Urbanization and Externalities: A Case Study in Rural China

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Abstract. This paper examines the multifaceted impact of urbanization and externalities through a case study in rural China, with a focus on the Miao and Dong ethnic groups in Guizhou Province. As economic development progresses, the benefits of improved infrastructure, employment, and public services are often accompanied by significant negative externalities, including environmental degradation and cultural erosion. Through the lens of air and water pollution, traffic congestion, and shifts in traditional cultural practices, this study highlights the need for policies that address both the social and environmental costs of rapid industrialization. The research draws on survey data from local villages to assess how development has influenced cultural change, education, and environmental quality. The findings suggest that while economic growth brings tangible improvements, the long-term sustainability of these benefits requires a careful balancing of development goals with the preservation of cultural heritage and the environment.

Keywords: Externalities, urbanization, pollution, China ethnic group, sustainability.

1. Introduction

In the modern era, development is seen in all areas, especially economics. The benefits brought by this can be seen clearly in various areas. As an economy grows, more workers are required to meet the increasing demand for goods and services, resulting in more job openings. Therefore, the employment rate and income will increase. In addition, as a country's economy grows, the scale of government investment in public infrastructure such as healthcare also increases, allowing citizens to benefit from better public services.

However, economic development cannot be considered from a singular perspective. The costs of this development should not be overlooked. Pollution often arises in regions that have experienced rapid development, including pollution of the air, water, noise and congestion. This is because development often leads to increasing production of goods and associated with increased transportation, all adding to the sources of pollution. In addition, the benefits of economic growth are not always evenly distributed across regions, and the rising inequalities may give rise to increasing dissatisfaction in those areas that are left behind.

This paper explores the multifaceted consequences of rapid economic development in different countries including China, a country known for its vast cultural diversity and authenticity. Firstly, the analysis categorizes different externalities linked to development. An emphasis will be placed on the negative externalities that have arisen as a result of rapid industrial and urban expansion. This includes a detailed case study of Guizhou, a province that exemplifies the intersection of development challenges and ethnic diversity.

China is home to 55 officially recognized ethnic minority groups, each with its own distinct culture and traditions, spread across all its provinces, including five autonomous regions. These groups are experiencing significant transitions due to changes in the economic landscape. The Miao and Dong ethnic groups, both located in Guizhou, are highlighted to illustrate these dynamics. The paper investigates how economic development has affected the traditional lifestyles and cultural integrity of these groups, highlighting the broader consequences of economic growth on regional and ethnic inequality. This analysis underscores the critical need for heterogeneous policies that specifically address the unique challenges faced by minority groups, which are often overlooked in the broader development agenda.

2. Background Knowledge

2.1. Spillover Effects

Externalities is a term used by economists that refers to the effect on a third party when a good or service is produced or consumed. These effects can be positive or negative and often occur outside the market mechanism. Positive externalities refer to the unintended benefits that economic activities generate for uninvolved parties. These effects, such as the spillover of knowledge from research or the social gains from education, extend beyond the direct participants and contribute to the overall welfare of society. However, negative externalities are common as well. Pollution from industrial producers or excessive noise from construction all impose costs on society beyond those directly engaged in these activities. These negative costs include health problems, environmental damage, and an overall decrease of living quality.

Externalities, both positive and negative, lead to market inefficiencies as market prices fail to fully reflect the total social costs or benefits associated with a transaction. Consequently, resources may be allocated inefficiently, leading to a suboptimal outcome from both economic and social perspectives. Therefore, sometimes these externalities need to be addressed, often by the government. These interventions could include policies such as regulations, taxes, or subsidies to foster more desirable societal outcomes.

Many negative effects can be generated from the development of rural areas. In fact, the private costs to producers of the development which are often companies contracted by the government only include purchasing factors of production, while external costs to third partis could include pollution of the air and water sources as well as congestion and noise which will lead to a range of negative impacts to the lives of population in proximity. This means that spill-over costs generated to third parties by producers during the production process is larger than the cost experienced by the producers of the developments. Therefore, resources are being over allocated due to the existence of negative externalities of production.

3. Research

3.1. Air Pollution

Air pollution is perhaps the most publicized example of an adverse consequence brought on by negative externalities. In large urban centers, increased transportation is often an indicator of development, as it plays such as important role in the functioning of a city [1]. However, the abundance of vehicles, especially those that are gas-powered, is a leading cause of air pollution. The concentration of industrial manufacturers in cities also releases a variety of different harmful pollutants into the air. As a result, residents who are exposed to these pollutants can suffer from a variety of negative health implications, mostly related to respiration [2].

As an example, Mokoena, et. al. conducted a study in Xi'an, a major city of China [3]. The results showed correlations between ambient air pollution and respiratory mortalities in the city between 2014-2016. The study suggests that breathing certain types of polluted air in Xi'an from 2014-2016 was linked to more deaths from respiratory diseases in the short-term [3]. Specifically, fine particles such as PM2.5 and SO2 were significantly associated with respiratory mortalities. Furthermore, observations of the delayed effects indicated another significant association between ozone and the respiratory mortality of women [3]. The study concluded that the adverse effects of pollution called for immediate control policies to reduce the present air pollution condition in Xi'an.

To counter the negative effects of air pollution, governments are acting to mitigate some of these conditions. According to Dr. David Pui, reducing air pollution in major metropolitan cities by 20% can save tens of thousands of lives annually [4]. The Chinese government has installed a 200-foot Smog-free tower in Xi'an. This tower costs $2 million to install and is known as the biggest air purifier in the world. The tower is built to remove PM2.5 particles, which can be breathed dangerously

deep into the lungs, from the air. The result of this installation is significant. A recent study by the project leader, Dr. Cao in 2018 showed a 19% PM2.5 drop over 3.86 square miles of the tower's vicinity [4].

Economically, the installation of the Smog-Free tower has brought additional benefits besides the apparent benefit of cleaner air to breathe. Specifically, a study conducted by Haiyong Zhang, Sanqin Mao and Xinyu Wang compared data before and after the assessment report of the Smog-Free tower was published [5]. The study showed that people were willing to pay more money for homes closer to the Smog-Free towers, especially after they learned about the effects through the assessment reports. In fact, after the assessment report of the SFT was released in April 2018, the housing prices within 1 kilometer of the towers increased by almost 4000 RMB per square meter, even houses over 4 kilometers away from the towers increased by over 3000 RMB per square meter [5].

The study also discovered that factors such as green plants and convenient transportation also contributed to people's willingness to pay. This study shows the benefits of government policies and actions targeting air pollution and the benefits it has. In addition, the installation of the Smog-Free towers is a case where the benefits received by the residents are larger than the costs paid by the government, meaning that the private benefits are larger than the social cost. For this reason, there is a proposal to build a second Smog-Free Tower in Xi'an with a height of 984 feet. Furthermore, there are discussions of installing similar large air-purifiers in other major cities in China such as Guangzhou, Hebei, and Henan, according to Dr. Cao [4].

Air pollution is an issue that is present around the globe. As another example India is also suffering from air pollution in many of its regions. In New Delhi, the capital city of the nation, air pollution is reaching levels beyond measurement. In fact, according to Emily Ruball [6], breathing one day of air in New Delhi has the same health implications as smoking 25 cigarettes. One of the most famous Indian tourist locations, the Taj Mahal is also being affected by this severe pollution. Many tourists are disappointed when they discover they can't even see the Taj Mahal itself as it is obscured by thick smog. Furthermore, some tourists are even experiencing burning sensations in their eyes and difficulties breathing [7].

Figure 1. New Delhi - Around 20 million people inflicted with stinging eyes in the worst pollution in three years. The Taj Mahal itself is also enveloped by smog and barely visible [7].

The government of India has also come up with a method to counter the pollution and benefit local citizens as well as tourists. They are using two air purifier vans parked near the Taj Mahal in an attempt to decrease the air pollution level. The company that produced the vans claims that the purifiers can clean 1.5 million cubic meters of air in eight hours and can operate within a 300-meter radius [6]. However, according to CNN [8], there is no way to confirm that these statistics are accurate as there are no monitoring stations around to calculate the change before and after this new installation.

Air pollutants are not limited to urban cities. During the development process of rural regions, the construction of infrastructures can generate massive amounts of air pollution to the atmosphere. For example, the construction process kicks up dust particles such as PM10, which is particulate matter 10 microns or less [9]. Additionally, the transfer of materials and operation of heavy machinery all rely on internal combustion engines, which burn gas and increase carbon emissions. Furthermore, many infrastructures will be installed with the purpose of attracting tourists. This is a strategy that is

commonly used by countries such as China to create long-term development, in which local job opportunities are increased and residents can generate a sustainable income from tourism. However, tourism often comes with costs as well as benefits. For example, the demand for transportation will rise as tourists start visiting from different regions. Increased transportation via gas vehicles results in increased emissions such as carbon monoxide, nitrogen oxides, and hydrocarbons. Additionally, heating and air conditioning in accommodations and catering services can add up to the intensity of these emissions. These pollutants will enter the atmosphere and result in the worsening of air conditions and smog.

3.2. Water Pollution

Water pollution is another major example of the effects of negative externalities. In fact, in many regions water contamination remains a pressing concern. In large urban centers, as development continues, manufacturing industries sometimes concentrate in certain areas. This often leads to the increased discharge of industrial effluents into water bodies. Inadequate infrastructure or methods to remove pollutants combined with rapid rates of industrialization and urbanization often intensify this negative impact. Consequently, the public could be exposed to greater health risks due to their proximity to these industrial zones and contaminated water sources.

Negative health impacts from polluted water sources are not limited to urban areas; they are just as severe, if not more so, in rural regions. Many governments in countries such as China are becoming increasingly focused on the development of rural areas with the hope of increasing economic balance between regions. Development in rural areas often includes the installation of infrastructure such as roads, dams, or buildings. Although all these developments might have a benefit to local economies and living standards, they also have a significant impact on the surrounding environment. For instance, road construction can lead to increased sedimentation and runoff into nearby water bodies, carrying pollutants such as soil, chemicals, and heavy metals. In addition, government's development of tourism will mean more tourism traffic that can lead to greater waste generation, including litter, plastic waste, and sewage, which contributes to the pollution of water bodies if not properly managed. However well-intended, development often comes with the cost of intensifying water pollution issues in rural areas.

Unlike urban areas, most water sources in rural areas are open, such as rivers and lakes, making them extremely vulnerable to pollution. Without access to clean water sanitation infrastructure, reliance on these water sources for drinking, cooking, and agricultural activities poses significant health risks. Populations can be infected easily by waterborne diseases such as diarrhea, cholera, and typhoid fever, and this is especially true for vulnerable groups such as children and elders. Furthermore, contaminated water used for irrigation can result in decreased crop yields and the possibility of toxin present in foods, endangering public health. Polluted water can also negatively impact the overall environmental health such as biodiversity and aquatic life, which populations depend on as a food source, further affecting the food consumed. All these aspects may combine to cause major health implications if left unattended.

Economically, environmental policies regarding water pollution may generate higher benefit than cost. Qianping Ren and Jeremy West investigated how cleaning up pollution in lakes and rivers will affect the location where people live [10]. The paper focused on the Section 319 program in the U.S. that involves the government helping to reduce water pollution. They find that as pollution decreases, the number of residents rises, resulting in more houses being built and the value of those houses increasing. They also found that the benefits brought by this program significantly outweigh the costs. In fact, there is approximately $7.62 benefit for every dollar spent by the government, and over half of the benefits come from building new homes. This finding is important because environmental policies often pose a higher cost than benefit economically, but this paper suggests that the policy is actually generating more benefit than cost.

Additionally, there are other negative externalities that can have impacts on housing prices. Alecia Cassidy, Robyn Meeks, and Michael Moore showed that the introduction of a program called the

Area of Concern (AOC) negatively affects housing prices [11]. Specifically, AOC listings caused a decrease in housing prices of 15.8% [11]. These price decreases were solely the result of the realization of the environmental problems that were already there, not because the environment got worse. They show that people's willingness to recognize the value of a piece of real estate can be negatively impacted by the realization of the presence of pollution.

There are several examples of catastrophes caused by water contamination. One example is in Flint Michigan, known as the Flint River Crisis. Flint is a city in Michigan. that was once wealthy and developed. However, the city now contains around 100,000 people, with one third of the population living under the poverty line and one sixth of houses abandoned. In 2011, the city fell under state control and faced the need to cut costs. One of the strategies was to pump treated water from Lake Huron which lowered costs. In the time it took to get water from Lake Huron, city officials decided to use treated water from the local Flint River. The Flint River has been a disposal site for factories for more than a century, receiving raw sewage, agricultural and urban runoff. In fact, the Flint River has caught fire twice due to the massive amount of pollution. However, the idea of temporarily using filtered water from the Flint River went wrong when the corrosive river water wasn't treated properly, causing lead to leach out of aging pipes into thousands of homes. A study conducted by Virginia Tech revealed that nearly 17% of samples registered above the federal action level off 15ppb, which indicates corrective actions needed to be taken. Research in 2015 also showed that blood-lead levels in children citywide has nearly doubled since 2014 and nearly tripled in certain neighborhoods. In fact, nearly 9000 children were supplied with lead-contaminated water for 18 months. Additionally, the lack of chlorine in the water sparked an outbreak of Legionnaires' disease that killed 12 and sickened 87 people in 2014, making it the third-largest outbreak of this disease recorded in the US [12].

3.3. Ground Water

Ground water contamination cannot be overlooked when examining pollutions. Ground water contamination is almost always due to human activities, often when products such as hazardous chemicals and heavy metals are released into groundwater sources, causing the water to be unsafe for use. Many chemicals can move through soil from the ground surface or leak from underground storage tanks to contaminate groundwater sources. The main sources of contamination include septic systems, landfills, and abandoned waste sites. Contaminations can often lead to serious health implications, especially when contaminants are toxic chemicals.

One of the worst examples of groundwater pollution occurred at Love Canal in Niagra Falls, New York. The Love Canal was originally constructed as a cheap source of power for the citizens. However, this idea was shattered in 1910 due to economy and Tesla's discovery of efficient electricity transfer. The canal became a dump site for chemical companies until it was covered up and sold to the government in 1953. In 1978, the tragedy happened. Rainfall caused the toxic chemicals to leach out of the containers and into over 100 homes as well as a public school. This caused trees and gardens to turn black and die, and noxious puddles were found everywhere. Children were getting burns on their body after playing near the puddles. Furthermore, there were increased incidences of birth defects and miscarriages found in the citizens near the canal. Many people near Love Canal were also found to have high white-blood cell counts, which is a possible indication of leukemia. Finally, President Carter approved financial aid for the area, making it the first emergency directed to a non-natural disaster. 221 families were evacuated, and over $7 million dollars were spent on government purchases of houses near the toxic areas [13].

A disturbing fact is that Love Canal is not the only example of such groundwater contamination. In fact, it is estimated that there are hundreds of these "ticking time bombs" around the country. This is because chemical sales in the US exceed $112 billion per year, and the missing link of liability is a leading cause to the presence of these dumps. These dumps will continue to exist if it is less expensive for companies to dump waste rather than store it safely, and firms can evade responsibility once the damage is discovered [13].

3.4. Traffic Congestion

Development in a region is often associated with an increase in transportation, especially cars. However, this often leads to traffic congestion, which indicates an excess of cars on the road resulting in slower speeds or even stopping.

This problem is even more observable during rush hours, because many people from China come to Beijing or Shanghai from foreign provinces. Due to high housing prices at the city center, they live in the outskirts, and work at city centers. This means that there is a lot of commuting in the same direction at similar times, before and after work. In fact, there is an average of 32 minutes per hour spent in traffic jams during rush hours, according to China daily [14].

China has been suffering from high congestion levels in the last decade due to population growth and rising car ownership rates. In response to this, the cities like Beijing and Shanghai have been using license plate restrictions and more public transportation.

A study of GPS data from 300 million cars across 1360 cities in 38 countries measured the traffic congestion and economic impact. The study involves direct-costs such as wasted time and fuel as well as higher consumer prices due to shipping delays caused by these congestions. Between Germany and the US, these numbers are concluded to be $461bn, or $975 per person. The city with the most congestion time spent by drives is Los Angeles, with an average of 102 hours. The study also calculated that that congestion costs in New York was $34bn last year, by far the highest sum in the study. From an international perspective, the capitals of developing economies suffered from some of the worst congestion. This is because these cities had roads and transportations systems that did not keep pace with the economic developments. In fact, drivers in Thailand lost an average of 56 hours per year to congestion, and drivers from Indonesia and Columbia lost 51 and 49 hours respectively [15].

Congestion pricing is the method of using the power of the market to reduce congestions. This method changes prices at different times to shift traffic from rush hour to times where there are left traffic. This method is effective because there can be a huge lift in congestion if even a small percent of cars is removed. There is a consensus among economists that congestion pricing represents the single most viable and sustainable approach to reducing traffic congestion. This method has proven to be effective in real-world application, each variably priced lane in the median of State Route 91 in Orange County, California, carries twice as many vehicles per lane as the free lanes during the hour with heaviest traffic [16].

In the 2019 version of the previous study Bogato, Columbia was ranked the city with most traffic congestions in the world, with commuters losing 191 hours. The costal cost of congestion in the freight transportation industry in the America lost as high as $74.1 billion annually due to congestion with $66.1 billion occurring in urban areas. Factoring in indicators such as pollution and accidents, congestions can cost cities billions of dollars every year. In the US, drivers lose $88 billion due to tailbacks with an average per-person cost of $1377. New York had the highest congesting costs at $11 billion last year. Los Angeles lost $8.2 billion while Chicago suffered the third-worst impact at $7.6 billion. However, when it comes to hours lost in traffic, Boston actually had the highest total at 149 per year, ahead of Chicago’s 145 and Philadelphia’s 142 [17].

This article observed the effects that commuting time has on the happiness and health of people in China. The study found through surveys that extended commuting time is not good for improving resident’s quality of life. However, commuting times can be decreased through the improvement of public transportation. They also observed that by improving the coverage of public transport, the reparation between house and job will become less significant. Furthermore, the study concluded that big data is crucial for improving quality of life in the future. Many new developments such as shared bikes and cars can also improve the efficiency of urban operations and living quality. Overall, the study believes that the application of modern technologies should be encouraged in urban transport [18].

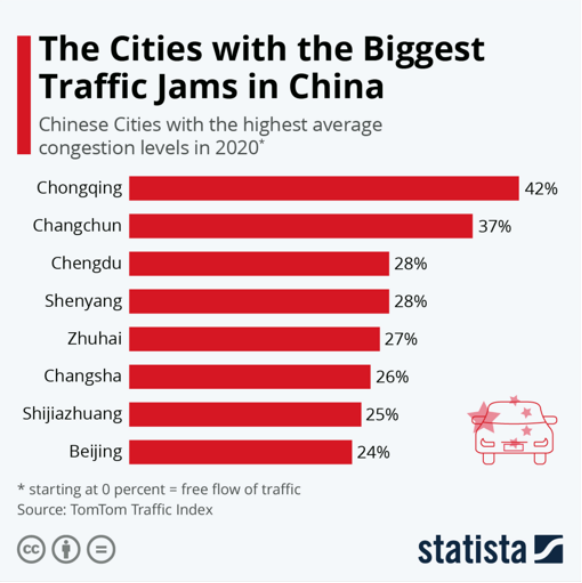

Figure 2. Ranking of Chinese cities with highest average congestions in 2020

The percentage in this chart represents the average amount of time increase in travelling compared to normal free flowing traffic. According to China Daily, the most densely populated Chinese cities include Shenzhen, Dongguan, Shanghai, Xiamen, and Foshan [19]. Interestingly, it can be noticed that none of these cities are on the list of Chinese cities with the highest average congestion levels in 2020. According to calculations of growth rate based on population numbers given by CEIdata, half of the cities on the chart have demonstrated relatively high growth rates in the period between 2000 and 2023. Chengdu (3rd on the chart) had a growth rate of 93% [20], Zhuhai (5th on the chart) had a growth rate of 101% [21], Changsha (6th on the list) had a growth rate of 70% and Beijing (8th on the chart) had a growth rate of 60% [22], [23]. Additionally, Shenyang and Changchun (2nd and 4th on the chart respectively) both have a populations growth of around 30% [20], [21]. This observation shows that high levels of congestion is potentially a result of rapid population growth. An explanation of this could be because of development of infrastructure such as roads capable of allowing the cars owned by the larger population to pass through quickly. A rapid growth of population could mean less time to react and put policies and infrastructures into place and therefore resulting in a system that is incapable of holding the increase in traffic, and causing high congestions rates. However, one migh argue that the city with the highest congestion rate on the chart, Chongqing, has only a population growth rate in the past 23 years of 12%. This could be explained by the sheer mass of the population with the lates 2023 data indication a total population of almost 32 million people [24]. Additionally, Chongqing is known for its mountainous landform which makes is hard to build wide roads to accomadate the traffic, accounting for the high rate of congestion [25].

4. Case Study in Guizhou, China

The Miao and Dong ethnic groups, which occupy most in Guizhou Province, are experiencing significant transitions as a result of rapid development in China. In most villages of these two groups that are undeveloped, above 90% of the villagers from age 20-60 work outside of the village in other counties or even other provinces. They only come back when there are traditional festivals or other large events, leaving only children and elders in the village. On the contrary, minority culture has also attracted interest from tourists, giving certain villages the opportunity to develop tourism and adapt into tourist-locations. Although making this adaptation may benefit the village in many ways, there are also consequences. As tourists start to visit, the villages are experiencing unprecedented pollution, littering and ecosystem damage. The surge in tourism brings with it a significant influx of contemporary culture, which has had a profound impact on local traditions and practices, particularly among communities such as the Miao and Dong. These groups are unique in that they do not maintain

written records of their history or language, relying solely on oral communication to preserve their cultural heritage. This method of cultural preservation makes them especially vulnerable to external influences. As tourists bring new ideas and ways of life into these areas, the local culture is exposed to modern influences that can lead to a gradual erosion of traditional practices and beliefs. The result is a real risk of many of these traditions becoming endangered or even extinct. The delicate balance between welcoming tourists and protecting the integrity of local culture is thus a critical concern, highlighting the need for sustainable tourism practices that respect and preserve the cultural heritage of these communities.

To better understand the status-quo, data are collected from surveys conducted in Guizhou, with a sample size of 203 surveyed across ten villages, including mostly students and their parents. Some summary statistics from the survey results are presented here and compared with known data of the entirety of China and Guizhou Province.

4.1. Level of Education

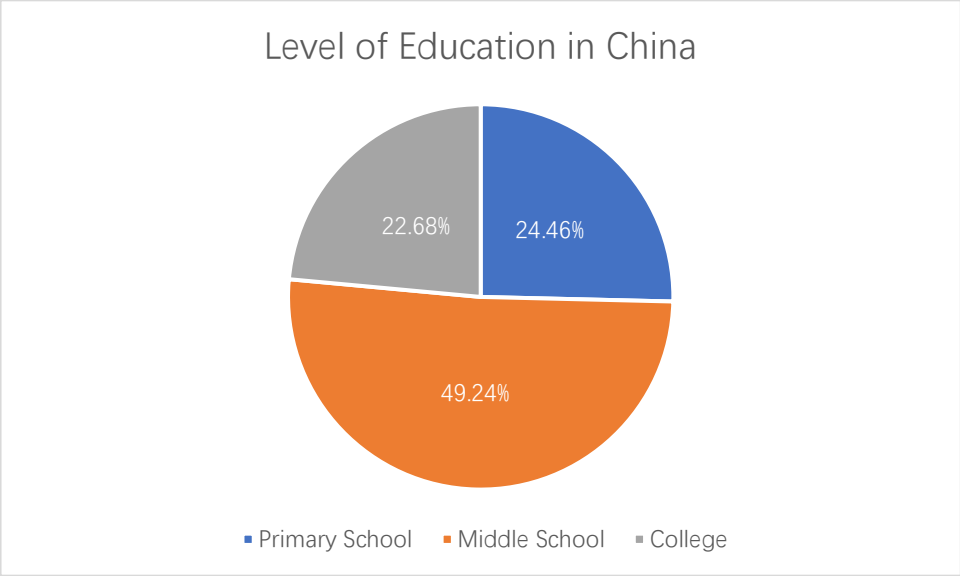

Figure 3. Level of education in China 2022 [26]

In China, primary school is 6 years, followed with 3 years of middle school and 3 years of high school before college. The first 9 years of education is free to attend, which is proven by the diagram of GuiZhou province and the whole of China, with most people ending education after the 9 years.

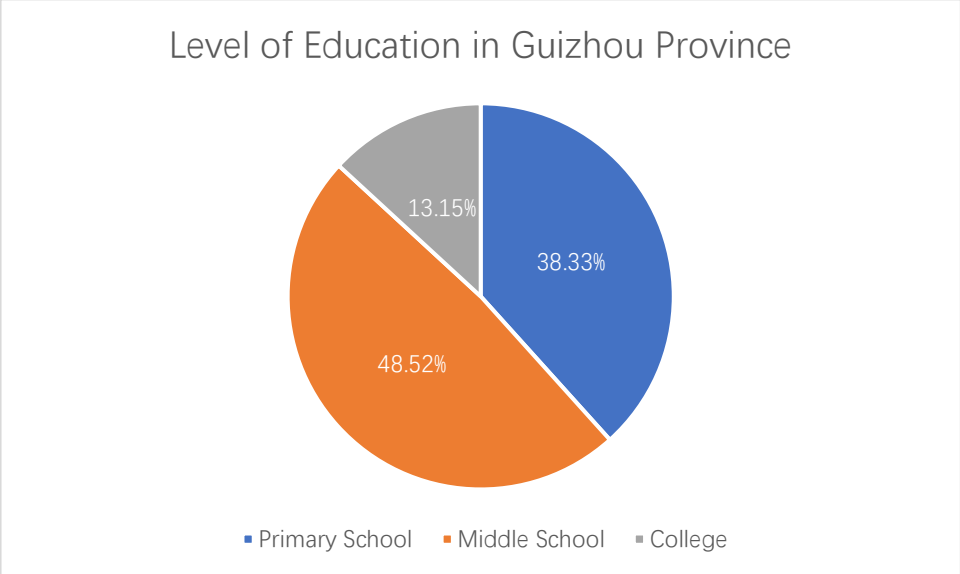

Figure 4. Level of education in Guizhou Province 2021 [27]

GuiZhou Province has a similar distribution of education levels as the entirety of China, since it has been undergoing major developments since the founding of the people's republic of China. Early developments include building of infrastructures such as roads, railroads, and hydraulics, successfully stimulating the rural economy and agriculture. Later on, around the late 20th and early 21st centuary, GuiZhou started promoting a market economy and opening up to techonological advancements [28]. These projects and developments greatly increased GuiZhou's economic output, with its 2023 GDP being ranked 22nd in China with 2,090 billion RMB [29]. These economic advancements and the government's policies without a doubt brought higher literacy rates in GuiZhou to match closely with the overall literacy percentages on the entire country. One benefit of education is that promoting Mandarin Chinese education in schools throughout Guizhou can significantly enhance literacy and educational attainment, helping bridge language barriers. This governmental initiative ensures that students from diverse linguistic backgrounds have access to the national language, which is crucial for their academic and professional futures in a Mandarin-dominant country. It also aids in integrating these communities into the broader socio-economic framework of China.

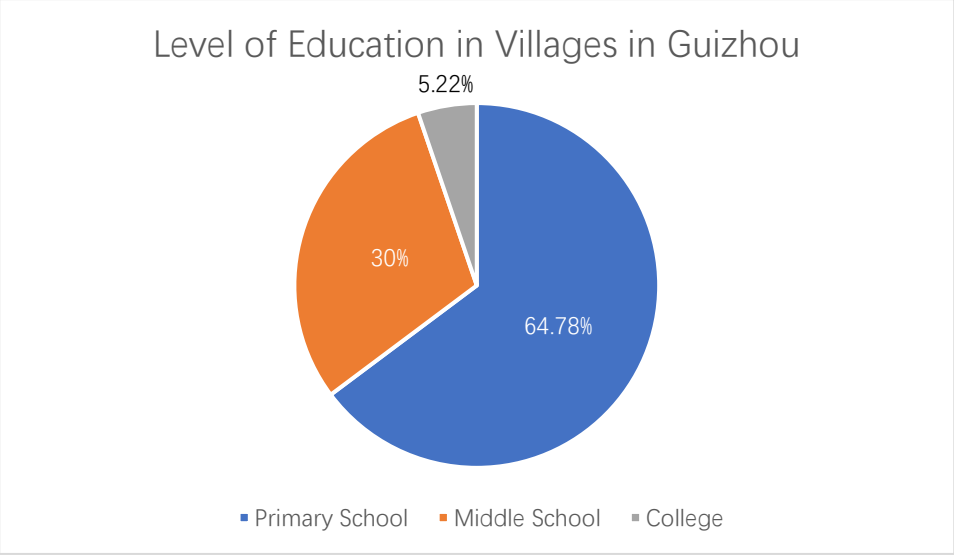

Figure 5. Survey results - Level of education in villages in Guizhou

However, the data collected in smaller villages indicate that most people only finish attending primary school. This phenomenon could be explained by the fact that most of the villages only had primary school and if students would like to continue their studies to middle school, they had to leave their village and go to school in this county. This means that, although the education itself is free of cost, there are still significant expenses brought by the students living outside of their home spending money on rent and food. Therefore, this cost could have caused many to end their education after primary school. However, currently, with improved government support, most children that I was able to speak with have plans to continue their education at least until middle school. Additionally, through speaking with the teachers, some of them expect middle school education to be available in the villages as they continue to develop, making it a lot more convenient for students to attend.

We might expect to see an increase in the level of education in villages where development occurs. As income increases, families can afford to allow their children to continue their education rather than send them off to work. Also, those who move to the developing villages might also be expected to be more highly educated than the current average in the lesser developed villages. However, the education distribution for GuiZhou province is already similar to that of China as a whole, so that development may not have such a large effect on education.

4.2. Age Distribution

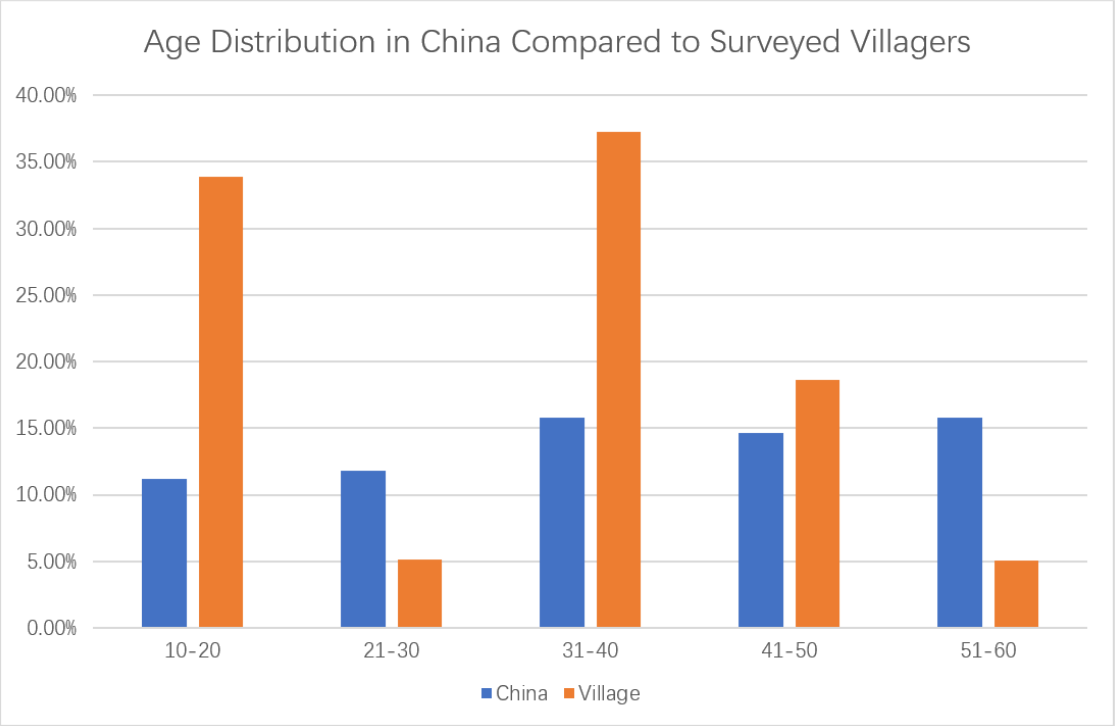

Figure 6. Age Distribution in China Compared to Surveyed Villagers [30]

As of the end of 2022, China's population stood at 1.41 billion. The age distribution was as follows: 11.87% were aged 10-20 years, 10.99% were 21-30 years old, 15.7% were between 31-40 years, 14.01% were aged 41-50 years, and 16.98% were between 51-60 years old.

It can be noticed from the age distribution of the surveyed people that most are 20 or younger or 31-40. The presence of many younger surveyed people could be explained because many of the surveys were done in schools. The lack of older surveyed people at the age of 51-60 is because most of the people around that age were relatively less willing to complete the survey or interview, mostly because some of them have less accurate hearing or understanding of the language that I spoke. However, there is another interpretation of this survey, being that it was survey taken around the time of Chinese New Year, meaning that lots of the people who go to other cities for work have come back to celebrate this cultural festival. However, there is also an abundance of people 31-40 years of age and the lack of people of 21-30 years of age. A reason for this could be because many of the 21–30-year young adults care less about culture than the previous generation of those around 40 years old. Therefore, those who are older generation are more likely to come back to celebrate the traditions, while the younger generation are more likely to stay and celebrate in modern cities.

As more development takes place the age distribution in the villages might be expected to include more young people, especially between 21-30 years of age. This is because the development of a region often brings new job opportunites for local residents, especially young people who are starting to look for work. For example, if the village was developed for tourism, there would be need for jobs such as guides and vendors. This would this will increase job opportunities and allow for young people to make a living in their own villages instead of having to leave for bigger cities to work.

4.3. Change in Culture

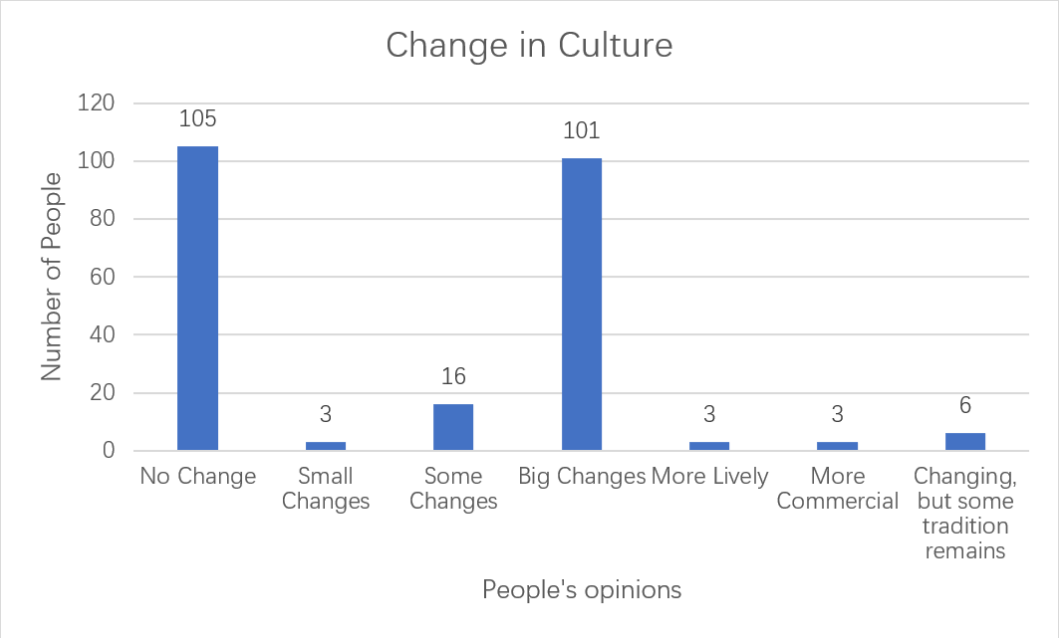

Figure 7. Survey results – reception of change in culture in the village

Understanding the relationship between age and cultural perception preferences in small villages is useful for understanding the impact of development on traditions. This chart above shows that there is an even split between people who think there are big changes in culture and no changes in culture. However, this could have been affected by the location where we took the surveys.

To better understand the correlation between age and the perception of culture change, our study utilized a Chi-Square test on the age group and perception categories, revealing a statistically significant association ($p = 0.0325$) between age groups and attitudes towards cultural change. The numbers indicate that both teenagers and adults are more inclined to prefer "Some Change" rather than "No Change", as the number of individuals favoring change is higher in both groups. The difference between these preferences is statistically significant, as indicated by the p-value from the Chi-Square test.

Understanding these preferences could facilitate more effective communication and engagement across generational divides. For example, the fact that more people on average think there has been a change in the culture and tradition shows that the modernization does not only impact the living standards but also affect the traditions. However, our survey results do not conclusively indicate whether this impact on cultural traditions is perceived as positive or negative by villagers.

4.4. Frequency of Eating Outside

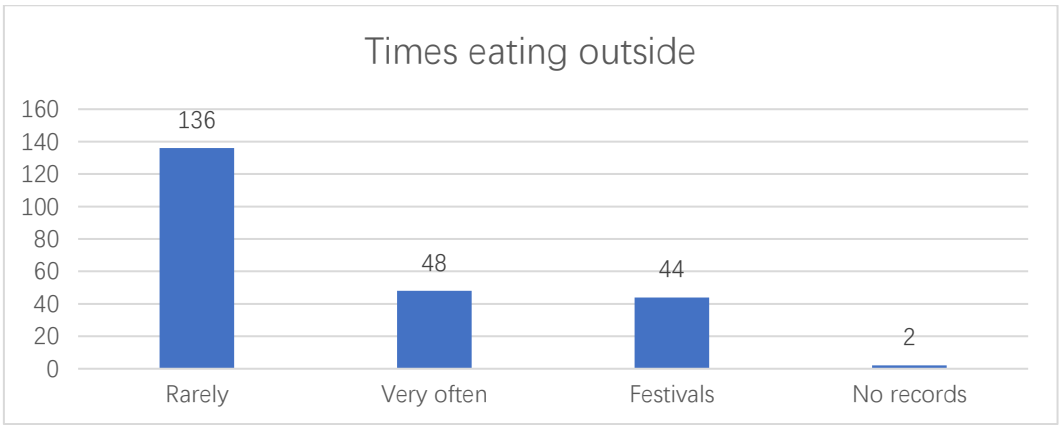

Figure 8. Survey results – frequency of eating outside

This chart shows that most of the people who took the survey rarely eat outside. With development, this can change, as development is often associated with an increase in disposable income of the individuals and with it comes the desire to increase living standards. As a result, restaurants will open to accommodate the residents' desire for increased living standards. Additionally, with more development, there could be an expansion in external dining options such as restaurants, further boosting residents' disposable income and enhancing their dining experiences. Therefore, as development start taking place, the number of times people each outside should increase.

4.5. Usage of Water Sources

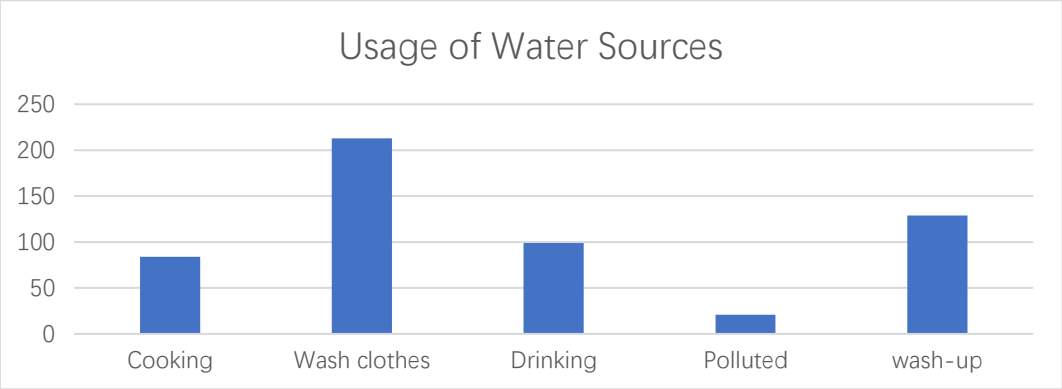

Figure 9. Survey results – usage of water sources

The water sources in this survey refers to open water sources such as lakes or rivers that are usually found in these villages due to their ancestor's habit of building civilization next to natural water sources. Although there is a relatively small portion of survey results that showed the water sources were too polluted to be used for anything, the distribution of uses also demonstrates something interesting. This chart shows that the people are more willing to use the water for external uses only, such as washing clothes or cleaning their body, instead of consuming the water into their bodies through drinking or cooking. This trend could mean that although not all water sources are too polluted for any use at all, pollutions are still present to make the villagers not willing to directly consume the water and only use it for external uses instead. There are two possible interpretations of the fact that the water sources are dirty. The first being that the cleaniness of the water sources can be improved by development and installations of infrastructures such as filters. The second possibility is that pollutions brought by development are responsible for the unclean water. An interview with a resident in a village about 3 km away from QianHu Miao village, yielded some interesting results A well-developed national 5A tourist location is based near a Miao village, she stated that although her business (a local hotel/homestay) and income has improved greatly, the water source which is a relatively small lake that is near her village has become completely unusable with foul smells due to the sewage from the tourist location. However, she also said that tap water has long been been put into place and the village now had greatly improved nfrastructures allowing for a modernized lifestyle. In terms of the future of the water quality, it is still unclear whether the new policies will ameliorate or exacerbate existing water quality issues.

4.6. Disposal of Trash

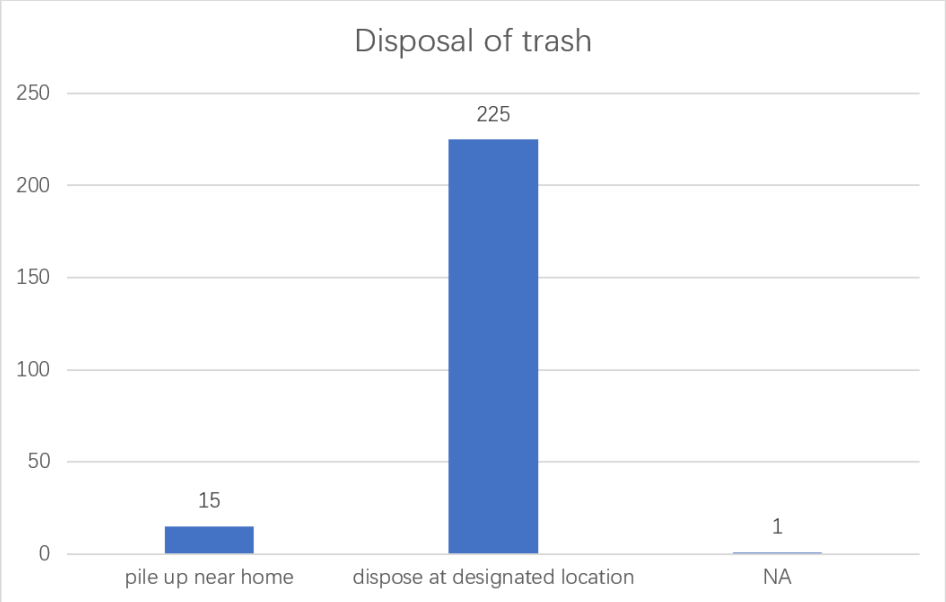

Figure 10. Survey results – usage of water sources

This chart indicates that almost all the people who took the survey dispose their trash at designated locations. Currently, trash disposal methods in the area appear to be effective, with the majority of residents using designated disposal sites, such as dustbins, for their garbage. This responsible behavior contributes to maintaining environmental cleanliness and community health. However, as development continues, the existing waste management systems might be strained by increased population and economic activities. This can lead to challenges such as overfilled disposal sites, increased littering, and improper waste handling, unless there is a corresponding enhancement in waste management infrastructure and stricter enforcement of regulations. Thus, while current practices are commendable, proactive measures are necessary to ensure that they remain effective in the face of future changes brought about by development.

5. Conclusion

Without a doubt, development is desirable to countries worldwide. This includes economic, environmental and politica advancement. Ultimately, development is mainly for purposes such as improving health and life expectancy, acquiring knowledge, and ian mproving the overall standard of living [31].

However, this development can come with costs, Economically, the spillover effects on third parties as result of an economic activity is referred to as an externality. Most of the externalities observed in this paper are negative externalities of production, meaning that the social cost of an activity is larger than the private costs. This means that unless action is taken to lower the cost on society, this activity is not not socially optimal. There are many externalities that are specific to development. This paper has provided evidence on air, water and groundwater pollution, as well as traffic congestion. Some of these costs can result in economic losses or major inconveniences in daily life. For example, traffic congestions cause the freight transportation industry to lose billions of dollars each year. More importantly, severe cases can lead to catastrophic losses including fatalities. The Flint River Crisis and Love Canal tragedy are examples of how insufficient attention to infrastructure can be disastrous.

In response to many of these costs, governments can take action and intervene. For example, in response to the severe air pollution that has been causing fatalities, China established Smog Free Towers in Xi'an to improve air quality. Furthermore, in response to traffic congestion, government may take action by limiting cars on the road through restrictions or fees for entering areas of severe

traffic congestion while lowering fees for parking outside these areas to encourage other ways of transportation.

The paper has also included a case study based in small villages of the Miao and Dong ethnic groups in Guizhou, China. The results received can provide information from many different areas. For example, in areas of development, water sources are likely slightly polluted as it is mostly used for external uses such as washing instead of consuming. There is also a trend that residents of younger age have mostly left their village and province to make a living. Furthermore, younger people are reporting less change in culture around them and less are coming back for events such as Chinese New Year.

Overall, although research in this paper reveals that development can sometimes be associated with negative spillover costs, it doesn't necessarily mean that development is negative. This is because most of these issues and costs can be avoided if the infrastructure meets the requirements of the development. Therefore, development would be much more preferred if it is led by the progress of infrastructure, instead of the infrastructure lagging behind and creating problems.

Acknowledgements

I, John Zhu, hereby declare that the work presented in this paper is my own original work. Where information has been derived from other sources, I confirm that this has been clearly and fully identified and acknowledged.

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