



Analysis on Causes of Township Enterprises Industrial Pollution and Countermeasures of Eco-compensation: A Case from Guiyang City of China

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ABSTRACT

Although township enterprises play a vital role in boosting the construction of China's rural urbanization, they cause serious industrial pollution by the waste they produce and by consuming large amounts of natural resources because of their features and negative effect on their external environment. To further analyse the industrial pollution causes and countermeasures of eco-compensation, five causes of industrial pollution by township enterprises were presented, and measures of eco-compensation for the pollution were discussed in the case study of Guiyang. The five major causes lie in the following: the weak awareness of environmental protection of government and township enterprises, malfunction of township enterprises market mechanism, government's failure in controlling over the township enterprises in industrial pollution, the unsustainable development of township enterprises, and the ineffective measures of industrial pollution. Some effective eco-compensation countermeasures to control the industrial pollution were proposed, including the following: frame a good agricultural environment, set up an interest coordination mechanism of township enterprises, build a production factor market for township enterprises, perfect the emission trading market, improve the management system of township enterprises environment, and establish a motivation system of environmental protection performance. Our results can lead to better understanding of the negative influences and causes of industrial pollution by township enterprises to perfect the eco-compensation mechanism and rational use of resources. Moreover, our results can lead to the benign development of rural population, resources, and environment in China.

INTRODUCTION

Since the implementation of the reform and open policy, the township enterprises in China have been developing rapidly and have become an important part of national economy. The development paves the way for the agricultural scale operation, which provides solid material foundation for the employment of surplus rural labour force, thereby accelerating the development of rural industrialization and urbanization and leading to the achievement of urban-rural integration. However, regarding the growth of township enterprises, their technology and management are generally poor, including the transformation and renovation of equipment. Slow large-scale expansion leads to increasing pollutant discharge and increasing severity of the damage to resource-developing reduction on the ecotope.

In recent years, as the economy in Guiyang rapidly develops (Fig. 1), the township enterprises play a major role in surplus rural labour force and urbanization. However, because of their properties and the external environment, wastage of natural resources is inevitable. Consequently, the large disposal of pollutants affects and hinders the growth of enterprises if such disposal is left uncontrolled. Rapid

development is just an illusion. The reality is that problems have existed for quite a long time in some regions of this city. The development of township enterprises is faced with multiple challenges. Achieving the sustainable development of township enterprises is the key to modernization and attainment of rural economic sustainable development. Considering that township enterprises are the main part of the market in a market-oriented economy, it is difficult for these enterprises to give consideration to the external economic efficiency and to establish a self-constraint mechanism that is geared toward environmental protection. Therefore, the analysis on causes of industrial pollution by township enterprises in Guiyang City and countermeasures are needed to boost agricultural modernization and rural economic development in the city.

STATE OF THE ART

Studies on the industrial pollution by township enterprises and on countermeasures are few. Most studies focus on urban enterprises because of the small number of township enterprises. Industrial pollution caused by enterprises has been extensively studied, e.g., the findings of Martinez-Lagunes (Martinez-Lagunes & Rodr ıguez-tirado 1998) on

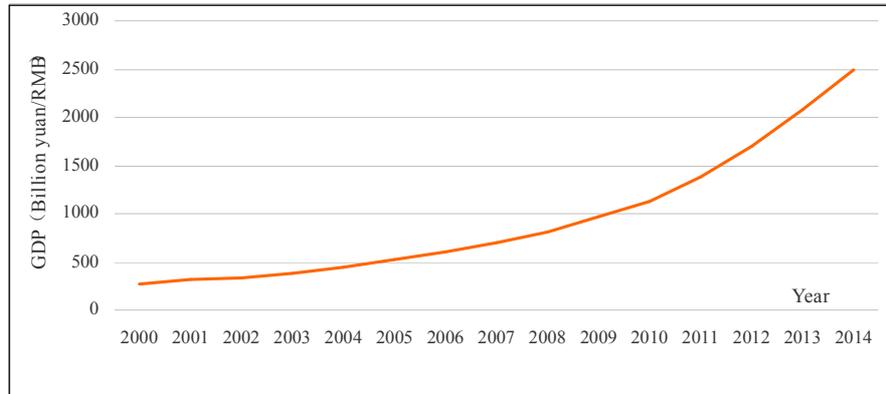


Fig. 1: 2000-2014 GDP in the City of Guiyang.

the relationship between water resource consumption as well as water pollution and enterprises' productivity, the analysis by Dasgupta et al. (2001) on the information of water pollution by Chinese enterprises and on the cost cutting and policies concerning water pollution, the environmental quality assessment of pollution to Bohai Sea by Gao & Chen (2012), and the studies on the status quo of heavy metal pollution in Pakistan and proposed control measures. Soil pollution by heavy metals in Luliang area, Shangxi Province, China and the risks of heavy metal pollution to surrounding fields, as well as the sites of coking plants, have been analysed by Yan (Martinez-Lagunes & Rodríguez-tirado 1998, Dasgupta et al. 2001, Gao & Chen 2012, Yan et al. 2015). Floehr has analysed the level of organic pollutants in Yangtze River and its neighbouring waters over the past 2 decades (Floehr et al. 2013). Measures of eco-compensation have been well studied. Eco-compensation has been defined by Cuperus as assistance for ecological function and quality damage in the process of development; the purpose is to improve the environmental quality in the polluted area and establish new areas with similar ecological function and environmental quality (Cuperus et al. 1996). Kellert thinks that eco-compensation must be in line with the principle of reality, of voluntariness, of conditions, and of equality (Kellert et al. 1984). Johst has set up an economic model of eco-environment in the case study of White stork protection to establish a detailed time and space arrangement of species and function-oriented eco-compensation and provided quantity support for the compensation policy (Johst et al. 2002). Cowell notes that eco-environmental cost compensation (environmental cost compensation) primarily refers to the environmental maintenance asset used to improve the eco-environment of the polluted areas or to build an area of similar eco-environment (Cowell 2003). Measures of eco-compensation have

been analysed by Brown, who evaluated the effect of these measures legally (Brown et al. 2013). Specific measures of eco-compensation in low-land farms in Switzerland have been analysed by Home (Home et al. 2014). Villarroya discussed and proved that the eco-compensation measures practiced in the projects of Spanish roads and railways can effectively reduce the ecological influence of program development (Villarroya et al. 2013). Guan introduced a method based on pollutant amount control; this method can be used to measure the standard of eco-compensation in water pollution (Guan et al. 2016). The industrial pollution caused by domestic and foreign enterprises suggests that as a component of enterprises, township enterprises place great pressure on the environment with the rapid growth of country's economy, thereby causing water, air, and soil pollution. Most studies confirmed the important role of eco-compensation mechanism in the recovery and development of ecosystem, as well as in the promotion of economic development. However, because of regionalism, seasonality of ecosystem, and the different levels of global economic development, the eco-compensation measures in different countries and regions must be adjusted accordingly. Therefore, this paper is of great theoretical and practical significance for the City of Guiyang and for China. Our results can lead to sustainable development of new socialist countryside.

CAUSES OF INDUSTRIAL POLLUTION BY TOWNSHIP ENTERPRISES IN GUIYANG

Weak environmental awareness of government and township enterprises: The rural and township enterprises in the City of Guiyang are less prioritized compared with the urban and large and medium-sized enterprises in terms of environmental protection. This gap diverts the attention to rural areas in China from the production process of products

that cause serious pollution, thereby raising the proportion of China's township enterprises pollution structure. As an agricultural power, the rural environmental pollution in Guiyang cannot be ignored. Lack of information on the importance of rural ecosystem and resource protection and the harm brought on by environmental pollution leads to reckless decisions. Short-sighted people blandly seek local development at the price of the environment and poorly understand the value of natural resources, including water, land, and living resources essential for farmers. These people also lack knowledge on the potential value of natural resources and awareness of sustainable development. Generally speaking, farmers' and public's participation in environmental protection is not satisfactory. Participation thus far is only limited to letters and complaints by ordinary people, environmental publicity, and environmental awareness investigation, which are not effective.

Malfunction of township enterprises market: Since it is difficult for rural environmental resources to meet the equity conditions required in a normal market mechanism, several problems exist in the case of township enterprises in Guiyang. The equity of rural environmental resources cannot be clearly defined. For instance, air and water in rural areas cannot be classified as properties of different towns and villages because these do not belong to any single people but to everyone. People are not motivated to maintain their own proprietorship, i.e., protect the freshness of the air and cleanliness of rivers. Because of the unclear equity, enterprises or individuals fail to invest long-term efforts and finances to environmental governance. Communal rural lands are used by farmers, but on certain occasions, farmers may be deprived of their right to use the land since the state has the right to acquire the land. Thus, it is unsafe for the property right of the collective and farmers. Effective market mechanism requires that scarce resources be freely utilized effectively, which can be guaranteed by the free transfer of property right.

Government's ineffective control over township enterprises in environmental pollution: The environmental protection in large cities, major industries and projects has paid more attention in Guizhou Province and many policies, rules, and standards formulated are available for large and medium-sized state-owned enterprises. These enterprises have planned economy orientation and are advanced in terms of techniques compared with backward township enterprises oriented by collective and individual economy. Although a set of improved environmental management systems have been developed in urban and large and medium-sized industries and even rural and township enterprises, some are not completely suitable. With the fast increase in the number of employees in township enterprises in Guiyang (Fig. 2)

and without normalized regulations and rules for implementation, it will be difficult to put these systems into practice. With the slow economic development in Guiyang, "inviting investment" has been the focus of the township government's work. However, the poor rural infrastructure and investment environment dampen the enthusiasm of most investors. The industries that cause serious pollution and cannot earn their place in cities are the most attractive. On one hand, countryside where raw materials and natural resources can be collected, and great amounts of rural environmental resources have been used up. However, cities that benefit from these resources do not pay for such benefit. On the other hand, the different industrial structures in towns and counties lead to more disposals of pollutants from cities, and those pollutants flow into the countryside. Thus, the pollution in the rural environment is worsening. However, cities do not pay the compensation fee to manage the pollution. The government is expected to encourage green agriculture and motivate farmers to apply farm manure. China is supposed to implement forest resource protection measures and encourage farmers to return the grain plots to forestry. The economic loss of farmers has not been compensated sufficiently.

Unsustainable development of township enterprises: The increasingly serious pollution caused by township enterprises has resulted in the disharmony between economic development and environmental protection, which affects the sustainable development of township enterprises. Lack of sustainable development worsens the existing environment of township enterprises. The abnormal distribution and disordered layout of township enterprises hinder the township enterprises from organizing effective short-distance coordination and socialized production. Thus, realization of scale economy and aggregation effect is unlikely. Economically, without high marginal income, the capital that township enterprises use in large-scale technical transformation, comprehensive utilization, and pollution control will not be sufficient, thereby making it difficult to solve the problem of pollution. Social resources, including land, capital, labour force, minerals, and energy, have been wasted for nothing. Apparently, the scattered and disordered layout of township enterprises expands the pollution source and enlarges the pollution area, which is not good for the division, management, and control of environmental protection zones and isolation belts, thereby adding to the difficulty of pollution control in rural ecology and hindering the sustainable development of economy of township enterprises. Environmental pollution is the outcome of industrialization, and an industrial structure has a direct link with the state of environmental pollution. Conventionally, the industrial structure, product structure, and even the process

structure are relatively complex, and some township enterprises have structures that can cause serious pollution. The complexity of pollution and structure contributes to the difficulty in managing and controlling pollution. Some regulations of national industry policy and macro-guidance on industrial development are beyond the grasp of township enterprises. Driven by interest and profit, these enterprises present a single structure in the industry, products, and process. If the single structure happens to cause no pollution, it has the advantage of clustering and can be beneficial to the economy and environmental protection. However, in most cases, the structure is effective in economy but causes severe pollution. For example, electroplating, tanning, casting, smelting, and coking specialized villages have caused serious regional pollution.

Ineffective measures of industrial pollution: The time-lag of township enterprises development in response to market orientation as well as the lack of scientific guidance result in development blind spots. Thus, redundant constructions and blind aggregation of polluting enterprises with lower efficiency have resulted in more pollutants and expanded the pollution area, thereby adding to the difficulty in pollution control. At the age of shortage economy, although enterprises can gain desirable economic benefit, the environmental pollution they caused prohibits their sustainable development. In the case of township enterprises with similar structure to urban ones in low-level industrial structure, the sustainable development of township enterprises will be hindered by the fierce competition between state-owned and township enterprises. After improvement, the competitiveness of state-owned enterprises improves through restructuring, asset reorganizing, and implementing a stockholding system. The inferior township enterprises will be in a disadvantageous position because market access and technical upgrade will be more difficult. Most of the township enterprises lack techniques and equipment for small-scale production, saving raw material, and reduction of pollutant disposal. They also lack techniques and equipment for easy, practical, and effective pollution control in small-scale production and flexible pollution control technique and equipment. The absence of scientific verification in many factories leads to improper distribution of projects or worsens the pollution, waste, and destruction of resources. Lack of scientific verification in pollution control leads to inappropriate control measures. Poor educational background and professional competence of environmental protection facilities operators are likely to result in misoperation, ineffective management of the facilities, and inefficient operation. Thus, pollution control may be ineffective and inefficient. Local governments follow the principle of “falling into the hands of polluters,” and invest-

ment on environmental protection investment in China is mainly from local governments and enterprises, with support from the central government. Compared with the input in economic development, the environmental protection input is much less. Zhejiang Province can be used as an example. As an economically developed region, Zhejiang has invested more on pollution control nationally, but many investments targeted cities rather than the countryside. That is why the phenomenon of two highs and two lows has emerged, as follows: high investment in developed and urban areas but low investment in underdeveloped and rural areas.

COUNTERMEASURES FOR INDUSTRIAL POLLUTION IN GUIYANG

Construction of sound agricultural market environment and establishment of township enterprises interest coordination mechanism: Driven by “interest” the township enterprises first consider their economic benefit but do not or hardly think about the problem of pollution; they are unwilling to offer to control the pollution. Market mechanism is needed in environmental administration and relies on economic means assisted by interest motivation to change the industrial structure, introduce new technology, develop new products, and solve the pollution problem. A compensation mechanism should be established for ecological environment to match with the market economy. Such mechanism should involve the following: to carry out environmental labelling system; to strengthen pollution charges; to end the situation of non-uniform charging, management, and low efficiency of capital utilization; to accumulate funds through all means; and to settle the environmental pollution caused by township enterprises. Financial ways are available. Environment-friendly banks can be established to provide concessional loans for enterprises of cleaning production. The scale of soft loan for special projects should be expanded, and a stable financially-supporting system for ecological protection should be set up. Preferential policies are supposed to be carried out to inspire township enterprises and non-governmental organizations and to devote themselves more to environmental protection. Taxation needs adjusting. New ecology taxes and compensation charge should be collected after investigating township enterprises. The criterion and application range of pollution charge rate must be determined according to the principle of feasibility; compensation fees need to be higher than the recovery cost, so that township enterprises will regard “environment” as the capital. The sewage charge system should be reformed. It is difficult to create a uniform sewage discharge standard because of the wide territory of China and different conditions. Therefore, national

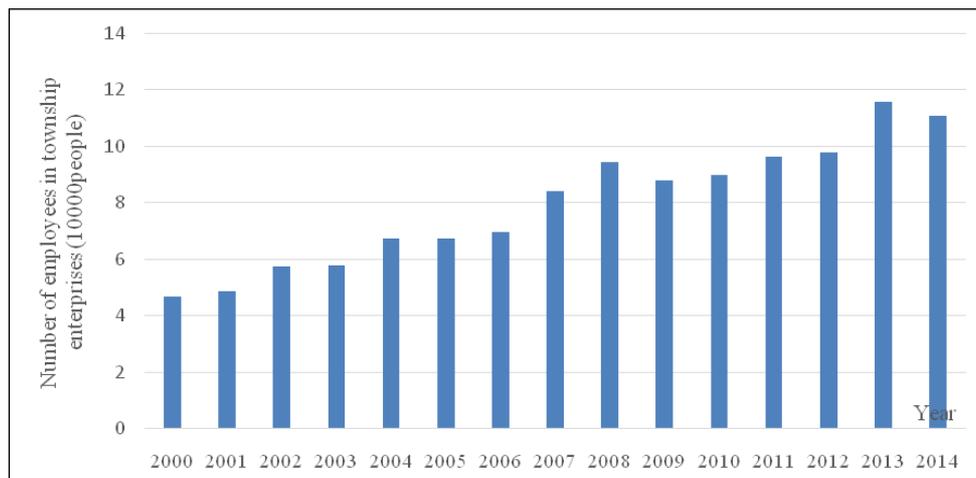


Fig. 2: Employees in township enterprises in the City of Guiyang.

principle and criterion can be formulated, followed by local ones. The local standard and regulations must be examined and approved by the National Environment Protection Agency before implementation, and the charging standard should fluctuate according to the price level to ensure that it is slightly higher than the operation cost of pollution reduction facilities.

To create a production factor market for township enterprises and to improve the emission trading market: The conflict between environmental policies and correct decision-making exists in each step of the enterprise development (planning, capital, developing, construction, production, comprehensive utilization, bio-safety disposal and emission, operation, and sales). However, the pollution trend can be controlled and globalized. Disastrous problems can be avoided if decision makers have foresight and are considerate. Even if the environment quality is not up to the standard for the moment, it is only temporary. On the contrary, any mistake or fault in environmental economic policy and in decision-making will result in irreversible harm to the quality of the ecotope. A one-vote-veto decision-making management system needs to be established. To improve the government's behaviour in environmental protection and pollution control, economic indicators cannot be used for assessing the leaders' performance and achievements; instead, they must be assessed in an overall manner to boost the greenization of achievement assessment. The institutional arrangement of achievement assessment must begin from the central party and government authorities for an all-round population and implementation of environmental protection assessment. Specifically, the environmental protection performance and achievements of top leaders in all provinces, autonomous regions, and direct-controlled

municipality is assessed by the central government. The top leaders of the Party committee in each city and prefecture should be assessed by the government of the province, autonomous region, and municipality. The top leaders in every neighbourhood, village, town should be assessed by the governments of prefecture, city, or district. Only in this way will a uniform performance assessment system of environmental protection be established. Thus, an effective constraint and incentive mechanism will be formed. The implementation of this system will help instill the view of sustainable development and a green concept of political achievements. The environmental protection can be carried forward to motivate the public's enthusiasm. Consequently, the objective of protecting and improving the environment will be achieved.

To perfect the environmental management system in township enterprises and build an incentive mechanism for environmental protection: The conflict between environmental policies and correct decision-making is evident in every step of the enterprise development (planning, capital, developing, construction, production, comprehensive utilization, bio-safety disposal and emission, operation, and sales). However, the pollution trend can be controlled and globalized, and disastrous problems can be avoided if decision makers have foresight and are considerate. Even if the environment quality is not up to the standard for the moment, this situation is only temporary. Any mistake or fault in environmental economic policy and in decision-making will result in irreversible harm to ecotope quality. A one-vote-veto decision-making management system needs to be established. To improve government's behaviour in environmental protection and pollution control, economic indicators cannot be used to assess the leaders' performance

and achievements. Instead, they must be assessed in an overall manner to boost the greenization of achievement assessment. The institutional arrangement of achievement assessment must begin from the central party and government authorities for an all-round population and implementation of environmental protection assessment. The environmental protection performance and achievements of top leaders in all provinces, autonomous regions, and direct-controlled municipality is assessed by the central government; and the top leaders of the Party committee in each city and prefecture should be assessed by the governments of the province, autonomous region, and municipality. The top leaders in every neighbourhood, village, and town should be assessed by the government of prefecture, city, or district. The aim is to establish a uniform performance assessment system of environmental protection. Thus, an effective constraint and incentive mechanism will be formed. The implementation of this system will help instill the view of sustainable development and a green concept of political achievements. Environmental protection can be carried forward to motivate the public's enthusiasm. Consequently, the objective of protecting and improving the environment will be achieved.

CONCLUSIONS

In recent years, the rapid development of township enterprises in China has laid a solid material foundation for joint development of industrialization and urbanization in rural areas and for urban-rural integration. However, the development leads to serious industrial pollution with more pollutants discharged and to destruction of ecological environment by the resource-developing production. For further analysis of the pollution causes and to propose countermeasures of eco-compensation, five primary causes of industrial pollution were analysed in a case study conducted in Guiyang City, Guizhou. Countermeasures were presented. Industrial pollution in Guiyang results from the following: weak consciousness the of environmental protection in government and township enterprises, malfunction of township enterprises market mechanism, ineffective management of the pollution, unsustainable development of township enterprises, and inefficient measures of pollution control in the enterprises. Some measures can help with the effective control over the industrial pollution, including framing a good agricultural market environment, establishing an interest coordination mechanism, creation of a production factor market, improvement of the emission trading market, creation of a perfect environment management system, and

establishment of an incentive system for environmental protection. Causes and countermeasures of industrial pollution caused by township enterprises were the focus of this paper. Considering the numerous causes and reasons, other aspects can be studied in the future, such as the composition of three wastes (waste gas, waste water, and industrial residue) discharged by township enterprises, quantitative measurement of economic loss, the connection between the enterprises' pollution discharge with their business benefit, the industrial structure of major businesses, and the emission charge of township enterprises in different industries.

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