



Planning for Urban Environmental Pollution Governance Under Urban-Rural Integration in China

Hongxia Zhao[†] and Xiuqing Zhang

College of forestry, Inner Mongolia Agricultural University, Inner Mongolia, Hohhot, 010010, China

[†]Corresponding author: Hongxia Zhao

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ABSTRACT

Urban-rural integration in China has resulted in the continuous migration of people to urban areas leading to the gradual elevation of the proportion of urban population in the total social population. This phenomenon has considerably aggravated the natural resources and ecological environment, causing serious environmental pollution. In this study, with Hohhot City in China as an example, five aspects of the pollution caused by urban-rural integration to urban environment were analysed and appropriate planning measures to govern urban environmental pollution were proposed. The results indicate that five main pollution issues result from urban environmental pollution caused by urban-rural integration. These problems include low-level regulation of construction waste disposal, numerous difficult-to-control sources of water pollutants, emergence of noise pollution as a new environmental pollution, high-level atmospheric pollution, and long-term soil pollution. The quality of urban environment could be effectively improved to realize a coordinated development of the environment and economy using four planning measures for environmental pollution governance. First, the government should establish laws and regulations for environmental pollution governance and issue environmental control plan. Second, the system of environmental pollution governance system should be standardized, and responsibilities of governing subjects should be defined. Third, capital investment on environmental protection should be broadened, and supervision of environmental pollution governance should be enhanced. Finally, the public should be stimulated to participate in environmental governance, and environmental education of the public should be reinforced. The results from this study can provide decision-making reference to explore planning measures to govern the urban environmental pollution caused by urban-rural integration by relevant governmental sectors.

INTRODUCTION

A city, which is a political, economic, and cultural centre of a nation or area, aggregates a large population, considerable amount of resources, and numerous socio-economic activities. As an inevitable product after an area achieves high-level economy, urbanization symbolizes human progress and development of civilization. This process results in the continuous migration of people into the city, leading to a gradual elevation of the proportion of urban population in the total social population. This phenomenon drives the secondary and tertiary industries to gradually concentrate and develop toward the city. Consequently, urbanization has aggravated the pressure on natural resources and ecological environment, generating a series of problems in environmental governance, such as resource exhaustion, environmental pollution, and ecological damage. These issues are due to unreasonable economic production mode, traffic jam and disorderly overall urban layout caused by inadequate infrastructure and unreasonable planning, disorderly dumped waste, and discharged sewage resulting from uncivilized behaviours of citi-

zens, among others. Therefore, exploring into the internal mechanism of the interaction between urbanization and urban environment has become a hotspot for academic and industrial studies.

EARLIER STUDIES

Numerous studies in other countries have been conducted to investigate the planning for governance of urban environmental pollution, and improvement in the environmental conditions was mainly realized using various governance tools, such as pollution charges, tradable sewage discharge license, governmental tax revenues, legal provisions, and other measures. Hahn believed that tradable sewage discharge license determined market clearing price to improve environmental pollution. This process involves the direct issuance of the necessary number of licenses and permitting sewage dischargers to obtain licenses through bidding (Hahn & Hester 1989). Stavins showed that tradable sewage discharge license is advantageous, primarily because environmental regulators could directly control discharge capacity (Stavins & Whitehead 1992). Matsueda once stud-

ied unilateral payment problem in one-way transboundary pollution and found that, theoretically, polluted countries could solve transboundary pollution problem very well by making unilateral payment (financial aid) to govern the behaviour of the polluting country (Matsueda 2002). Managi deemed that strict environmental legislation could stimulate enterprise innovation and improve the technological level of enterprise production. Moreover, legislation is conducive to increase market and environmental output, improving environmental quality while elevating living standard and reducing environmental pollution (Managi et al. 2005). Vandenbergh believed that approximately 30%-40% of greenhouse gases discharged in the US originated from individuals and households. Thus, individuals and households are potential sources to remarkably reduce discharge. Moreover, the authors have suggested the enhancement of the education of citizens on the awareness of environmental pollution (Vandenbergh et al. 2008). For example, Ring advocated the crosswise ecological transfer payment of governments at all levels under the central government, and ecological value-added tax of this state was apportioned to local governments according to a certain proportion to stimulate local governments to focus on strengthening local environmental pollution governance (Ring 2008). Parker believed that transboundary governance of environmental pollution could promote radical improvement in environmental quality (Parker 2008). Yanase comparatively analysed two optional pollution governance tools (discharge tax and command control-type regulation) and believed that the results of discharge tax had more influence on pollution and social welfare than those of command control-type regulation (Yanase 2009). Guojian deemed that governance of environmental pollution could be realized by sufficiently motivating initiatives of enterprises and citizens to participate in transboundary governance and giving important role of environmental supervision measures in environmental transboundary governance (Guojian 2010). Schmalensee analysed the sulphur dioxide subsidy transaction system in the US and explained that a good environmental regulation tool based on market incentives should be reasonably designed. Otherwise, this market would fail (Schmalensee & Stavins 2013). Hottenrott believed that formulating environmental protection measures was good to stimulate enterprises to adopt and generalize environmental protection technology. Moreover, innovation of enterprise technology would lead to decentralization to relieve cost caused by environmental damage and realize environmental pollution governance (Hottenrott & Rexhäuser 2015). Oates discussed the relationship between environmental quality and intergovernmental competition. The author believed that the government attracts new in-

dustries and revenues by adjusting tax rate and fiscal expenditure, and excessive competition between local governments result in heavy pollution enterprises, which would deteriorate environmental quality (Oates & Schwab 2015). Dai discussed the establishment of regulation for water quality and the design and implemented measures in China and EU. The author focused on analysing measures for governing agricultural water pollution (Dai 2015). Nilsson discussed the effect of legal measures in governing biological eutrophication in water pollution in the Baltic Sea (Nilsson 2015). Liqueste introduced a comprehensive method to evaluate the measures of governing water pollution (Liqueste et al. 2016). Countries outside China have intensively analysed relevant systems on governance planning on environmental pollution, and the majority of these studies were concentrated on taking full advantages of the principles and methods of institutional economics, game theory, and information economics to study environmental problems. These studies have realized much achievement on policy failure, market failure, property right property, and other problems. General rules were constructed from the rights and duties of environmental pollution stakeholders, economic impact of environmental legislation, and case analysis of environmental management. Under urban-rural integration, expanding the planning for governance of urban environmental pollution is of great significance and will play an important role in realizing sustainable development strategy in the economy of China. This process facilitates the coordination between economic development with environmental protection and ecological construction. In this study, with Hohhot City in China as an example, corresponding planning measures were introduced by analysing the status of urban environmental pollution and governance planning with urban-rural integration. The results from this study is expected to guide relevant governmental sectors to persist in formulating comprehensive decisions for coordinated environment and urban development and continuously solve eco-environmental problems in construction caused by urban-rural integration.

ENVIRONMENTAL POLLUTION STATUS OF HOHHOT CITY

Astounding advances in urban-rural integration have resulted in the accumulation of construction wastes and remarkably improved housing conditions and living standard of peasants. Improper garbage disposal of construction materials has become one of the main sources of environmental pollution, because bricks, tiles, and armoured concrete have replaced sun-dried mud brick buildings. In addition to construction wastes generated by repair of houses, several newly built enterprises have also become producers

of construction wastes. Remarkable increase in waste materials is due to the construction of new houses and roads. Most house builders are villagers who have not attained a high educational level. Thus, these villagers do not appropriately use building materials, resulting in environmental pollution and huge waste of construction materials. In addition, as replacement to sun-dried mud bricks which can be recycled, large quantities of armoured concrete, limestone residues, and waste metals are generated in the demolition of waste workshops, transformation of shanty towns, and dangerous building transformation. Numerous roads are constructed as a result of urban-rural integration, increasing road hardening areas. Wastes from these constructions are arbitrarily stacked everywhere. When stacked outdoor, domestic solid wastes will be mixed with these construction wastes. The recovery rate of building wastes is not high, ultimately leading to environmental pollution. Large-scale urban construction has started in Hohhot City with continuously increasing construction area as shown in Fig. 1. However, construction wastes in the area are indiscriminately stacked on roadsides and riversides and are simply dumped because of the limited technological level, old technical equipment, and backward technologies. Moreover, construction wastes present considerable harmful effect on soil. Long-term arbitrary stacking of building wastes has altered soil component elements, and heavy metal contents in soil have been increasing, seriously affecting crops. Furthermore, construction wastes also affect air such that these wastes stacked outdoor throughout the year will generate many harmful gases after decomposition because of damp. Dust flies everywhere, leading to the widespread of bacteria, causing environmental pollution.

Various difficult-to-control pollutant sources of water:

Urban sewage discharged recklessly without proper disposal leads to serious pollution of the urban ecological environment. The resulting pollution not only threatens the health of the broad masses but also limits urban economic development. Domestic sewage discharged without proper disposal enters surface waters, such as ponds, lakes, and rivers with relatively low terrain, seriously polluting various water sources. Moreover, domestic sewage will easily cause spread of contagious diseases. Consequently, infectious diseases, endemic diseases, and diseases will frequently occur in some areas. Despite the increasingly prosperous development caused by urban-rural integration, many drainage measures are still backward in urban areas such that high quantity of pollutants have accumulated in ditches after infiltration of domestic sewage arbitrarily discharged in village ditches. During heavy rainfall, runoffs scour pollutants to river ditch system, and when rainfall generates runoffs, these pollutants are carried into the surface water

body. Despite the remarkable progress has been achieved in urban socio-economic development, the amount of total urban sewage treatment continues to rise as shown in Fig. 2. With the rapid development of animal husbandry surrounding the urban area and continuously enhanced environmental awareness of people, breeding pollution has become a secondary industrial pollution and the third pollution source following municipal solid waste pollution. Pollution from livestock and poultry industry of a water body is mainly derived from water used by these industries and the sewage caused by water scouring. Excessive application of livestock and poultry faeces in farmland will also result in the underground penetration of nitrogen remaining in soil. This process will result in nitrogen and organic matter pollution of underground water, which will deteriorate water quality. Moreover, urea will also increase atmospheric nitrogen content, because this form of nitrogen is volatile in air. Very high levels of atmospheric nitrogen will generate acid rain, which is harmful to human health.

Emergence of noise pollution as a new type of environmental pollution:

Noise pollution has emerged as an important type of pollution caused by economic development, increasing enterprises, and industrial development. Noise pollution is globally regarded as a major pollution following water and atmospheric pollutions and has seriously damaged the environment. Urban progress is accompanied by increasing motor vehicles, because the demand for vehicles escalates when urban development has reached a certain scale. Rapid development in the use of motor vehicles will bring convenience for travel. This phenomenon is also an important manifestation of economic development and social progress. However, problems are generated by the people's poor awareness of environmental protection. No relevant laws or regulations about governance of noise pollution have been passed, and administrative departments lack supervisory regulation. Noise cannot be effectively controlled. Braking noise, whistle, and running noise of mechanical vehicles constitute traffic noise pollution, and these noises seriously influence the lives of residents. Various areas have been attracting investors and numerous real estate agents to invest on real estate in local areas, accelerating the urban-rural integration process and full real estate development. With the demolition of dangerous houses, expanded urban development scale, and transformation of shanty towns, villagers choose to live in tall buildings, which are built each year. The many construction sites, with accelerated urban-rural integration, will lead to the establishment of service industries in areas with dense population. Sound equipment together with sales promotion and propaganda will influence nearby residents. Given that enterprise development plan is not included in urban-rural integra-

tion, many enterprises are close to residential districts or are not built according to environmental protection standards. Equipment noise during processing of enterprises or transport of materials is high and large fans, pneumatic diggers, and electric saws produce high decibels of sound. This kind of noise is extensive and persistent, and equipment will not stop operating if only workshops manage the business. Sounds have broad sources and great influence, which not only disturbs nearby residents but also greatly harms worker health in these enterprises.

Hohhot City has been vigorously promoting development of urban-rural integration. As the populace excessively aggregates, living facilities are increasingly necessary. Villages and urban areas start changing the original warming mode, which is, by making fire using stoves. People have started to warm themselves through installed heaters such that installed heaters and boilers, as well as the demand for coal, has remarkably increased during winter. Hence, heavy metal, such as arsenic in fuel coal, has emerged as one of the main sources of atmospheric pollution. Air quality in Hohhot City, which originally had good air quality, has declined as fuel coal consumption increased. Consequently, atmospheric pollution has become increasingly serious. Accelerated increase in population hampers the self-purification ability of the environment to keep up with pollution. Environmental bearing capacity is exceeded, environmental pollution problems are increasingly prominent, and operating cost in governing industrial exhaust emission has continuously grown (Fig. 3). In urban-rural integration, with increased population, environmental pollution in living conditions also occurs. People's living conditions are enhanced better, but the yields of waste water, exhaust gas, and solid waste simultaneously increase. Kitchen waste, package waste, disposable goods waste, waste clothes, shoes, and hats have also increased, seriously affecting atmospheric quality. Moreover, increasing motor vehicles is also one of the main atmospheric pollution sources, development of urban-rural integration is accompanied by increasing population, elevated living quality, increasing households buying cars, and increasing enterprises. Thus, exhaust discharge is enormous, contributing several forces to atmospheric pollution, namely, factories emitting smoke, increase in automobiles and enterprises, and no effective management mechanism. Exhausts are emitted into the air, causing atmospheric pollution, and several waste sulphur oxide gases with pungent smell and high concentrations are emitted to the air, causing hazy weather and greenhouse effect.

Long-term duration of soil pollution: Considerable recycling of domestic garbage is difficult because of the outdated rural facilities for disposing domestic garbage and weak awareness of villager on environmental protection.

Thus, domestic garbage, such as disposable plastic products, waste battery, old clothes, tubes, and lamp bulbs, is arbitrarily discarded on the roadside and water side. This litter not only becomes a place for breeding flies, mosquitoes, mice, and pathogens but also encroaches upon land which then loses its deserved construction functions. More seriously, prolonged stack of mixed garbage will stink, rot, ferment, and even generate reactions, releasing gases harmful to human health. Moreover, permeated liquid will pollute the soil, seriously impacting the living quality. With increasing markets and expanded scale of using disposable plastic bags, once markets close, many indisposed plastic bags and garbage remain, which seriously impacts overall image. In addition to these bags, a small part of heavy metals in soil will be dissolved in water, so they persist to permeate in soil and are immobilized, generating local pollution, which will not diffuse to deep soil layer. Typical substances are cadmium and mercury, and volatile organic compounds permeate into the deep underground because of natural causes (e.g., soil erosion). Volatile organic compounds with high volatility, low viscosity, and larger density than water are difficult to decompose in soil or underground water. These compounds will easily permeate in soil and transfer to underground water and aquifer. Consequently, these pollutants, which are typically organic phosphorus compounds, are diffused to deep underground layer and persist in liquid or gaseous form. These hazardous substances permeate into underground water from polluted soil. Residents will absorb these hazardous pollutants, because they drink or use underground water or eat crops planted with polluted soil.

PLANNING MEASURES FOR GOVERNING URBAN ENVIRONMENTAL POLLUTION CAUSED BY URBAN-RURAL INTEGRATION

Establishment of laws and regulations for governing environmental pollution and planning for environmental governance: Governance of urban environmental pollution should adhere to legislated administration and unwaveringly step on the legislation path. Only this process can guarantee that urban development would keep pace with progress. Currently enforced laws and standards should be revised and amended to augment the legal void. Local governments should amend local laws, technical specifications, and environmental standard system, as well as encourage different areas to formulate stricter local pollutant discharge standard and enforce complete supervision system of environmental law. To clarify responsibilities, conduct codes, powerful supervision, and efficient operation, local areas should define responsibilities in law enforcement according to laws, scientifically set law enforcement positions,

confirm law enforcement procedures, and regularly publish enforcement results. Local governments should formulate an organic combination of appropriate administrative law enforcement and enforcement responsibilities, absolute accountability system of environmental governance, and complete internal inspection mechanism inside environmental protection system. Moreover, the offence reporting system for violations of environmental law violation should be strengthened, and internal, hierarchical, and external supervisions should be combined. Legal aid for pollution victims and further enhancement of transfer procedures of environmental criminal cases should be established. Additionally, the local government should clarify existing laws and regulations in environmental protection, revise some repeated or conflicting clauses of these laws and regulations, and properly integrate specific laws according to the principle of sort management. Achievement of these processes guarantees comprehensive, pertinent, and applicable laws for environmental protection. Furthermore, criminal responsibilities should be affixed in specific environmental laws, criminal sanction of environmental criminals should be reinforced and smooth operation of environmental protection and administrative management should be ensured.

Standardization of the mechanism of environmental pollution governance and confirming the responsibilities of governance subjects: For problems existing in the mechanism of governing urban environmental pollution currently enforced in China, the relationship between the department responsible for governing environmental pollution and the authorities, administrative organs, and other departments should be delineated according to a unified and independent management system with clear rights and obligations. In governance, a vertical governance pattern should be built such that regional environmental governance departments at all levels should be responsible for reporting environmental affairs successively to upper levels in the department, thereby intervention from government at the same level can be reduced. High independence of HR and financial power of the environmental governance department from the government and other departments should be guaranteed. Interference from other authorities can be avoided such that the right of environmental governance can be exercised better to improve the efficiency of governing environmental pollution. Limits of authority of environmental governance institutions at all levels should be clarified to reasonably distribute rights of administrative departments for environmental protection at all levels in legal form. Provincial (e.g., autonomous region) and municipal environmental administration departments cannot undertake all matters, or various districts cannot manage all concerns. Efficiency of environmental pollution governance can only

be improved and offside can only be avoided by building management pattern which centres on provincial- and municipal-level environmental administration departments while supported by various districts. Finally, limits of authority of various departments in governing environmental pollution should be defined. Unified supervisory administration of competent administrative departments for environmental protection is an all-round, cross-system, and trans-department supervisory administration. Division of labour should be established with individual responsibilities in supervisory administration among different departments to determine who should be responsible for a system or department. The responsibilities and obligations of each department should also be confirmed legally to make reasonable division among different departments with distinct responsibilities and close cooperation.

Enhancement of capital investment and supervision of environmental pollution governance: The government should establish and achieve a liability system of governmental investment in environmental protection. The government should also undertake some investments on environmental infrastructure of public welfare property, and trans-regional comprehensive pollution governance. The government should also self-construct and develop an environmental administrative department. Enterprises should bear generated pollution or supplement investment on environmental loss and bear investment and management risks. The government should enhance policy orientation, actively import social capital and outbound capital, create a stable policy environment for enterprises and social investors, and ensure that these enterprises will obtain reasonable economic return in investment on environmental protection. The government should be strict with law-based administration, and enterprises or enterprises violating relevant law and regulation standards on pollution should provide enough investment on environmental protection. If private capital is invested on environmental protection both at home and abroad, the government should formulate some taxes and price preference policies serving the environment. The government should establish a mechanism to supervise fund for environmental protection and improve capital usage efficiency in environmental protection. The use of capital for environmental protection by the government should be announced regularly. The capital for environmental protection will be allocated in batches and instalments, and supervision and management of the use of capital for environmental protection should be enforced. The government should establish mechanism to supervise environmental pollution governance, rectify the responsibility scope of various departments, and gradually set up new mechanisms to govern environmental pollution as supervised by pro-

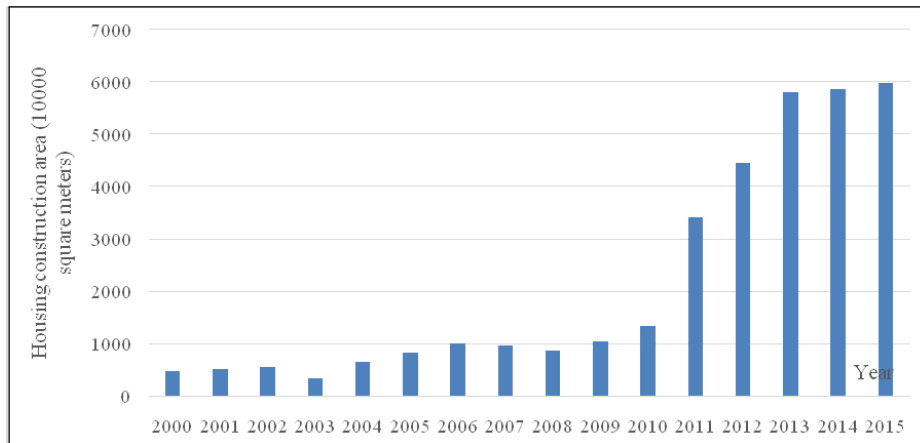


Fig. 1: Housing construction area in Hohhot city during 2000-2015.

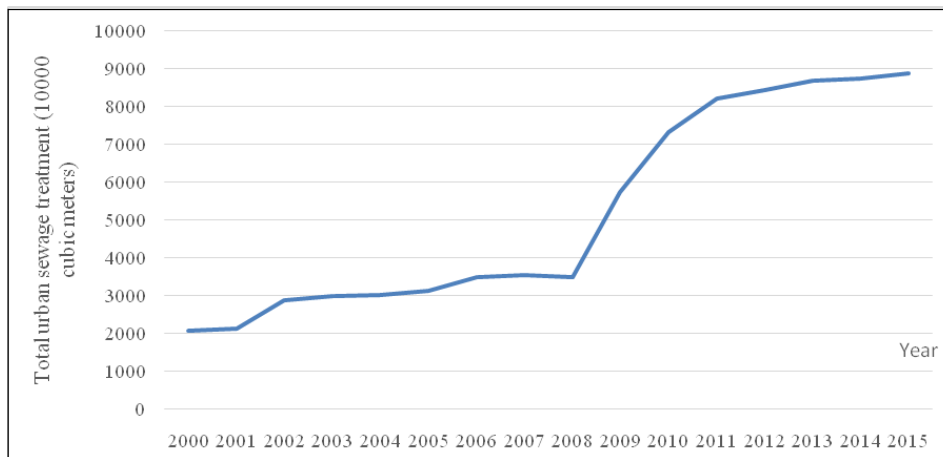


Fig. 2: Total urban sewage treatment in Hohhot city during 2000-2015.

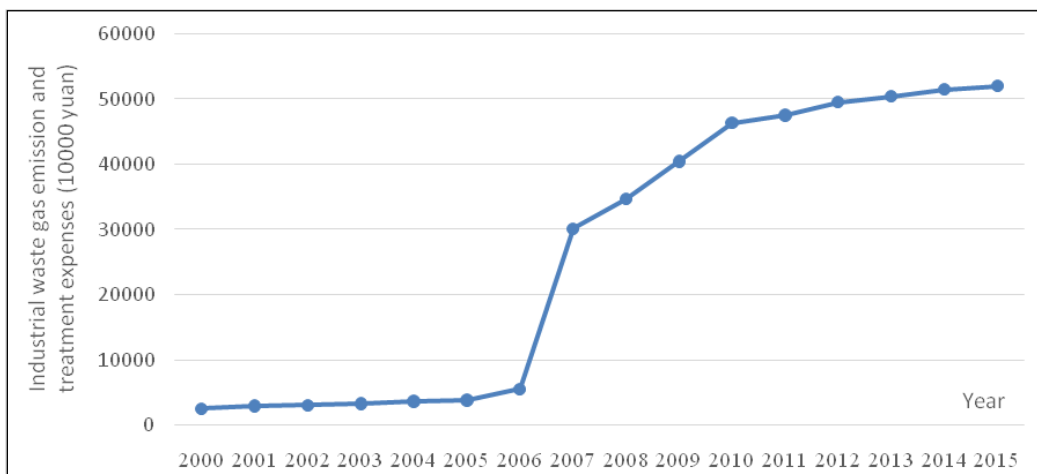


Fig. 3: Industrial waste gas emission and disposal expense in Hohhot City during 2000-2015.

vincial and municipal governments and regulated by districts and units. Local work of governing environmental pollution at the provincial and municipal levels should not only have vigorous support but also necessary guidance and supervision. The government should continuously enhance regional environmental supervision institutions, coordinate trans-regional environmental pollution governance problems, and urge inspection of prominent environmental problems. Regional governments should be responsible for environmental quality of their own regions, supervise environmental pollution governance work of their subordinate governments, and establish matched supervision mechanism for environmental protection. A set of systematic environmental economic policies should be established to harness the economic means and market mechanism to protect and govern the environment. With overall planning of coordinated regional development as its objective, the government should adhere to principles of "polluters pay, users compensate, developers protect, and destructors restore." Economic means of environmental pollution governance in Hohhot City should implement environmental taxes or charging policies, environmental permit system, and improve the effect of pollution governance in multiple forms, such as by cash subsidy, low-interest loan, and tax subsidy.

Elevation of the degree of participation in environmental governance and enhancement of the environmental education of the masses: Public participation is a basic principle in the environmental protection law in China. This process refers to the behaviour in which citizens participate in the decision-making activities related to environmental governance through certain procedures or approaches in environmental protection to influence governmental activities. Public participation is a kind of legal supervision and supplements governmental acts. First, public participation in governing environmental pollution should be legally defined. Environmental protection institutions should pay high attention to the rights of the masses to participate in national political affairs and create favourable conditions to allow the masses to participate in environmental pollution governance. The position of individual environmental right should be mainly confirmed through legislation, and environmental litigious rights of citizens through environmental legislation should be guaranteed. Citizens should be encouraged to correct unjust governmental acts by environmental petition, administrative litigation, civil procedures, or requiring enterprises to stop the damage caused by pollution. Second, an information communication platform of public participation should be established. Public participation and governmental information disclosure constitute a bilateral interaction between the government and the public. Environmental protection institutions should cre-

ate an information platform which can facilitate the communication with the public. Leaders from environmental pollution governance departments should be able to communicate with the public online, realize dialogue and communication between the government and the public within a stipulated time, promptly summarize feedbacks of the public, and continuously enhance their work. Third, environmental information should be issued promptly and accurately. Environmental pollution governance institutions should announce environmental information through news media, public announcement, network platform, etc. The information may include construction projects related to major environmental decision making and public hearing convening. Consequently, the right to be informed of the masses is guaranteed, and the public can be guided to actively participate in environmental protection and cooperate with law enforcement agencies of environmental pollution governance to form powerful deterrence for social supervision of unlawful acts. Citizens are urban subjects, and numerous decisions made by citizens form an urban image. Urban environment is closely related to each citizen, who is both a creator and beneficiary of the environment. The strength of urban environmental awareness of citizens has direct bearing on the coordinated development of urban environment and economic society. Urban environmental awareness should be an awareness which is beneficial for a healthy and sustainable urban development as residents and constructors of a city. Performing multiple forms of environmental propagandas is an important carrier to improve environmental awareness and urban awareness of citizens. Thus, the government should actively implement activities, such as "world environmental propaganda week," organize citizens to build landscape garden cities and hygienic urban areas, and organize practical activities to popularize scientific knowledge of environmental protection among the entire population. Contests on environmental protection of clean and harmless factories, enterprises, and units may also be conducted. The government should raise environmental awareness among the general public, advocate green production method and lifestyle, and carry forward ecological civilization to enhance urban awareness and environmental awareness of citizens to realize a qualitative change. Additionally, the government should stimulate the people to participate in environmental protection, create rich atmosphere of public opinions for environmental supervision, and form powerful deterrence of social supervision of unlawful acts.

CONCLUSION

Industrialization has increasingly intensified the contradiction between urban-rural integration and environmental

pollution in China. The relationship between the progress caused by urban-rural integration and environmental pollution has become a strategic problem influencing the socioeconomic sustainable development in China. Planning measures appropriate to govern urban environmental pollution were explored to further analyse the pollution caused by urban-rural integration to urban environment. In this study, with Hohhot City in China as an example, the degrees of pollution were analysed according to five aspects caused by urban-rural integration to urban environment and planning measures for governing urban environmental pollution were proposed. The results indicate that urban environmental pollution has resulted in five pollution issues, namely, low-level governance of construction waste materials, abundant difficult-to-control pollution sources of water body, emergence of noise pollution as a new environmental pollution type, high-level atmospheric pollution, and long-term soil pollution. The quality of urban environment can be effectively improved to realize a coordinated development of environment and economy using four measures in governing environmental pollution. These measures include the establishment of laws and regulations for governing environmental pollution and issuance of environmental control plan, standardization of the system for governing environmental pollution and defining responsibilities of governing subjects, enlarging capital investment and enhancing the supervision of environmental pollution governance, and elevating the degree of participation in environmental governance and reinforcing environmental education of the public. This paper emphasizes the planning measures for governing urban environmental pollution caused by urban-rural integration. An in-depth study should be conducted to measure the degree of urban environmental pollution and urban-rural integration, spatial influence of village, and town distribution on urban environmental pollution. Time sequence models of urbanization and ecological environment should be established, and coupling relationship and mechanism between urbanization and ecological environment should be explored. Moreover, the process by which the government coordinates with the governance of rural and urban environmental pollution should be determined, and whether quality of urban-rural integra-

tion is related to environmental pollution in space and time should be elucidated.

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