



An indicator approach to industrial sustainability assessment: The case of China's Capital Economic Circle

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ABSTRACT

While industrial sector has long been the economic engine of China's Capital Economic Circle (CEC) including Beijing, Tianjin, and Hebei province, the consequences of its rapid expansion such as environmental degradation and social concerns are attracting exceptional attention. In recent years, policies and measures are largely applied to industrial sector of the CEC to find out a sustainable pathway. However, the sustainable development performance is lacking in scientific evaluation. To comprehensively understand the status quo of industrial performance under the pressure of climate change adaptation and mitigation, this study establishes an evaluation framework of sustainable performance for industrial sector of the CEC, synthesizing the economic, environmental and social pillars. Particularly, we use global principal component analysis (GPCA), a dynamic multi-criteria decision making model, to assess the progress of industrial performance in each region from a time series perspective. We find that industrial sectors in all three regions show good trends of sustainable development during 2009–2015. Among them, the industrial sector of Tianjin performed the best and maintained the best improving status because of its positive performance on innovation, employees' benefits, and economic structure. The industrial sector in Beijing had medium performance but it had outstanding advantages on social dimension for its high proportion of R&D employment with high income level. Hebei's industrial sector performed the worst for its relatively lower energy efficiency and heavy industry-based economic structure. The innovation-driven development mode in Beijing and Tianjin provides a direction for Hebei's industrial sectors.

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1. Introduction

In response to the excessive exploitation of natural resources globally, the growing crisis of environmental pollution, and vast social inequality, the idea of sustainable development has been introduced and incorporated into several levels of the society (Waas et al., 2014). According to the Brundtland Report (WCED, 1978), sustainable development was defined as “the development that meets the needs of the present generation, without compromising the ability of future generations to meet their own needs.” Guided by this idea, China proposed a sustainable development strategy in the China Sustainable Development Report (CAS, 1999) and promised to strive to develop it in an efficient manner with minimum environment cost. China's sustainable development

strategy is used to not only guide the country-level economic development but also the sector-specific development progress. When sectors gradually adopt sustainable development, the whole society achieves the goal of sustainable development strategy. It is of great significance for governments and scholars to discuss approaches and pathway towards a sustainable development of industrial sector in China, particularly in the Capital Economic Circle (CEC) that includes Beijing, Tianjin, and Hebei province. The first reason is that sustainable development is the strategic direction for the CEC; and the second reason is that industrial sector is the pillar of regional economy, which significantly impacts economic, environmental, and social dimensions.

1.1. An overview of the industrial sectors in Beijing, Tianjin and Hebei

The CEC was formed considering the background of sustainable development strategy. During the transformation process to the

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sustainable development mode, industrial sector of each region in CEC gradually adjusted to its new functional orientation. As a scientific and technological innovation center, Beijing has highlighted knowledge and green economies, and has attempted to optimize the economic structure by vigorously developing the service sector and reducing the proportion of the industrial sector. Considering Tianjin, it is designed to be a nationwide advanced manufacturing research and development (R&D) base to ensure that the advanced manufacturing industries, such as electronic information, as well as certain strategic emerging industries, such as aerospace, biomedicine, energy saving, and protection industries are given priority to develop. Hebei continues to encourage traditional industries, in order to develop as a new industrial base and undertake the transformation of scientific and technological achievements created by Beijing and Tianjin.

Industrial sector of the CEC significantly impacts economic, environmental, and social dimensions. It is the pillar of regional economy, accounting for a large proportion of the regional gross domestic product (GDP). In comparison to the end of the 11th Five-Year Plan, the industrial value added (IVA) at constant prices in each region significantly improved. For example, in 2010, the IVA of Beijing, Tianjin, and Hebei was 264.8 billion yuan, 451.93 billion yuan, and 869.59 billion yuan, respectively; while in 2015, the IVA increased to 351.53 billion yuan, 845.94 billion yuan, and 1329.03 billion yuan, respectively, growing by 32.75%, 87.19%, and 52.83%, respectively. Also, industrial sector in each region has a different structural feature (see Fig. 1). Considering the industrial sector of Beijing, the top five highest IVAs were in the manufacture of automobiles (MA), production and supply of electric power and heat power (PSEH), manufacture of medicines (MM), manufacture of computers, communication, and other electronic equipment (MCC), and processing of petroleum, coking, and processing of nuclear fuel (PPCP). Their total IVA accounted for over 60% of the whole industrial sector. Considering Tianjin, the top five industries were smelting and pressing of ferrous metals (SPF), MCC, MA, manufacture of food (MF), and manufacture of raw chemical materials and chemical products (MRCMCP), whose total IVA accounted for approximately 50% of the whole industrial sector. Considering Hebei as the industry-specific IVA data could not be obtained, this study cannot describe the industrial structure. However, from the perspective of light and heavy industries, it is observed that majority of the IVA was derived from the heavy industry, accounting for over 75%. Although the IVA of the industrial sectors in the CEC region showed an increasing trend, the growth rate slowed down annually from 2010 to 2015, which is related to the increased IVA proportion of the tertiary industry. This means that the economy gradually turned to the tertiary mode, but the IVA

proportion continued to account for over 15% in Beijing, and over 40% in Tianjin and Hebei province.

1.2. Challenges and policy guidance for industrial sector of the CEC

The industrial sector significantly affects the environment as it is the major consumer of natural resources and energy, and also the major emission source of waste. Sustainable development requires industrial sector not only to enhance energy efficiency but also to update its energy structure. The coal-based energy structure has caused several issues, particularly the recent air quality crisis. The fog and haze issue has become a nightmare for people living in the CEC. Although this issue was triggered by complicated factors, the combustion of non-clean coal and air pollution of the industrial sector are no doubt main reasons (Zhang et al., 2013). Governments have encouraged industrial sectors to enhance their energy efficiency and innovation level, which have inevitably changed the employment condition. For example, considering the industrial sector in Beijing, both the proportion and income of R&D employees have significantly increased owing to employment adjustment.

As one of the most important participants of the sustainable development strategy, industrial sectors of Beijing, Tianjin, and Hebei have experienced a variety of policy adjustments during the period of the 12th Five-year Plan. On the one hand, they have changed and upgraded their industrial structure based on their own function of promoting coordinated development; and on the other hand, the policy of reducing excessive industrial capacity requires the industrial sector, particularly the iron-steel, machinery, light, building materials, and electronic industries to control new capacity and eliminate backward capacity. In parallel, the State Council released the *Plan for the Transformation and Upgrading of Industrial Sector (2011–2015)*. The plan emphasized on the whole industrial sector to develop on the basis of five features, namely being innovation-driven, highly-efficient, environment-friendly, and considering people's livelihood benefit and endogenous growth, in order to continuously enhance the industrial sector's core competitiveness and sustainable development capacity (The State Council Of China, 2011). The above political regulations have a complicated impact on the economic growth, resource usage, and social employment structure of the industrial sectors in the CEC region.

1.3. The contributions of this paper

However, the effects of above polices and regulations in practice have been rarely scientifically tested until now. In addition, it is

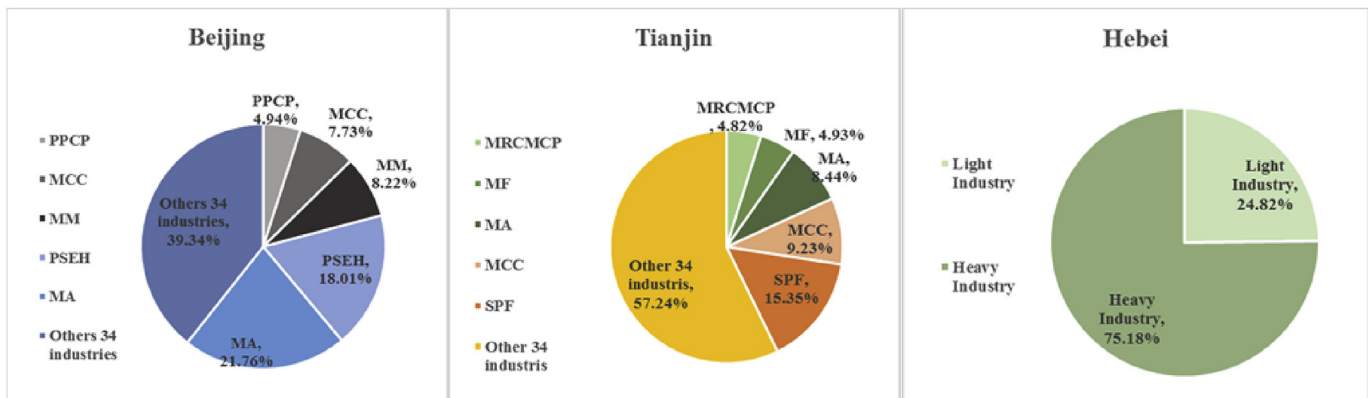


Fig. 1. Industrial structure in Beijing, Tianjin, and Hebei in 2015.

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