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SURVEY ON CHINA'S INDUSTRIAL TRANSFORMATION AND POLLUTION GENERATION

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ABSTRACT

The country's finite freshwater resources are being strained by ever-increasing water demands resulting from population and economic development throughout China's industrial revolution. Meanwhile, extensive water contamination that developed as a result of industrialization exacerbates water scarcity. This is an excellent piece of work. Provides an overview of water scarcity and pollution in the United States. China, and investigates the fundamental causes of water contamination—increased pollution levels. industrial, municipal, and agricultural pollution discharges excessive water abstraction from the environment, and poor water quality Management of water resources and pollution control enforcement regulations. The three most important factors that influence long-term water quality economic change, and technological advancement After that, institutional and policy changes, as well as innovation, are addressed. in particulars The quality of China's surface water has deteriorated during the past two decades. China is approaching a critical juncture in its development, according to decades of evidence. Pollution reduction and improvement are two goals of the industrial transition. There will be a degradation in environmental quality. Measures and policies To speed up the process, institutional changes are also suggested. China's surface water quality is improving.

KEYWORDS: *Water Resources, Water Pollution, Water Abstraction, Economic Transformation Technological Innovation, Policy And Institutional Reform.*

1. INTRODUCTION

The geographical mismatch between the allocation of water supplies and the distribution of population and industrial activity exacerbates the water shortages (Cheng and Hu, 2012). For example, the North China Plain, which is home to about a third of China's population, gross domestic product (GDP), and industrial production, has just around 8% of the country's water resources. The southwest, on the other hand, possesses almost a fifth of the country's water resources but generates less than 1% of the country's GDP and industrial production (Cheng et al., 2009). Water resources in China are also subject to significant inter- and intra-annual fluctuation, making efficient use of surface water resources difficult [1]. The pronounced continental monsoon climate causes 60–70%, and even up to 80% in the north, of the precipitation to fall during the summer, with precipitation in the wettest years up to eight times greater than in the drier years (Cheng et al., 2009; Liu and Speed, 2009).

Since the 1950s, the inexorable rise in population, along with rapid industrial growth and urbanization since the 1980s, has dramatically increased water demands from agricultural, industrial, and residential uses, while the physical water supply has remained largely unchanged. This results in widespread water shortages, especially in the country's northern and western regions. The unequal geographical distribution of water resources has resulted in inadequate water supply in 400 of China's 668 cities, with more than 100 of them suffering severe water shortages (MWR (Ministry of Water Resources), 2003). If present practices and levels of industrial and economic growth continue, balancing the limited availability of water resources with the growing demand brought on by economic development and population expansion may become much more difficult in the near future. The water scarcity is made worse by deterioration in water quality caused by human pollution releases, since the contaminated water may be of little or no value [2]. Over the last few decades, China's surface water and groundwater have been heavily contaminated by industrial and urban wastewaters, domestic wastes, and agricultural operations (Liu and Diamond, 2005). Only 64.2 percent of river sections, 58.8% of large lake regions, 81.1 percent of major reservoirs, and 23.2 percent of groundwater wells could satisfy the quality requirements for drinking water sources, according to the most recent national water quality study (MWR (Ministry of Water Resources), 2012). Meanwhile, severe pollution has made 17.2% of river sections, 24.7 percent of lake regions, and 4.5 percent of reservoirs essentially unusable (MWR, 2012). Because the highly contaminated water could no longer fulfill the criteria of the intended uses, certain water-related activities and expenditures, such as water transfers and water abstraction, have been jeopardized [3].

Water pollution's root causes when the quantity of contaminants released into a water body exceeds the natural ecosystem's capacity to handle them, water pollution occurs. Water quality has deteriorated considerably in China over the past few decades, owing to large increases in pollution discharges and increasing freshwater removal from the environment. Meanwhile, poor water resource management methods and lax implementation of environmental laws have exacerbated water quality degradation. Industrial wastewater, municipal wastewater, and agricultural pollutants are the three main causes of water contamination. China's increasing industrialization and urbanization, along with changes in farming methods, have resulted in a significant rise in pollutant discharges and widespread water contamination. The water pollution issue was exacerbated by a considerable lag in the building of urban infrastructure for the collection and treatment of industrial effluent and sewage, as well as increased soil erosion from deforestation and excessive grazing, and over-applications of agrochemicals. When rivers (and their tributaries) run through highly populated regions, huge amounts of wastewater from industrial and municipal sources frequently cause significant degradation of water quality (World Bank, 2006) [4]. Organic pollutants (such as petroleum hydrocarbons), nutrients (nitrogen and phosphorus), and different heavy metals are all significant contaminants in water systems. In the past, industrial effluent was the primary source of water contamination in China.

Over the last three decades, fast industrial change has dramatically increased the growth of large-scale energy and metallurgical production, resulting in a commensurate rise in pollution emissions. The predominance of small-scale manufacturing facilities and family-based workshops, which often used obsolete and inefficient technology, resulted in huge quantities of industrial waste and wastewater, which were largely disposed of without adequate treatment. The level of pollution varies considerably depending on the industry. There is significant contribution of the top polluting industries in terms of wastewater, COD, ammonium nitrogen (NH_4^+–N), heavy metals, and petroleum hydrocarbon discharges from industrial sources. The paper and paper products sector is the largest producer of wastewater volume (18%) and COD (23%), as well as a significant source of NH4 +–N. The raw chemical materials and chemical products sector is the most significant source of NH4 +–N (35.3%), as well as wastewater, COD, and petroleum hydrocarbons. The non-ferrous metal manufacturing and processing industry (27.5 percent), the leather, fur, and feather product manufacturing industry (19.4 percent), the metal product manufacturing industry (17.7%), and the non-ferrous metal ore mining industry (17.7%) are the main sources of heavy metals (14.0). These four sectors together accounted for almost 80% of heavy metal emissions from industrial sources. The coal mining and washing sector (17.1 percent) and the ferrous metal production and processing industry are the main discharge sources of petroleum hydrocarbons (16.1 percent). Despite remaining a major source of water pollution, the volume of industrial wastewater discharged into the aquatic environment had stabilized, and COD and NH4 +-N contributions had been steadily declining over the past decade. Over the last three decades, China has experienced the world's largest scale of urbanization, with approximately 150–200 million people migrating from villages and rural towns to cities. Over the next four decades, China's urban population is expected to rise from 43 percent to 70 percent [5].

Rapid urbanization has resulted in a significant increase in water consumption in cities, as well as the discharge of municipal wastewater Municipal wastewater production increased by about 6% per year between 1997 and 2011, reaching 42.8 billion tones. The volume of municipal wastewater and its pollutants (COD and NH4 +–N) loadings had been gradually increasing, canceling out any potential improvement in water quality from lower industrial wastewater discharge The rapid industrial expansion and urbanization in China has outpaced the development of treatment capacity for industrial and municipal wastewaters. Between 1995 and 2008, the overall capacity of wastewater treatment grew almost tenfold, reaching roughly 83 million tons per day, but the percentage of wastewater treated increased just slightly, from nearly 20 to 66 percent (MEP (Ministry of Environmental Protection), 2009). The lack of sewage collecting networks, in particular, has resulted in underutilization of municipal wastewater treatment plants in many places (World Bank, 2006). In comparison to their bigger counterparts, mid- and small-sized communities have spent much less on wastewater treatment, and substantial amounts of wastewater have been released straight into surface water bodies (World Bank, 2006) [6]. Worse, in villages and rural towns, wastewater collection and treatment infrastructure was almost non-existent. Domestic garbage and wastewater often ended up in small streams linked to major rivers and lakes in southern China, where there are many lakes and extensive networks of waterways.

Overall, large quantities of untreated industrial and municipal effluent contaminated receiving water bodies severely. Agricultural runoff is the most common and major non-point source of surface water contamination in China. Chemical fertilizer application increased by about 5 times between 1978 and 2004, with the average application level reaching around 420 kg/ha/year in 2004 (World Bank, 2006). Similarly, between 1992 and 2002, the use of agricultural pesticides more than doubled (World Bank, 2006). Entrophication in lakes and near-shore marine waters is primarily caused by excessive fertilizer use and inefficient irrigation practices (MEP (Ministry of Environmental Protection), 2012). Water pollution caused by agricultural sources has received far less attention in China than pollution caused by industrial and municipal sources, owing to the difficulty of monitoring and regulating such non-point sources. It's also difficult to account for agricultural sources' contribution to surface water pollution because of their dispersed nature. For the first time in 2011, pollutant emissions from agricultural sources, such as farming, intensive aquaculture, and intensive livestock farming, were recorded in the national wastewater pollutant inventory. Agricultural sources released a total of 11.86 million tonnes of COD in 2011, accounting for 47.4% of total wastewater COD from all sources. Meanwhile, agricultural sources released a total of 0.83 million tonnes of NH4 + –N, accounting for 31.8 percent of total wastewater NH4 + –N from all sources. As a result, agricultural pollutant emissions require special attention in China's water pollution control efforts. Since the late 1970s, when China's economy began to take off, water consumption has been rising. Between 1980 and 2007, industrial water demand almost quadrupled, while municipal water consumption has continuously increased owing to population expansion and urbanization (MWR, 2010) [7]. The industrial sector consumes approximately a quarter of the country's water, and with continuing industrial development, the percentage of water dedicated to industrial output is projected to rise. Municipal water use accounts for about 13% of total water consumption, with rising population, faster urbanization, and improved living conditions in both urban and rural regions anticipated to increase demand for clean freshwater. On the other hand, with the development of water-saving irrigation technology and drought-resistant crops, agricultural demand, which accounts for over 60% of China's water supply, has been decreasing (MWR (Ministry of Water Resources), 2007, 2010, 2012). Increased abstraction from groundwater and water channels has mostly fulfilled growing water demand, causing severe harm to freshwater and estuarine ecosystems (Shen and Speed, 2009; Wang et al., 2009).

2. DISCUSSION

Despite the fact that the local offices are led by the central government, they are politically and financially reliant on the local government. Complex and interconnected institutional structures, as well as bureaucratic procedures, provide major obstacles to efficient water resource management and pollution control (Liu and Speed, 2009; Winooski, 2009). Moreover, despite the existence of a reasonably well-established legal framework governing environmental protection, applicable rules and regulations are often disregarded. On a national level, this is due to a general policy framework that prioritizes economic growth above environmental and natural resource protection (On a local level, incoherent implementation of national policies and enforcement of laws and regulations across administrative regions, divergent interests among different levels and branches of government, and a lack of power and resources for relevant governmental offices all contribute to the problem OECD (Organization for Economic Cooperation and Development). The buildup of non-degradable contaminants released from both point and diffuse sources is a common cause of water pollution. Due to the participation of numerous local governments, effective implementation of water pollution management laws is especially difficult since the major rivers all flow through distinct functional zones (e.g. forest areas, agricultural areas, and industrial areas) and administrative districts.

In China's multi-tiered environmental law enforcement system, the government body that directly oversees water pollution, the Ministry of Environmental Protection (MEP), has very little administrative authority and institutional capability (Winalski, 2009). Furthermore, the government has relied largely on ineffective regulatory tools to combat water contamination (Bernstein, 1997). Despite the fact that the federal government promotes environmental preservation and sustainable development, local governments, which are more concerned with local economic growth and social stability, often fail to hold polluting businesses responsible. Figure 2: Water resources (surface water and groundwater) and water abstraction for agricultural, industrial, and municipal purposes in China's main river basins. result in pollutant discharges far exceeding total maximum daily loads (TMDLs), i.e., the maximum amount of pollutants that water bodies can receive while still meeting targeted quality standards (USEPA (US Environmental Protection Agency), 1991), and, as a result, widespread surface water pollution. Long-term water quality improvement economic, technical, and policy drivers One of the major problems for China's water resource management is how to satisfy growing demands resulting from fast economic and social development with limited water supplies of generally low quality). Based on the experiences of industrialized nations, we think that economic, technical, and policy factors play critical roles in encouraging long-term water conservation and quality improvement.

In terms of supply, not only are existing water resources restricted, but the expense of additional exploitation of water resources in China is becoming costlier. Despite the increased water demand caused by rapid economic development and population growth over the last three decades, future economic transformation may potentially assist decrease water abstraction from the environment The assumption that present levels of water usage habits and efficiency would persist in the future is frequently used to estimate future water demand. Globally, the doubling of the population, coupled with rising per capita demand, has resulted in a four-fold rise in water abstraction over the last half-century, yet worldwide water withdrawal still only accounts for 8% of renewable freshwater resources; SEAC (Swedish Environmental Advisory Council), 2007). Economic transition from extensive to intense development enabled nations to improve productivity without increasing their use of natural resources, particularly water.

Continued economic growth is anticipated to have an effect not just on water consumption, but also on water quality by decreasing the overall quantity of pollutants The organization of China's water resource management and pollution control administration system, as well as the related administrative responsibilities of the government agencies involved. Environment. Massive industrialization has always been followed with environmental degradation in industrialized nations, according to history. For economic development, traditional economies generally rely on low-productivity rural industries (such as farming and livestock rearing). As nations move from traditional to developed economies, manufacturing is stressed in order to create a strong industrial basis that will sustain socioeconomic growth, while service activities will acquire greater weight as development progresses. When a consequence, as the country's economic structure changes, the pollution intensity of GDP rises at first, then declines (Auty, 1997). With continuing increases in personal income, manufacturing's significance in the broader national economy will decline, while individuals will begin to pay more attention to health and environmental quality (Lee et al., 2009). As a consequence, during the late stages of a country's industrial transition, pollution will be reduced and environmental quality will improve (Auty, 1997; Lee et al., 2009). During the industrialization of many industrialized nations, such as the United Kingdom and the United States, this pollution development pattern was plainly visible [8].

2.1.*APPLICATION:*

China has managed to develop a very strong manufacturing-based economy over the last few decades and has surpassed the United States as the world's second biggest economy. Since the late 1970s, when China's economic reforms started, the country's GDP has been steadily increasing. Between 1979 and 2012, the average yearly GDP growth rate was above 10%. Figure 4b depicts the relative contributions of the primary, secondary, and tertiary sectors to China's GDP between 1952 and 2012. China's economy has progressed in a predictable pattern from heavy dependence on agriculture to a strong manufacturing-based economy, which will ultimately convert into a service-based one. During the early stages of industrialization, China depended heavily on heavy industries, which generated substantial pollution emissions. To make matters worse, many industries used to run on obsolete machinery and processes, resulting in considerable resource waste and high pollution emissions. Since the late 1970s, the secondary sector (manufacturing and industries) has continuously accounted for over half of the country's GDP, while the tertiary sector (i.e. the service industry) has steadily grown in significance since the mid-1980s. In 2012, China's secondary and tertiary industries accounted for 45.3 and 44.6 percent of GDP, respectively. By the end of 2013, it is anticipated that the tertiary sector will have surpassed the secondary sector as the biggest in the national economy. These developments indicate that China is on its way to becoming a service-based economy. China wants to transition from a low-cost manufacturing economy to a knowledge economy focused on scientific innovation in the long run. Meanwhile, as the general population becomes wealthier, they are becoming more worried about widespread environmental degradation. Domestic and international forces are also exerting considerable pressure on the government to address environmental issues. Overall, China is likely to reach a tipping point in its industrial transformation, when increased productivity will reduce pollution [9].

2.2.*ADVANTAGE:*

Although it is impossible to forecast future water demand, it is fair to expect that the strain on water resources from continuing population and productivity increase will be partly offset by improvements in water use efficiency (Economy, 2009). Increased water demand and open market competition are anticipated to stimulate technical innovation, resulting in improved water resource management via conservation, recycling, and reuse, as well as more water efficiency services (Cheng et al., 2009). Simultaneously, the development of more effective but lower-cost treatment technologies may significantly enhance the quality of wastewater released while also facilitating water recycling and reuse. Despite recent advances, substantial improvements in water usage efficiency have yet to be achieved. Agriculture, being China's biggest user of water, used to lag well below the world's advanced standards in terms of water usage efficiency. In 2006, the national integrated irrigation water usage efficiency was 0.38, less than half of what industrialized nations achieved (MWR, 2007). By 2011, the national integrated irrigation water usage efficiency had been increased to 0.51 by adopting water-saving irrigation technology and strengthening water management practices (MWR, 2012). Industrial production consumes almost a quarter of China's water, and industrial water usage is inefficient as well. With considerable efforts on industrial water conservation, recycling, and reuse, China was able to decrease water consumption per million Yuan industrial production (value added) from 17,800 m3 in 2006 to 7800 m3 in 2011, which was still much greater than that of industrialized nations (o5000 m3) (MWR, 2007, 2012; NDRC, 2007). In 2006, the recycling rate of industrial water was just 60–65 percent, compared to 80–85 percent in industrialized nations (MWR, 2007; NDRC, 2007). Municipal wastewater reclamation in China was still in its infancy compared to industrialized nations, with just 4% (0.98 billion m3) of total municipal wastewater recovered in 2006 (MHURD (Ministry of Housing and Urban-Rural Development), 2007). Clearly, more technical innovation may assist decrease water demands from the agricultural, industrial, and municipal sectors by improving water usage efficiency and boosting wastewater recycling and reuse [10].

2.3.*WORKING:*

In China, the economic revolution that took a century in the West was completed in less than three decades, followed by enormous environmental issues. Since the early 1980s, environmental protection has been established as one of the fundamental national policies in the face of extensive environmental degradation caused by rapid industrialization, population expansion, and inadequate environmental monitoring. China's comprehensive regulations and pollution control methods, which were mainly modeled after those of developed nations, have reduced the pace of environmental deterioration and avoided large-scale environmental disasters. China has supported sustainable development as a national priority and set the aim of creating a resource-saving and environmentally friendly society, as the limitations of limited natural resources and environmental deterioration on future growth become more apparent. Market-based water pricing, based on the experiences of east European countries over the last two decades, could lead to a significant reduction in the use of chemical fertilizers and thus non-point source pollution in the agricultural sector, while pollution from industrial sources could be reduced by phasing out outdated production technologies and adopting clean technologies (World Bank, 2006). Increased water and wastewater treatment prices may reduce public water use, allowing a larger percentage of municipal effluent to be treated by existing facilities (World Bank, 2006). Similar policies are being implemented or considered in China's economic restructuring and environmental management. China's shift to right-based water resource management began in 2002 with the revision of the Water Law (enacted in 1988). (Cheng and Hu, 2012). A water rights licensing system was created, as well as a compensation system and a river basin management system (People's Congress, 2002).

In order to implement integrated water resource management, several water authorities and similar bureaus were established at the province, municipal, and county levels (Jiao, 2006). China's mainly supply-driven water resource management policies and practices have been successful in balancing limited water supplies with rising demands from the agricultural, industrial, and municipal sectors. Nonetheless, demand-side management methods targeted at increasing water efficiency, decreasing wasteful water usage, and encouraging use efficiency and conservation are available. The Special Programmed on Water Pollution Control and Treatment will invest a total of 35.6 billion Yuan between 2008 and 2020 to control pollutant discharges, strengthen monitoring and early warning capacity, restore water quality, ensure drinking water safety, achieve breakthroughs in key pollution control technologies, and improve the country's water pollution innovation ability. Such extensive pollution control methods have improved the water quality in several of the formerly severely contaminated rivers and lakes, at least in part.

3. CONCLUSION

Water scarcity and pollution in China are major issues with substantial worldwide economic, social, and environmental consequences. Increased pollutant discharges from industrial, municipal, and agricultural sources, excessive water abstraction from the environment, and inadequate water resource management and implementation of pollution control laws all contributed to widespread contamination of surface water. Economic development gives the money to invest in water-saving and treatment technology, as well as making policy measures more affordable, as the country's economy shifts from extensive to intense mode. Water-saving technologies and wastewater treatment technology innovation, as well as their application, may assist decrease water consumption by increasing water usage efficiency, recycling and reuse, and reducing pollutant discharges. Reforms in legislative and institutional frameworks may aid in improving water resource efficiency and reducing pollution. Contrary to popular belief, China's future growth will be stifled by water scarcity and pollution. Instead, a combination of economic, technological, and policy drivers not only allows for the decoupling of economic growth from water consumption, but also promotes continued improvement in surface water quality. Despite the limitations of limited water supplies, China is anticipated to be able to continue its industrial transformation and maintain economic development while properly preserving the environment and public health.

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