Environmental Policy and Rural Industrial Development in China

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Abstract

China's environmental policy emphasizes the use of economic instruments. By levying a fee for discharges, the government hopes to internalize environmental costs associated with production and consumption. This policy has been working relatively well in the urban areas, but faces a grave challenge in the rural areas where there has been a development of rural industries on a massive scale since the late 1970s. Polluting industries scattered in villages pose a major threat to the rural environment. The dispersedness of rural industries and the insufficiency of environmental monitoring have become major obstacles for the implementation of environmental legislation. Based on a field study in Qinshan town in eastern China's Zhejiang province, this study discusses limitations in the implementation of China's environmental laws in combating industrial pollution in the rural areas.

Keywords: rural industrial pollution, policy, implementation

Introduction

The spread of polluting industries in rural areas can have a profound impact on the rural environment. The lack of centralized treatment for industrial wastes means that industrial

Table 2. Major rural water and airborne polluters in 1994

pollutants can spread and stay in the rural ecosystem, causing serious damage to agriculture and the lives of rural people. Since the Industrial Revolution, most industries have typically developed in urban areas. Although rural areas may have some location advantages for certain industries, which prefer to be closer to the sources of their raw material, rural industrial development on a massive scale has never occurred in the past (Fothergill 1985; Fulton 1974). The environmental impact of rural industrial development has thus never been thoroughly examined.

Since the sweeping economic reforms in the late 1970s, China has been experiencing dramatic rural industrial development. Nearly 25 million rural enterprises have emerged in the countryside. More than 130 million rural workers are working in these rural industries, which generate more than 70 percent of the gross rural output. Among all the rural

Table 1. Total rural industrial pollutant discharges between 1985 and 1995

Years	1985	1990	1995
Wastewater (million tons)	1,610	1,830	5,900
Industrial dust and fly ash (million tons)	n/a	3.3	5.8*
Solid waste (million tons)	50	115	410
Sulfur dioxide (million tons)	n/a	2.2	5.5

* 1994 data.

Source: data derived from Zhang 1994, 449; UNDP 1996; and China Commercial Time 1997.

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Wastewater Sources	Percentage [1]	Airborne Emission Sources	Percentage [2]
1.) Paper mill	43.8	1.) Brickyard	43.0
2.) Tannery	6.8	2.) Cement plant	20.5
3.) Printing and dyeing mill	6.6	3.) Metallurgical industry	11.0
4.) Brewery	3.8	4.) Coking plant	3.3
5.) Amylum-related	1.5	5.) Sulfur refining	0.2

[1] Percentage of total amount of industrial wastewater in the rural areas.

[2] Percentage of total amount of airborne emissions from the rural industries.

Source: data derived from Zhang 1994, 449.

enterprises, more than 93 percent are run by rural households (MoA 1995a). The rapid rural industrial development has significantly increased the amount of industrial pollutants in these rural areas (Table 1). In some regions, untreated pollutants discharged into water and air have seriously damaged the quality of the rural environment. According to a joint report by the United Nations Food and Agriculture Organization, United Nations Development Program, and the Ministry of Agriculture of China (FAO, UNDP and MoA 1997), about 1.4 million hectares of cultivated land are irrigated by untreated wastewater. Recent studies (USEB 1997; Mei 1992) suggest that between ten and twenty million hectares of China's farmland suffer from severe heavy metal contamination (such as chrome, arsenic, lead, and zinc), so that pollutant residues have appeared in increasing quantity in the food chain. Among the numerous activities that rural enterprises produce, the engage in production of paper, dye, cement, bricks, amyl, chemicals, coke, and porcelain; electroplating; tanning; abstracting sulfur, mercury and gold, and brewing are among the most harmful to the rural environment (UNDP 1996). These processes have a very high rate of wastewater discharge and of toxic chemical poisoning (Table 2). Along with a rapid growth in pollution related production, the amount of pollutant discharges has also been increasing very quickly. For example, the paper and pulp industry, the biggest wastewater producer among the rural industries, expanded 24 times from 1978 to 1993 while the other two major polluters, the cement and brick-making industries, expanded more than 38 and 6 times respectively (Table 3). Although this period was also characterized by the

Table 3. Production Expansions of the Top Three Rural Polluters, 1978-1993

Year	Paper Making	Cement	Bricks
	(million tons)	(million tons)	(billions)
1978	0.4	3.3	73.0
1979	0.6	5.4	89.1
1980	0.8	6.7	110.4
1981	1.0	9.2	124.0
1982	1.1	12.2	152.4
1983	1.4	15.3	170.5
1984	1.6	19.4	202.7
1985	2.2	29.1	238.5
1986	2.6	36.7	280.3
1987	3.3	45.0	330.2
1988	4.1	54.2	368.2
1989	4.6	63.1	356.1
1990	4.8	55.8	339.1
1991	5.7	70.8	355.0
1992	7.9	103.8	495.4
1993	10.3	127.6	494.8

Source: RSYC 1994, 341.

enactment and vigorous enforcement of environmental legislation, it seems that the environmental law effort was unable to contain the rapid expansion of industrial pollution in the rural area.

While the economic success of rural industrial development has been widely acclaimed, increasing rural industrial pollution is starting to draw attentions from both the government and researchers. Recently, the central government decided to directly intervene in the clean up of the Huai River basin, a region undergoing very intensive rural industrial development. As part of the operation, thousands of small enterprises were shut down (Beijing Review 1997). Although the unusual intervention by the central government was acclaimed in the official media as a success, some polluting industries have reportedly reemerged when the crackdown is over (Chen, Wu and Zhou 1999). Clearly, there are implementation problems that have yet to be solved.

The lack of success of China's environmental legislation in rural area seems to suggest that these legislation and implementations have failed to consider the unique environmental behavior of the rural enterprises and the difficulties in environmental law enforcement in rural area. This paper is intended to investigate the limitations that exist in rural area restricting the implementation of the government's environmental legislation. It begins with a review of the development of China's environmental policy in the context of incentives and punishments with respect to the environmental behavior of industrial firms. Through a case study at the village level, this paper identifies a number of constraints for the enforcement of the government's existing environmental policies.

China's Environmental Policy

China's first nationwide environmental legislation was enacted in 1979. Since then 16 laws have been enacted by China's parliament, the National People's Congress. These laws are further enhanced by more than 20 regulations from the government, to ensure their proper implementation. In addition to the system of regulations, there are environmental rules, methods, and standards formulated by the National Environmental Protection Agency (NEPA). There are local Environmental Protection Bureaus (EPBs) affiliated with provincial, municipal, and county level governments, responsible for enacting these rules, methods, and standards (Figure 1). This bureaucratic-authoritative approach can be problematic in environmental protection as well as in other policy areas because it is often characterized by poor upward flow of information and a bureaucratic execution of commands (Ross 1988). Since the early 1980s, the emphasis of the environmental policy has been shifting from such a direct "com-



Source: Wang 1992, 457.

Figure 1. China's Administration System for Environmental Protection.

mand-and-control" system to the use of economic instruments. The government attempts to use pricing mechanisms such as tax, finance and investment incentives to influence the behavior of polluters and to internalize environmental costs associated with production and consumption. The existing economic instruments include a pollution levy system, rewards and premiums for efficient resource use, a financing mechanism for environmental protection, and a discharge permit system (Wang and Lu 1997; Zhang 1994).

A major question raised by researchers concerns how the economic instrument approach is implemented (Chan, Wong, Cheung and Lu 1995; Wang and Lu 1997; and Zhang, Wu and Wang 1997). Given that China's political and economic system is still in transition from a socialist command system to a market-oriented one, researchers have voiced their doubt about the successful implementation of these economic instruments. The policy has already been criticized as unsystematic: "Little attention has been paid to the environmental implications of macro-economic policy adjustments nor to opportunities for better integration of environmental and sectoral policy . . . Environmental and sectoral policies are often inconsistent, and even in conflict" (Wang and Lu 1997, 20). For rural enterprise development, the government faces a serious dilemma. On the one hand, more than 200 million rural laborers are no longer needed by agriculture. It could become a major disaster if these rural workers would move into the urban areas. The government hopes that the development of rural enterprises will generate jobs locally and retain these excess laborers in the rural areas. On the other hand, the development is almost certain to result in a severe environmental destruction if not closely monitored and supervised. Studies have suggested that the environmental consequences of rural enterprise development are often overlooked (Maurer, Wu, Wang and Xue 1998).

The economic instrument approach is also criticized for its abusive implementations at the local level. Studies reveal that some local authorities make use of the system to broaden their sources of income by levying pollution charges on the provision of civil services, such as water supply. As a result, some enterprises pay charges on both fresh water intake and wastewater discharge (Zhang, Wang, Wu and Wang 1997). Thus, enterprises in some areas might have to pay a significantly higher amount for discharges although the pollution levy in general is often believed to be too low to meet the treatment and damage costs. Such an inconsistency in environmental policy implementation sends a wrong message to the polluters and allows them to question the legitimacy of the pollution levy system.

With economic regionalism diminishing central government control, questions are also being arisen on how local governments balance their needs for economic development and growth with the need for environmental protection (Chan, Wong, Chueng and Lo 1995; UNDP 1996). Some local governments may become more lenient towards the polluters when they are under pressure to meet their investment goals (Zhang and Ferris 1998). In fact, some studies have already indicated the existence of local resistance to the pollution levy system (Florig, Spofford, Ma and Ma 1995; Wang and Lu 1997). Wang's study indicates that "local governments believe that the implementation of economic instruments will unduly penalize industry and therefore influence the economic competitiveness of sectors or products in domestic and international trade markets" (Wang and Lu 1997, 28). Since the administrative structure (Figure 1) has all the local EPBs under dual supervision of both the local governments and the upper level EPBs, local EPBs may find it difficult to carry out their mandates. The central government tries to remedy these problems by using the mass media, environmental organizations, environmental education programs, and environmental students' movements to raise public awareness of environmental problems (Hamburger 1998). These efforts unfortunately, can hardly reach the rural areas because of poor communication, few education programs, and low level of literacy among the rural people.

Although the environmental policy is widely considered as a success in the urban areas with the visible decline in pollution, the rapid increase in rural industrial pollution and the fact that only a small number of rural polluting enterprises have actually paid for discharges have clearly suggested the failure of this policy in the rural areas (Florig et al. 1995; Zhang et al. 1997; Abigail 1997). China's rural enterprises have unique development style and exhibit great regional differences. As well, most rural enterprises are too small to afford the necessary equipment and advanced techniques needed for the proper treatment of industrial wastes (Lin 1997). Irregularity and instability in their production are cited as major problems for environmental law enforcement in rural area (Amsden, Liu and Zhang 1996). On the other hand, government pollution abatement funds usually do not go to the rural enterprises as many EPB officials worry that the funds may not be used for environmental purpose owing to a poor monitoring system (Wang and Lu 1997). Studies conducted by the United Nations Development Program indicated that poor environmental monitoring makes it impossible to collect accurate data pertaining to the pollution situation in the rural area, thus making it difficult to formulate a sound pollution control strategy (UNDP 1996). While many problems are presented in various studies pertaining to environmental destruction by the rural enterprises, few studies provide sound solutions for the proper implementation of the environmental legislation. Since the rural industrial sector is expanding at a rate of nearly 20 percent each year, there is an urgent need to have an effective approach with respect to rural industrial pollution.

The Case Study Area and Research Methodology

The town of *Qinshan* is located midway between Shanghai and Hangzhou, the two metropolitan areas in the region. For nearly two decades, the town and its area of jurisdiction² have been enjoying a very high level of industrial development. The annual per capita income of the rural households reached 3,155 *Yuan* in 1994, comparable to the nationwide average urban income (MoA 1995a; MoA 1995b). The study area is within a region characterized by a canal network, which is traditionally used for both waterway transportation and agricultural irrigation. While this historical endowment of waterway transportation helped the development of the rural industries, it also accelerated the spread of industrial pollutants into the agricultural eco-system as many rural enterprises rely on the canal water for production and waste discharges (Figure 2).

The field study first identified the industrial polluters in the area. In order to distinguish polluting and non-polluting enterprises, some local government archives were utilized, which contain the detailed production information of each enterprise registered in the town's industrial office. According to the types of production, a number of enterprises were selected whose production might generate pollution. Each of these enterprises was then consulted for the type, estimated amount and concentration of the wastes produced. This preliminary survey requested the selected enterprises to provide informa-



Figure 2. Distribution of Pollution Makers in Qinshan.

tion with regard to only the three major types of pollution: solid wastes, wastewater and airborne emissions. The information collected was verified based upon the national standards for relevant industrial pollutants formulated by the National Environmental Protection Agency (NEPA 1992-1995). If any of the three types of pollutant discharges exceeded the national standard, the enterprise would be considered as a pollution maker. Following this method, a total of 41 enterprises were concluded as pollution makers in the study area.³

A questionnaire survey of these 41 enterprises was conducted and yielded 31 valid cases. Although there were serious pollution makers among the 10 enterprises that declined to respond to the survey, they as a whole did not appear to be significantly different from the 31 valid cases with regard to the seriousness of pollutant discharges. The key variables included in the questionnaire are types of production, equipment, and pollutants; estimated amounts of pollutant discharges; waste treatment procedures; discharge locations; years of operation; operation permits from the local environmental agency; and the managers' attitudes toward waste treatment. Information related to enterprise ownership, general operations, management style, employees as well as business performance were also collected. Some of the discussions in this paper are also based on site observations and interviews with local government officials and enterprise managers.

Research Findings

Development Constraints

The earliest rural industrial development in *Qinshan* can be traced to the early 1970s when the central government launched a major agricultural mechanization program. Once tractors and reapers began to appear in the agricultural plots, workshops to maintain the machinery also appeared. However, these workshops soon found that their machine tools were at rest for most of the year, but that their equipment enabled them to produce certain daily goods and machinery parts to be sold in the urban areas. As a result, some workshops tentatively produced their first-ever commercial products and found them to be much more profitable than agricultural products. As a result, the rural industrial development quickly extended to other trade areas. In *Qinshan*, the earliest practice of rural industrial development included a powder metallurgical factory, a few garment factories and several building material plants. Almost all of the factories were run collectively by the commune or brigades at that time.

Once the rural economic reform of 1979 made individual rural households instead of production teams responsible for the management of the land, it also became possible for rural households to become directly involved in the rural industrial development.⁴ However, such a phenomenon did not appear until the mid-1980s. With rapid capital accumulation, more individual rural households started to join the rush of rural industrial development. Sole and joint ownership quickly became the main component of rural industry. However, because of the rapid development, most householdbased enterprises operated using modest capital. Such modest financial means in rural industrial development has become a major obstacle for clean production. In Qinshan, only one polluting enterprise responded positively to the survey on whether or not it would operate in line with the government's guidelines on industrial waste discharge. In the event that all the rural enterprises would be required to meet a deadline to set up equipment to treat their industrial wastes or face financial penalties, more than 40 percent of the polluting enterprises preferred to rather shut down their enterprises entirely (Table 4). Interviews with some enterprise managers and local EPB officials revealed a huge difference between them on enterprises' financial responsibility for pollution. Almost all the entrepreneurs overestimated the amount. Obviously, many rural entrepreneurs were simply fearful of being forced to pay. It appears that smaller rural enterprises were particularly sensitive to any fee for discharges.

Production involving small amount of fixed capital and large labor force enables enterprises to start up quickly and to change activities easily. While these conditions for production might allow the enterprises to respond quickly to a capricious market, they also make the industries vulnerable to a possible government attack on polluting industries, that is, when the government starts to crack down polluting industries they can easily shut down the factories without incurring too many losses. The existence of such a fluky mentality

Table 4. Reactions to government order for waste treatment

Reactions	Number of Enterprises	Percentage
Fully comply	1	3.2
Partly comply	5	16.1
Ignore orders	12	38.7
Terminate production entirely	13	41.9
Total	31	100.0

among many of the entrepreneurs seems to have played a very important role in the methods of operation of these pollution-generating activities.

Small-scale industrial activities have also led the rural enterprises to purchase used or disused industrial equipment from urban areas. Rural enterprises purchasing used equipment from urban areas began to accelerate from the early 1990s. These tactics coincide with the stricter environmental law enforcement in cities, which has forced many urban polluting enterprises either to abandon their out-dated production equipment or to relocate entire factories to suburban or rural areas. For example, the nearby city of Shanghai has recently relocated over 700 industrial enterprises, all classified as "serious polluters," from its downtown area to outlying suburbs as part of a campaign to reduce pollution and make room for the development of the city's service sectors (China Environmental Reporter 1997). The survey in Qinshan asked the polluting enterprises about the origin of their start-up equipment using three categories: new equipment, used equipment from rural enterprises, and used equipment from urban enterprises. Their responses are compared with the number of years of operation of their enterprises. The results reveal that the median age of the rural enterprises using second-hand equipment from urban areas is clearly shorter than the other two groups (Figure 3). The length of the boxes in Figure 3 shows the spread or variability in terms of the number of vears of operation. It suggests that acquiring urban used equipment among the rural enterprises is rather a recent trend.

The reuse of environmentally substandard equipment has led to an increase in the amount of pollutant discharge in villages. Among all forms of pollutants, untreated wastewater discharge has been the most significant problem (Table 5). This is obviously related to the types of polluting industries in the area (Table 6). According to local officials, water contamination has significantly changed the rural people's life-style. No more than 30 years ago, most rural households depended on the canal water for domestic use, but this practice may be gone forever. Even the shallow groundwater, on which most rural households are now relying by using wells, is threatened. Furthermore, water pollution has started to affect agriculture in the region. Laboratory analysis of the



Figure 3. Boxplots for the Years of Operation.

soil and grains in 1993 suggested that they were both contaminated by alien chemicals that could only have come from the industrial wastewater.⁵

Spatial Constraints

One of the major characteristics of China's rural enterprises is their spatial dispersion. This pattern began to be seen in the very early stages of development. Although various factors are discussed in the literature (Byrd and Gelb 1990), limited supply of arable land and tight controls on mobility are considered as the two most important reasons for dispersion. Limited arable land resource became a very serious issue when the baby boomers of the 1950s and 1960s entered the labor force. As of 1994, the average amount of cultivated land area per rural worker dropped to less than 0.2 hectare. In some densely populated provinces, such as Zhejiang province, it dropped down to less than 0.1 hectare (RSYC 1995, IV-73). In these areas, the land that each household received did not require the full-time effort of the rural household. As a result, rural people sought non-agricultural employment once the economic reforms had granted each household the right to manage its own labor force. However, the existence of a household registration system, which gives different treatments to rural and urban residents,6 made it very difficult for excess rural laborers to work in urban areas. Thus, the only option left for the rural households was to find a way that would permit them to work in the non-agricultural sector without moving into the urban areas. As a result, most household-based rural enterprises emerged in villages.

Enterprises scattered in villages and townships make environmental monitoring difficult. Local environmental monitoring officials agreed that activity impacting the envi-

Table 5. Pollution types of the polluting industries in Qinshan

Pollution Types N	Number of Enterprises	Percentage
Solid waste only	1	3.2
Wastewater only	20	64.5
Airborne emission only	0	0.0
Solid waste and air emission	2	6.5
Solid waste and wastewater	4	12.9
Wastewater and airborne emission	1	3.2
Solid waste, wastewater and airborne emis	sion 3	9.7
Total	31	100.0

Table 6. Industrial types of the polluting enterprises

Industrial Types	Number	Percentage
Building materials	9	29.0
Bulb factory	1	3.2
Chemical	3	9.7
Construction	1	3.2
Food processing	2	6.5
Mechanical	2	6.5
Metallurgical	2	6.5
Pesticide	1	3.2
Plastic	3	9.7
Plating	1	3.2
Textile	6	19.4
Total	31	100.0

ronment carrying out by village enterprises were difficult to supervise and control due to the lack of qualified personnel and equipment as well as the instability of rural enterprises. If the pollution levy system were to be enforced, the EPB's revenues from fee collection could drop sharply since it would have to use more of its limited resources to monitor the small and scattered rural enterprises. Since these revenues are essential in the development and maintenance of local waste treatment facilities, the local EPB has to give priority to the larger and more serious polluters. The Qinshan survey reveals that only a small number of the polluting enterprises have been inspected by the local environmental monitoring station based in the county town. Only three of them have received warning notifications from the station, and all these three are located within the town. Field visits to the villages found that factories producing similar types but greater amounts of wastewater had never been inspected by the EPB.

The fact that village-based polluting firms are apt to escape from penalties is probably responsible for the recent increase of polluting industries in the villages. The relative lack of monitoring can become an inducement for the transfer of urban polluting industries into the rural areas. Among those rural enterprises using second-hand equipment from urban areas, as suggested in Figure 3, nearly 80 percent are located in the villages.

For the local EPB, it would be desirable to see a more centralized development of rural enterprises. One of the obstacles that prevents village enterprises from moving into the town has been the continued involvement of industrial workers in agriculture. Although non-agricultural work has become the major economic activity for most rural households with agriculture being virtually sidelined, few rural households have decided to give up agriculture entirely. Since neither the governments nor the rural enterprises provide employment insurance for the workers, rural people are concerned that their basic economic security might be threatened in the event that their enterprises fail to succeed. Furthermore, significant fluctuations of the rural industrial sector in the late 1980s and the early 1990s confirmed the rural people not to solely rely on the enterprises. In continuing to engage in agriculture, they believe they can at least maintain a basic living (Xu 1994). In Qinshan, it is not uncommon for a rural family to spend most evenings and weekends working on the land. Since a rural household has to maintain the means for agricultural production, such as tools and storage spaces, it is highly unlikely that they will be able to move into the towns while still engaged in agriculture. Since almost all of the employees, and in most cases even the owners, do not wish to abandon the land, maintaining a comfortable travelling distance between enterprises, residences and farming plots becomes an important issue in the location decision of new enterprises. Thus, the agricultural connection of enterprise workers has been primarily responsible for the dispersion of rural enterprises.

In recent years, with intense market competition, more rural enterprises appear to be willing to relocate into the town. The survey finds that more than 15 percent of the village-based polluting enterprises in Qinshan expressed their willingness to relocate. The majority of them agreed on the reasons for such an intended move, that is, to replace the traditional canal transportation with more efficient automobile transportation. Some enterprises intend to relocate simply because their villages are too small to make road construction worthwhile. This pursuit of economies of scale might bring more village enterprises into the town and could make it easier for pollution control. Nevertheless, with the majority of rural households still reluctant to leave their villages and new household-based enterprises continuing to emerge, it is unlikely that such a move could dramatically change the spatial setting of the rural enterprises.

Administrative Constraints

China has a highly centralized public finance system dating back to the 1950s. A town government was only allowed to retain a small amount of income to offset certain expenditures. These budgetary revenues normally provide only minimal support for the basic operation of a town government. In addition, there are so-called extra-budgetary revenues that are not subject to budgetary supervision. These revenues include supplementary agricultural, industrial and commercial taxes allowed by the central government. Before widespread rural industrial development, these revenues were largely based on supplementary agricultural tax and were very small. The development of rural industries has significantly changed the situation. In *Qinshan*, almost all of these extra-budgetary revenues now come from the enterprises. They have become crucial for community and infrastructure development, aid to agriculture, as well as monetary rewards for government employees. These extra-budgetary revenues have become the greatest incentive for town governments in rural industrial development (Song and Du 1990).

In *Qinshan*, the town government is also the direct owner of many enterprises including a medium-sized cement plant, several building materials and prefabrication plants, and a sizable textile mill. The local government, therefore, has a double role: town government administration and the management of enterprises. Furthermore, the amount of revenue from these government-run enterprises also becomes an important factor in the personal income of government officials. It goes even further in the villages where cadres held concurrent positions in collectively owned enterprises. This twofold role of the local governments does not seem to have raised many objections from the local people. In fact, many rural people believe that it has been helpful for the success of some enterprises since such an income system adds some extra motivations for these cadres to work harder. However, this twofold role of local government becomes problematic when officials are involved in pollution control. Since the county EPB is unable to monitor all the rural enterprises' environmental behavior, much of these responsibilities were transferred to the town authority. Some town government officials thus become the *de facto* executors of environmental laws. Because of a conflict of interest created by the twofold role of the local governments, the local officials appeared to be reluctant in penalize their enterprises for waste discharges.

Further discussions with local officials in *Qinshan* revealed that unequal enforcement of environmental laws in the whole region could be another reason for their protective approaches in pollution control. They worried about the negative impact on the competitiveness of local products in the market if strict pollution control would be imposed. They believed that forcing an enterprise operating on a marginal profit to retool or set up a costly waste treatment facility would be tantamount to ordering it to shut down since the costs would have to be transferred to its products and the rising prices of its products would force it out of the market anyway. The direct consequences for the local government, if

these enterprises were to close, would be rising unemployment and falling revenues, which both the town government as a whole and the officials as individual employees obviously do not want to see. According to the local officials, *Qinshan* would not be willing to undertake environmental reforms unless their competitors in other towns are willing to establish treatment facilities or retool following the same standard and carry these measures out at the same time. Therefore, the multiple role of the town government together with the uneven implementation of environmental laws makes it very difficult for local authorities to penalize enterprises for environmental pollution.

Discussion and Conclusions

The core of the economic instrument approach to environmental protection is to make polluters pay. With difficulties in pollution monitoring and the reluctance of local authorities to cooperate, the economic instrument approach has not been working in the rural areas. As pollution worsens and local governments wrangle for economic advantages at the cost of the environment, the central government is forced to intervene. However, without the support from local level, such an intervention cannot last. The reemergence of polluting enterprises after the central government's crackdown along the Huai River basin appears to be a good example.

It seems that the economic instrument policy relies too much on a top-down approach in monitoring, control and supervision. While this may work in cities where industries are more concentrated and pollution-monitoring systems are well developed, it can face great difficulties in the rural areas where polluting industries dispersed in villages. Such an uneven implementation of environmental laws between urban and rural areas has been a major reason for the transfer of urban polluting industries into the rural areas. To halt such a dangerous transfer, the policy must be more evenly implemented among urban and rural areas. In rural area, this again requires the support and cooperation at the grass-roots level.

An observation made in the town of *Qinshan* suggests a possible bottom-up approach. Several enterprises in the town jointly installed a device to filter the solid contaminants included in their wastewater before it was discharged into the canal system. Although it was a very rough device, this joint effort did demonstrate a cooperative spirit to reduce pollution. More importantly, the cost sharing arrangement among these enterprises did not create an excess financial burden for the participant enterprises. An important implication of this effort is that it can germinate a good sense of environment among the enterprises, lead them to monitor each other in pollutant discharges, and make them more self-restrained in

their environmental behaviors. It can also become supplemental to enhance the pollution monitoring effort of the local EPBs. If such efforts are well coordinated, it would also become easier for the enterprises to upgrade the treatment equipment when their economic conditions are improved. However, this approach requires a more spatially concentrated development of the rural enterprises.

The dispersion of rural enterprises is one of the key factors for the environmental destruction of rural areas. A more centralized development would make it easier for environmental monitoring and waste treatment. As suggested by the relocation of some village enterprises in Qinshan, it can also become beneficial to the development of rural enterprises. In order to achieve this goal, rural households should not be encouraged to engage in dual economic activities in both industrial works and agriculture. A significant portion of them should concentrate on their work in towns, particularly when enterprise incomes have become sufficient for them to make a decent and stable living in towns. However, this would require a fundamental change of the government's policy for rural areas. Further studies will be needed to address issues related to such a transformation. As already indicated in this study, the existing land tenure system, the household registration system, as well as the establishment of a social security system are among the most urgent ones.

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Endnotes

- 1. Telephone: (514) 848-8064; Fax: (514) 848-2057; Email: haiqing@vax2.concordia.ca
- 2. Town (*Zhen*) is the lowest level in China's urban system. A town administration normally has the jurisdiction over several administrative villages. Each of these administrative villages may contain a number of small and naturally formed villages. A town is normally upgraded from a township, which is administratively similar to a town but not included in the urban system.
- 3. Each year, all enterprises report to the town's industrial office their production details. This record was used in identifying the pollution sources in the study area. However, it should be noted that there were a considerable number of unregistered enterprises, mostly household-run workshops, which never report their production details to the industrial office. Among them, there were pollution makers. Due to difficulties in verification, this study did not include these unregistered enterprises. For simplicity, this study did not take into account pollution types other than solid wastes, wastewater and airborne emissions.

- 4. Although each rural household was given a small piece of land for family management before the reform, this land was often too small to make a living for the whole household. Almost every rural worker, therefore, had to work in a collective production team that managed most of the land. The rural economic reform redistributed the land to individual rural households and made each rural household responsible for production decisions and labor management. This opened the door for rural people to work in the non-agricultural sector.
- Samples collected and tested by the prefecture environmental monitoring office.
- As part of this scheme, basic urban supplies and services, such as grain rations, education, employment, and housing, were available only to urban residents.

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