting, that's broken, so we emphasize care here [in this school] because that's what students need. I think schools have to reflect the values and needs of the particular community that they serve, not necessarily the agenda from the state or the agenda from the government. Schools should be a microcosm of the communities they're in. So that's why we emphasize social-emotional learning, have discussions…stress empathy, giving back, those are all things that if curated the right way, will benefit the community we're in… As far as the "achievement gap" I don't put much credence into it. There is a gap certainly… There, supposedly, is a disparity between suburban schools and what they supposedly have, or do, or can do, and what their students have the capacity to do compared to rural schools or urban schools… Does a gap exist? Yes. Do I know that as a school that we prioritize what I know the needs of our students are? Yes… So, the country, in particular, our district, when they talk about the achievement gap, they're talking about the literacy and mathematics rates. But that's not accounting for the rest of the pie. They want us to focus on literacy and mathematics and ignore all those other things and I posit that making sure students feel valued, cared for, listened to, involved in their learning, really being able to explore things and learn things that they care about, those things, having an avenue toward those things closes the achievement gap…as opposed to from gate, 'go to math class for 45 minutes…that's not working, go to math class for 60 minutes…that's not working let's do two periods (90 minutes)"… time is not doing it. Like where we are right here, I had a heated conversation with another administrator, the conversation was really direct… They have issues that they state, but they're not addressing them… like say, students are disrespectful, not taking advantage of their time, whatever undesirable behaviors students sometimes exhibit, it's our job to fill the void. To me, that's the achievement gap. We can't ignore the needs that are right in front of us, as those things may impede their academic progress down the line. That's just my position, but you can see that in the way I govern this particular school and go about my day-to-day stuff.

As for "failing schools" my first response would be failing at what? If half the country, well over half the country, is failing at mathematics, does that mean most of the schools in the country are failing schools? Yes, or no? That's just up for debate. Our school does not…is not proficient at this current time. But keep this in mind, prior to the State switching assessments from HSPA (High School Proficiency Assessment) to PARCC (Partnership for Assessment of College and Careers) in

2014, in literacy 100% of our students were proficient. That was up from 85% and 80%... we worked our way up to that. And without changing anything in terms of the way we taught, the rigor, anything, once the state changed the assessment, we went from 80, 90, 100% to 40% and 30%... same school, basically the same students, same adults... and conclusions are drawn from that. So, what changed?

At the current time, our students are not demonstrating proficiency that the District or the State would like. We've identified those things, we're working on those things, we're actively implementing strategies to get students closer to that, but we're not doing that at the expense of the social-emotional learning and filling all the voids we know students have. Even today honestly, you were observing some of it...that student was crying, crying her eyes out because she can't find her wallet... the key to her being happy, being a good daughter, being able to buy Christmas gifts and things, she's distraught. She missed math class this morning. So honestly the school district would say, "put her back in class" but no, that's not what she needs right now. She needs to know there are adults here that are gonna help calm her down first, and then help her get through the issue. Then, yes. She can get extra homework because one, she needs to know adults care and two, there's a solution to what feels like the biggest thing in the world... So honestly, our approach is to take care of the needs of our students when they arise as opposed to, when we know all of these things are happening, we're still just gonna send them into math or to literacy for 90 minutes. We really try to exude that care throughout the day and I think it shows... For instance, I'd say offhand 90% of our students' parents visit our school four to five times per year. That's involvement and buy-in. I know some schools where they can get parents to come in at all.

Both Ms. McNally and Mr. Johnson identify commonly understood phrases like "achievement gap" and "failing schools", and the correlating adherence to testing highly influences how they see their roles, and the education students receive. In Ms. McNally expressing that she hasn't drank the "Kool-Aid" concerning the "achievement gap" and "failing schools", she expressed an awareness that those phrases are highly impactful in urban education. And though the understanding is that certain schools and certain students are not achieving, and thus "failing", she presents an awareness that the common takeaway is also incomplete. Nonetheless, she keeps her personal views separate from her mission as the school's instructional leader.

Principal Johnson, on the other hand, was far more outspoken in calling out the testing regime that, in his view, ignores the reality of students' needs. He was clear in identifying his school's stressing of social-emotional learning for students in hopes of providing an education that addresses students' holistic needs. To challenge the "achievement gap" and "failing schools" narrative affixed to urban schools and his school specifically, Mr. Johnson indicated how fluid and manipulatable those terms can be. When he indicated that his school went from exhibiting high rates of proficiency on one state assessment, and following a switch of state assessments, his school was deemed far below proficient, we are presented with a broader perspective of these scores that many in the general public are likely unaware of.

In moving toward the specific focus of the study, I asked: *What are your thoughts on college and career readiness, and when was the first time you heard that phrase?*

Ms. McNally responded: The first time I heard college and career readiness...it's been a while now. I think back to when we were using the 100-Book Challenge (2009). But my thoughts on college

and career and job readiness is that we have a lot of mechanisms to give our kids exposure to whatever they need to learn about. As far as college and career readiness, I wanna give our kids as much opportunities or exposures so they can make decisions that put them in the best position whether that is college or career…We have senior seminars, we have the 12+ [Program] downstairs with people who are college and career advisors, we have our own guidance counselors who work with the students, we have staff members in place to mentor, check in and meet with students about college and career readiness…we have our students apply for a "reach" school and a "match" school, we have FAFSA night coming up this week to provide our families with the tools to fill out the FAFSA because sometimes they can be difficult. We try to give our kids as much support in college and career readiness as possible so that they can make the best decisions. I remember back when I was in high school, no one gave me the opportunity to explore different ideas or different notions of what I could or even wanted to do or was interested in because I learned that from my family. I believe to be college and career ready in this day in age, is that we should give kids all college options that are right for them and in the right price range like for me, I want to a community college for three years before I went to Temple [University] to make a fiscally sound decision. We don't have to go to the most expensive schools to get a good education. Whether it's a two-year school or four-year school, we have CTE certifications and that where a student wants to go, maybe they start off at an entry level position and then have options to work their way up because at the end of the day, you have be able to go home, to go to work for your family, put meals on the table…We have be able to meet kids where they're at. Not everyone is gonna be able to go to Princeton. And I don't want students to feel stressed out where they believe they need to do those kinds of things…we try to center the kids' interests to make sure we're providing them with the best opportunities so they're on the best track to thrive when they leave these four walls.

Mr. Johnson replied: I think the first time I heard the phrase "college and career readiness" was probably about fifteen years ago (2007) … I started teaching in 2001 and don't remember hearing about that phrase in 2001 and 2002. I think you have to educate for college and career readiness… you need to do it to the extent that the students you have embrace that idea if that's what they want to do or pursue. If you're educating students who have no interest in going to college, and you still focus on college applications, SATs or whatever, that will cause a student to drop out because we are not talking about anything they are interested in. So, we have to teach or expose students to whatever possibilities that are out there… We have to figure out what student's interests are, what they're goals are, and teach to that.

When asked about the first time both principals remember hearing the phrase "college and career readiness", both put the date after 2005 and before 2010, which indicates that during this time in GCSD, there was a new focus on educating students for "college and career readiness" that was not as apparent prior to 2005. And when asked about their thoughts on "college and career" readiness, both principals identified the importance of students' planning with their individual interest in mind, as well as how important students continuing their education, either in college or in the trades, is toward their gaining future employment. The idea that students accumulating more education, whether collegiate or vocational, led to meaningful employment was never questioned or critiqued.

To get a sense of whether students are being prepared for the occupational world that lies ahead, I asked: *Is it important, in educating for college and career readiness, that you and the school staff*

know todays and tomorrow's economic and occupational landscape? And how confident are you that you and your staff are preparing kids for what awaits them occupationally in future?

Mr. Johnson responded: Yes. There has to be a balance. One of my responsibilities…it's not my job to forecast where jobs and careers are going, but it is my responsibility to be aware of the trends that are coming and align our practices, structures and approaches with what's ahead to prepare them for those. The opportunities that we're preparing our seniors for in some way shape or form, would be different from what we expose our 9th graders to. For instance, we have quite a few labs on our campus… and we are the only school in the district that stresses and emphasizes entrepreneurship because I think that's a trend and it seems to be the way forward… and an emphasis around the country. Students learn how to manage their time, their own businesses… We also have a "maker space" to allow students to tinker, to play, to think, to design, to figure out what their interests are and allow them to pursue that potential… but that's a good question. I do not think I know as much as I possibly could know but, honestly, I and my staff, I believe, probably do a better job than many other schools simply because of our Learning Through Interests (LTI) system where students do a great deal of interest exploration. There's a great component to our LTI system called "exposures" so our students constantly have contact with experts in the field and you often hear the tagline: "This is what you [students] need to know five years from now." So, we are getting that kind of information from the experts. I'm not gonna sit here and say I do tons of research or subscribe to journal articles or anything like that. But I do feel ultra-confident that we have a finger on the pulse of what's out there - which is why we have the maker-space.

Ms. McNally responded: There's so many jobs in the job market and even I'm not that well versed in the job market today and I know it's gonna look completely different over time. If you think about the 9th graders today who will be voting for our next president, all these changes educating kids in the workforce and the jobs that are out there is important because things are changing so much… a lot of today's jobs are gonna be eliminated. I think we have some work to do in terms of preparing kids for the work-world that lies ahead, even five to seven years out when some of them will be college graduates, I mean, we can't even predict what that will look like in five to seven years. It's kinda insane… I guess certainly we can do a better job… but over the summer we had a training with our Career and Technical Education Director about some of the jobs out there and turnkeying it…we just brought in CTE to our school this year so I think would probably have to tighten up on that a little bit. I'm pretty sure teachers are talking about it, but perhaps we could do a better job in that regard.

Interestingly, both principals acknowledged an awareness that much of the job landscape is going to change in the future. Additionally, both Mr. Johnson and Ms. McNally communicated the importance of knowing what occupational and economic opportunities are out there for their students, but conceded there's not much they know about what the future holds for them occupationally or what they can do to, functionally, address that uncertainty for students. Principal Johnson communicated his school's focus on entrepreneurship and trying to align their school's curriculum to meet the opportunities of the future, while Principal McNally focused on her school relying on training from the CTE Department.

In trying to connect the growing disconnect between one's formal educational attainment and its sufficiency in securing a "good job" in return, I asked: *If our District supposedly educates students for "college and career readiness", how do you deal with the competing realities inside of our economy… for instance, when we consider that maximization of corporate profits includes employers*

finding cheaper labor someplace else, or that as folks are walking around with more formal education than ever before but there may not be enough good paying jobs… how do we prepare students for the idea that the relationship between formal education attainment and securing a "good paying job" is becoming increasingly tenuous? Or even is there a space to have those conversations with students?

Mr. Johnson responded: Honestly, we don't. Not for any reason or another we just…don't. I think it would be worthwhile, and in fact I'm gonna write it down… to have… and I love and appreciate our LTI system because those kinds of things should be talked about formally, as a point of awareness for students as they make their transition and the choices that they make.

Ms. McNally responded: I know completely what you're asking. There is a space but I think we can do better with all the opportunities that are out there in this country like becoming self-employed, doing something outside of your comfort zone. I went to school to be a teacher and became a teacher. I went back to school to become a principal and became a principal, but I know that's not always the case for everyone. For instance, my husband went to school for communications, and then ended up starting a powerwash business, something that had nothing to do with what he went to school for. He started off with a squeegee and a bucket and grew his business and now he's living the American Dream against all odds. But I think if we keep giving kids exposure by bringing in people from different careers and their paths to getting there… and we do a lot that here, we bring in a lot folks from the medical profession and people from other professions and those exposures are really eye opening and the students really seem to connect to the stories.

Though Mr. Johnson and Ms. McNally seemed to understand, conceptually at least, the question posed, both seemed to revert back to what their respective schools were doing to provide students with a greater awareness of what careers are available. Certainly, exposing students to professions within the workworld, and mechanisms to pursue their potential professional interests has value, but there did not seem to be much of a mechanism for confronting or conveying to students a complicated and growing reality that the job market is growing increasingly harsh for American jobseekers - evenly the formally educated.

In trying to specify the mechanisms employed by corporations that threatens the availability of reliable work for future jobseekers, I asked: *As schools are tasked with preparing kids for the world and the economy of tomorrow, do your schools do a good job in conveying this reality to students: that corporations take consistent steps to find the cheapest labor (through offshoring, automation, usage of artificial intelligence, etc.) including not employing humans at all in efforts to maximize their own profits?*

Ms. McNally responded: I didn't know that. That's crazy. I would like to say yes, but I know that we can do a better job educating our students. I mean we do have an Allied Health program and we talk about the dynamics of healthcare and the entry-level position, but that really just started. So, we really have to push kids to think outside the box and beyond their comfort zone, finding their interests and new interests…you have my mind really thinking on this. I think we're really maybe in the beginning stages of having these conversations. But we do try to get students to the point where they are aware of the jobs that are out there… we're bringing in opportunities for students to earn these CTE certifications where they can go right into the workforce so the conversations are starting. Could we do better, absolutely.

Principal Johnson: I'm certainly aware that it is happening but I haven't acted upon that institutionally.

Following this question and the principal's respective answers, I assured them my intent was not to demean the work they do as instructional leaders; only to better understand what "college and career readiness" means in their specific contexts. Ms. McNally, after acknowledging her school could do a better job in supplying students with such information, referred back to what her school is doing to prepare students for obtaining vocational certifications based on their individual interests. Mr. Johnson did respond that he is aware of corporations, motivated by profit maximization, seeking a mechanism to employ the cheapest form of labor, but that he has not formally connected that knowledge to what students are learning in his school.

In efforts to understand how Principals Johnson and McNally's schools cover the following topics, I posed the question: *How does school staff engage or approach conversations on globalization, automation, artificial intelligence, workplace discrimination and expanding social networks?*

Mr. Johnson replied: Globalization as an isolated topic, we don't or haven't to be honest. I can't say that it hasn't happened in pockets from this educator or another but we have not, schoolwide, addressed it as an issue. I am familiar with automation and we do make students aware of things based on their interests. I am reluctant to suggest we do things on a whole-school basis in that our school is driven by students' personal interests…so if a student says they're interested in X, Y, or Z, it'll happen. I can't say whether or not students are aware of automation's impact on the future of the workforce but everybody sees it happening… Like every day, you just gave an example about self-checkout…but I don't know if we talk about it in a way students understand or pay greater attention to as far as how it will impact them. Same thing for artificial intelligence. Regarding workplace discrimination, the answer is no…you just asked me about three, four, or five different things and whether they addressed certain things that are worthwhile that students should know, and I am gonna write those things down. Students need to be aware and exposed to these things now… I mean I think our school does a really good job in cultivating a child's interest and helping support them in the direction they want to go, but these kinds of questions illustrate there's a whole other lens that's missing…that we really don't deal with at all.

Ms. McNally responded: I mean regarding globalization, if it's in the curriculum, that's where students will get it. In terms of automation, I'm not really sure. I don't really think we talk too much about automation here. Regarding artificial intelligence, I'd have to refer to one of our science teachers, but I would think somewhat. And for workplace discrimination, we don't really cover that in here. Maybe we should have those conversations if they're necessary. These are good questions. Regarding impressing upon students, the need to expand their network, we do have our exposures that I was talking about earlier, and that does connect them with professionals from around the region… and we do have Every Child Deserves a Champion program where we connect our students with mentors, and our staff do have those conversations with students I'm sure… We also have outside organizations that engage with our students like Women of the Dream, we have affiliations with Rutgers Future Scholars and we're trying to get a mentorship program with medical students who are willing to come in and volunteer their time and work with our kids…so we do have a lot of external partnerships to work with our kids. These were some tough questions (laughs.)

Following that conclusion question, both Mr. Johnson and Ms. McNally presented a personal awareness of some of the terminology, and they've witnessed some of them themselves. They both trusted that some topics may come up in the course of curricular content, but neither could pinpoint which subject covers which topic, if at all. Additionally, both conceded that perhaps more could be done to expose their students to the occupational future they reasonably will experience.

Student's Perspective

In a focus group setting, I posed the question: *What do you believe the role of a student is?* as a mechanism to make the students comfortable with sharing their thoughts in addressing a question everyone could answer confidently and according to their own experience.

Nadine (18/F): To get good grades…to get my degree, and eventually get a job.

Manny (17/M): I feel like in life you're always a student because learning doesn't just come from school. You can learn outside of school…you're learning all the time actually…it's something you carry on for life, you know?

Alexis (18/F): I agree… pretty much we are always learning whether in school or not…even when we're done school… we're trying to have our careers and level up… we're still always gonna try to be better versions of ourselves, we're always gonna be a student and there's always gonna be a teacher.

Nikki (17/F): I think the same, but to add on I think being a student is doing what we're expected to do in life, you know, accept the challenge in trying to be successful…finding ways to achieve those goals…just doing what you know you should be doing… I know some of us don't listen to it but I feel like that's what being a student is, trying to figure what's right for you.

Brian (18/M): For me being a student isn't always what it seems, like especially to parents they see and think that, "oh yall got technology, this, that, and third… all don't have to do all the things we did", but they don't see just how stressful and how challenging it can be… Like a lot of students, they deal with a lot of personal issues like at home with mom, dad…maybe unhappy marriage or whatever, they deal with that and they have to come to school, get all As or maybe all As and Bs depending on how strict a parent is. And if they don't get those good grades the parent may either abuse them mentally by saying "oh I'm disappointed in you, you not gonna be nothing in life" or they'll physically abuse you…yeah, it ain't all that is cracked up to be…

Juan (17/M): As Manny and Alexis stated, you're always gonna be learning even if you're not in the classroom… I remember my mom talking to me about bills and taxes when I was younger, but I didn't understand money. But as I had jobs from freshman year 'til now, she started talking to me about bills, taxes, mandatory taxes, this expense, that expense and showing me the ins and outs of paying bills, how to manage your money, your time, and invest wisely.

Here students took turns explaining what being a student meant to them. Notably, few focused on the traditionally recognized role of the title, "student"; rather, participants identified their lives and expectations outside of school as central to their roles as students. Additionally, student participants identified the misconception that being a student is easy and terminal, noting that we are all students because we are always learning, and in that, always trying to achieve greater heights.

In beginning to focus the interview, I asked students: *Where did you get the idea that getting a college degree would eventually lead to you getting a good job?*

Juan: For me the answer isn't so much a degree will get me the things I want, but the military, I learned, would. I'm gonna do my years in the military, learn a profession, get paid along the way, have help with buying a home, and when I decide to go to college, I'll get help through the GI Bill…and after that I'm gonna make about $70,000 when I get out with the job, I'm gonna learn in the military… so that I can do better than Greenwood City, to do better than Jersey. Coming into my senior year, I was asking myself what I'm gonna do for my life…for my career…and I was looking at college and thinking: financial aid isn't really gonna help that much. I know college is for some people, and it's not for others, but for me, when my teacher brought up the military, it was wit' it.

Nadine: I guess all my prior schooling up until now… I guess the way it looked. Like if you get good grades, it would reflect well on the teacher, and if a student got poor grades, it would reflect poorly. So, I guess we focus on getting good grades because we're expected to from our parents and teachers, and eventually it becomes a habit to keep getting good grades and eventually a job? I dunno…

Cynthia: The way I always thought it was either get your education, or be a bum, and I didn't wanna be a bum. I don't wanna live paycheck to paycheck, I wanna be financially stable for my whole family, and any one that comes down the line.

Brene' (18/F): I kinda disagree, cuz everyone is their own unique person, so school isn't for everybody…not everyone learns in the same way…if you could find a way to productive in your life and creative, without school, and you could be successful and financially stable, then you should feel comfortable pursuing that. Some students may not seem like they're that smart when they're in school, but you'll see them a few years later doing really well even if they didn't take the normal route.

Notably, no student expressed the idea that going to college to get a degree in order to get a "good job" was explicitly initiated from the school site. Students did share their desire to be successful in the future, and seemed open about how to achieve success, but there was not a unilateral expectation that going to college and earning a degree was the only path forward toward achieving financial or occupational success.

In bringing sharper focus to the study topic, I asked students: *Have you ever heard of the phrase "college and career readiness"? And if so, what does it mean to you? Do you remember anyone explaining what it means?*

Nikki: I think sophomore year (2020) … I don't recall anyone really breaking it down or anything.

Jamir (18/M): I think it's an effort to get us focused on college. Every year since we were freshmen (2019), that's been the thing. College, college, college, but not really much on the career side. not much talk about the workforce or the military until the senior year.

Cynthia: Yeah, I heard of it. I guess it means get an education so you can have a career or something? At least that's what I took from it.

Nadine: Yeah, I heard of it… I guess, like, being prepared to go to college and handle the work they give you… and eventually get a good job?

Brene (18/F): I think when I got to high school, maybe in my sophomore (2020) or junior year (2021), and again, I think it's about preparing kids for college and the course-load they're giving you… I think there's more focus on the college part than the career readiness part… I guess because the thinking is we have to go to college to get a career, so they prep you for college the most.

Brian: When we heard about it, I think through my history teacher would say things like "this is gonna help you for college" and things like this, but we didn't really start getting into college preparation until like my senior year with senior seminar.

Juan: And it was just for, like, filling out applications and you didn't think you wanted to go to college, they help you fill out applications for like, a trade school or tech school…but no one actually explained what that term meant.

Students roundly reported being familiar with hearing the phrase "college and career readiness" beginning with their high school careers. Additionally, none shared a common understanding of what "college and career readiness" meant beyond the assumption that getting students ready for college was a mechanism toward getting them ready for careers. It was also common for student respondents to report not having much attention being paid to the career portion of "college and career readiness."

In trying to ascertain if students believed they should be informed about the occupational outlook of the future if they are, in fact, being educated for "college and career readiness", I asked: *If a school is saying they are educating for "college and career readiness", do you think it is important for students to know today's occupational and economic landscape as well as tomorrow's? And have you learned that?*

Jamir: Yeah, we should know.

Manny: Yup.

Nadine: I think it's important and no, we didn't learn that.

Group Agrees entirely.

Juan: I have a little brother here, and he's a sophomore now, and I'm more fearful for his future than I am for my own. He shows tremendous promise in the sport of boxing and he can take it far and go far in life… but with my mom, as long as you stay on top of your grades and don't ask for too much or do the wrong thing, you're good with her… but if you don't stay on top of your grades, she takes phones, [video game] cords, and for him even [boxing] practice, and one time she made him miss a boxing match, which as an amateur trying to make it, that's huge…and he showing he's not really interested in school, but trying to get through it as best he can.

Brene: I'm currently in a "college and career readiness" program now, called Women of the Dream and I really appreciate it…they're helping me with so many things like my FAFSA application…

they're helping me with everything, my [college] essays, and whenever I tell my mom about all the things, we're doing she's like, "why didn't I have this when I was growing up" and without it, I'd probably be struggling trying to get through all of this on my own.

Cynthia: True. Having someone there helping me figure out things is really helpful and something I think everyone really needs and should have access to that kinda help.

Alexis: I think bottomline, people go to college so they can get a good job, but they have to know what they're getting into. If you take out loans, you're gonna have to find a job…you have to know what's ahead for you.

Student-participants all responded that schools should make them aware of what the occupational and economic landscape of the future has in store for them. Unfortunately, most remarked that they have not been exposed to that material, and the help that is available is appreciated, but largely directed toward guiding students through the college-entrance process.

Further, I asked students to assess their own awareness of the lies ahead for them occupationally in inquiring: *How confident are you that you are aware of what awaits you, a current student, in the workworld of the future? Has anyone had a conversation with you about what the job landscape of the future will look like even for folks who get college degrees??*

Brian: I'm not very confident… because, there's ideas that I have that in a perfect world, that things will go like this…so like, I have hopeful ideas that when I graduate [college], this can happen but I'm not really sure what can happen… like there's a bunch of possibilities, but I'm not, like, fully prepared for what happens after graduation… No one has spoken to me about the future work world.

Nikki: Not very. I think some may be, but I know I'm not.

Alexis: You can think you know, but when reality hits, it may be completely different than how you planned things.

Cynthia: I do know there's not enough jobs for everybody…sooooo…

Brene: I agree, the jobs that we do have, the jobs that are available, are jobs that don't pay enough…I mean if you have a job that's only paying minimum wage or close to it, which are most of the jobs available, who's gonna choose that route… so it kinda feels like you're stuck…And it's happening to everyone.

Jamir: And even those jobs aren't that easy to get… and it's not really talked about here [in school] or anywhere else really.

Students roundly expressed apprehension and caution when asked about their level of preparedness pertaining to the availability of future occupational opportunities. Though it would seem to be common for unknowns to elicit a sense of uncertainty, students here communicated a cognizance that the occupational landscape today is unfriendly, which likely only heightens their concerns for their own futures despite their plans of continuing their education beyond high school. What demands attention was the widespread belief that this topic that concerned them,

was not being addressed in a space purported to educate students for "college and career readiness."

In trying to understand student's conception of "college and career readiness" along with a vision of their own occupational future, I asked: *How can you be prepared for an economy where, in order to increase corporate profits and efficiency, companies are finding ways to employ less people? How can you prepare for that as someone who will be entering the workforce as a college graduate in about four to five years? How well do schools cover the following: globalization? Automation? Artificial Intelligence?*

Nadine: I don't think you can really prepare for it but I think you can have, like, backup plans. I mean think that's the only way… because if you are aware that companies are trying to hire less people, and if you don't know where you stand amongst other candidates, then you don't know how that first choice is gonna go for you so you're gonna need to have other fall-back plans.

Juan: I see it everywhere like self-checkout in stores.

Jamir: Facts… those things there are replacing human beings who could've had that job.

Nikki: But actually, I don't really have a better answer…partly because it's the first time I'm hearing questions like this…I just know you can't put all your eggs in one basket, you gotta spread everything out and whoever accepts you, thank God! (laughs)…because other places may have rejected you and now you at least have something.

Cynthia: I don't really feel prepared for this now that we're talking about it because it's really never talked about. I get the focus on college and everything and I think that's important, but this…is…just different.

Brian: In my opinion, I think they're trying to keep us blind to it cuz it was never mentioned before, and it should be covered because this is the kinda world we're gonna have to deal with…this is the future.

Brene: I feel like they should tell us this stuff in junior year or senior year especially because… I learned machines are, like, taking a lot of people's jobs from my mom and my dad, but not here [school]. It can be something like a factory line, and a lot of the stuff is being built by machines…those are jobs.

Nadine: I've heard of globalization… not really automation, but don't really know what it means… it's the first time I've heard this question…I think I would have at least wanted to know more about it because it puts some things into perspective about why things are the way they are, and also because it can show us how much real-er life gets after you graduate.

Juan: I mean a lot of people struggle [occupationally] but don't really understand why so you think "that can't really happen to me" … and then you see how much bigger things are and how you see how many people are competing for the same spot you want, so then it makes sense. But there's a lot, now that we're talking, a lot I don't know about globalization or automation either.

Brian: I've not heard anything about globalization and maybe a little about automation…but I guess it's regarding machines and robots? …doing things people do at work? Which I guess cuts jobs? I mean I guess we should learn about it because we need to know what's going on…even though it sounds intimidating at least we still know what's happening.

Cynthia: I have heard about artificial intelligence, you know I guess it's all the Siri(s) and Alexa(s), but as far as work, I'm not aware of it… but again I guess we should know all of this stuff because it's showing how they're slimming down depending to the kind of career you want… slimming down on opportunities to get a job for some people…just really making it hard to find a job.

Alexis: Yeah, like Siri!… And then it gets hard because here we are spending all our time in school and college to hopefully get a job, and there's people trying to find ways with robots and AI, to make sure we don't have them. It kinda seems like a waste I guess… and this is the first time I was asked these questions or even thought about this.

Jamir: I guess I would have really liked to know about this in the beginning of high school I think instead of, I guess, *just* doing internships we would have had a better idea of what's going on.

Brene: I've seen some of this covered on some TED Talks and Tik Tok where they were talking about people who went to college, graduated and struggled to find work because they can't find any jobs with that degree… That led me to think about what degrees I should not major in because I don't want that to happen to me…and so they fall into regular jobs that they didn't need a degree in and it's scary because - what did you go to college for if you can't find a job?

Nadine: Come to think of it, I only started thinking about these things since we're all sitting here like this.

Again, students expressed apprehension with the concepts this conversation brought to their attention. Though students recognized an erosion of occupational opportunities for current jobseekers is occurring in big box retail settings and fast-food restaurants, students began to express concern over what it means for them in future if such a phenomenon continued and expanded. Further, student-participants expressed concern that this material was not conveyed to them in school and feel unprepared to encounter this in the future.

Finally, in an attempt to connect the added layer of workplace discrimination to the possibility of a hostile job market for today's jobseeker of color, I asked: *Have you learned anything at all about workplace discrimination, even among educated persons of color in school? And if so, what?*

Nadine: Yeah, I have. It's like minorities versus white people, they [minorities] get hired less and paid less, there's certain jobs they [minorities] don't get…they [minorities] just get treated poorly and get put in lower positions or do more work just to get paid less.

Jamir: Nope.

Cynthia: No.

Brene: Not at all.

Brian: Not that I remember

Alexis: Actually, a couple days ago, in one of my classes, we were going over financial literacy and it was talking about how in New Orleans, how one family was trying to buy a home but for certain laws weren't able to buy it because they weren't white… Certain laws stopped Black people from buying a house… they couldn't own or sell homes. I think they're called "covenant agreements"? I heard of that, but not really anything related to work.

Manny: I think all these things are important and no they weren't really taught… I think the reason they weren't covered is because people are scared that it might deter students from wanting to go to college or something, and a lot of schools like bragging that "we have 100% college acceptance rate" and things like this, but they're not giving us a realistic viewpoint of what's actually happening.

Alexis: They just want to make the schools look better so that whoever's in charge gets paid more, the school gets more funding and stuff like that… and the thing is the fear doesn't make sense because I think we can handle this even though it may not seem like good news.

Juan: Yeah, especially if we have the right people communicating it who will say, "even though this is happening you can still find a way to do it" … you know, provide the right motivation, even though they are aware of what's actually happening. We need to know what's happening because we're gonna be the ones that have to deal with it. Yall already got your education and career…so what about us?

Some students expressed an awareness of what discrimination is conceptually, and possibly societally, but none connected how workplace discrimination could impact their own occupational aspirations in spite of their plans of pursuing more formal education. Additionally, all students indicated the topic of workplace discrimination, pertaining student's own futures, was largely not explored within their schooling experience, though they recognized the value in learning more about such workplace topics that may seem difficult to confront.

DISCUSSION

In urban schools educating for "college and career readiness", there appears to be a need for greater focus dedicated to preparing students, at least conceptually, for realities that await them as they transition into becoming jobseekers. While there may not be much any building administrator or current student can do to alter the realities of corporations operating in a neoliberal economy, leaving students without pertinent information that could allow them to be cognizant of, and plan accordingly for, what awaits them ought not continue if we can help it. Though this specific study left elements of educating for "college and career readiness" unexplored, including a comparative analysis of how well-off, suburban districts with a majority white student body approach "college and career readiness", or whether a formalized curriculum for schools to yield "college and career ready" students exists and what that entails operationally among other things, hopefully subsequent research can begin exploring such matters going forward. And while those questions, and likely many others, are beyond the scope of this specific study, further research is warranted so that today's students, specifically students of color, can be better prepared for their transition from educated student to career seekers.

CONCLUSION

In picking up where Leah Z. Owens and I left off, there was a recognition that a disconnect between what "college and career readiness" suggested to students, that accumulating more formal education or vocational training was sufficient to secure gainful employment, and the operating reality that within a neoliberal economy, corporations prioritize profit maximization through pursuing the cheapest labor source, irrespective of one's educational attainment. In an era of neoliberal globalization, corporations purposefully opt to sidestep domestic labor in both blue collar and white-collar sectors, to avail themselves to a foreign workforce that is paid less with far less regulatory oversight. At the same time, domestically, corporations employ mechanisms to secure the cheapest labor source through increased automation, and more frequent use of temporary, non-unionized labor - all while the American workforce is far more formally educated than in decades past. *In short, what is disregarded is that Americans have become more educated as corporations make secure, quality employment opportunities more difficult for Americans to obtain.*

Here, my effort was to build beyond our prior research in identifying the blindspots in educating for "college and career readiness" alone, but to find out what educating for "college and career readiness" looks like in schools that purport to educate their students for "college and career readiness". In interviewing two GCSD principals and nine GCSD students, we are able to develop a better understanding of the "college and career readiness" paradigm in practice through the perspectives and experiences of those charged with implementing it (administrators), as well as those responsible for receiving it (students).

According to both administrators and students, educating for "college and career readiness", functionally, seemed to focus primarily on improving students' academic abilities in preparation for continuing their education either in college, technical schools, or in the pursuit of employment at the conclusion of their high school careers. What seemed clear was that though most participants were familiar with the phrase "college and career readiness", there seemed to be little consensus or formalized understanding of what that meant, and what the expectations of being educated for "college and career readiness" was in the first place. The lack of codified meaning or definition, presumably, led both principals and students to continue what they were likely inclined to do anyway, albeit armed with a reinforced conception that acquiring more formal education is sufficient to secure a career in the future.

When administrators were asked how they ensure their students are being educated for "college and career readiness", GCSD administrators stressed their commitment to student learning and increasing student's awareness of occupational possibilities. Through the use of internships and exposures, both administrators indicated the conceptual value of making their students cognizant of the array of career paths that existed as well as, hopefully, expanding students' social network by putting them in contact with professionals across various fields. To be sure, ensuring students are academically prepared for educational pursuits beyond high school and exposing them to a variety of workforce possibilities is better than doing nothing, but it is not clear from their perspectives, that either approach is demonstrably different than what they were inclined to do prior to the stressing of "college and career readiness" from those hierarchically above them.

Similarly, students reported a lack of clarity on what "college and career readiness" meant either definitionally, or functionally. Most recalled hearing the phrase for the first time in high school,

but could only assume it meant that if students got an education, they would presumably be career ready. Some students reported their pursuit of academic success was instilled in them from family and intrinsically, but the idea that the more formal education they amassed, the better positioned they would be in entering the workforce was communicated to them through the verbiage of "college and career readiness" - which they were first exposed to in their respective high schools.

Through the study, it became apparent that the realities of tomorrow's workplace, globalization, the implementation of automation, offshoring and artificial intelligence, all of which cost the American workforce millions of jobs over the past three decades and is continuing unabated - even in industries that required a college degree and were once deemed safe, is being ignored in schools purported to emphasize "college and career readiness". Additionally, both students and administrators conceded they scarcely cover the topic of workplace discrimination though it has remained virtually unchanged for twenty-five years, and despite the fact the schools' entire student body of Black and Latino students are most likely to be impacted by it in the future. In the end, both principals and students recognized the lack of attention paid to inconvenient, occupational realities that exist in today's workforce and likely tomorrows, but also shared a desire to see such topics taught more in schools in the future.

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