



Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Assessment of the practices and contributions of China's green industry to the socio-economic development

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ARTICLE INFO

Article history:

Received 28 October 2015

Received in revised form

30 October 2016

Accepted 10 November 2016

Available online xxx

Keywords:

Green economy

Green industry

Relative green degree

Contribution rate

ABSTRACT

The concept of a green economy has been advocated globally ever since it was first proposed. In China, green economy has been adopted as the national strategy for future economic development. In this paper, we applied statistical description, grey correlation, proportion and elastic coefficient analysis to assess contributions of green industry to the national development from 2008 to 2012. We found that: (1) The average green degree of China's economic industry, 45%, was relatively low. The relative green degrees from high to low were 65% for service industry, 55% for agriculture industry, and 24% for manufacturing industry, respectively. (2) The share that added values of green industry took up gross domestic product (GDP) was between 41% and 48%. Green industry growth was highly correlated to the national economic growth evidenced by their grey correlation coefficient of 0.8532. (3) Both categories and quantities of green products were increasing annually and the growth rate of exported green products exceeded 50% during the study period. The gross domestic product grew by 0.04% owing to the increase of 1% in green product exports. (4) The pulling effect of green industry on employment was not significant, with a contribution rate of about 8%. With governmental support, green industry has made big improvements but there is still a lot of space for it to grow in the long term and it requires greater attention from managers and decision-makers in order to make more contribution to the society and the economy.

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1. Introduction

Since the beginning of the 21st century, the global economy has developed rapidly and scientific innovations have been increasing continuously. However, even as they enjoy abundant material achievements of this period, people are also facing the threats of energy crises, resource crises, climate change, and environmental pollution. At present, shortage of resources and environmental restrictions are the biggest challenges to China's economic growth. Maintaining its rapid economic growth would become increasingly difficult for China as the traditional high-consumption and high-pollution production pattern it adopted at the cost of the environment and resources has been restricted. Hence, China needs to take the green development road by accelerating the promotion of scientific technology, changing its economic development pattern

as rapidly as possible, and eliminating industries that are laggards in this regard.

The Food and Agriculture Organization (FAO, 2006) considered a green economy as an economic system that is mutually compatible with the natural environment. Presently, green economy is considered to be not only environment-friendly—the concept has evolved to include a development issue, that is, the coordinated and unified development of an economy, the environment, and society. The United Nations (UN) Environment Management Group in 2011 pointed out that transitioning to a green economy is the way to achieve sustainable development, which requires breaking resource-intensive growth patterns and transforming to a sustainable development mode to create higher values. The United Nations Environment Programme (2011) developed a working definition of a green economy as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one that is low carbon, resource efficient, and socially inclusive. This definition was widely accepted by scholars. Since then, many foreign scholars have

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extended this concept. Anufriev (2013) noted that the term low carbon green economy mainly refers to reducing greenhouse gas emissions as much as possible during the operation of economic entities, particularly the emission of carbon dioxide. Morgera and Savaresi (2013) explained the concept of green economy from a legal perspective and emphasized the transformation from green development to a green economy.

From the viewpoint of the industrial sector, the most important aim is to develop green industry for developing a green economy. Green industry is formed mainly on the basis of changes to economic growth in reality as follows: 1) Resource supply. Many developing countries including China consumed large quantities of natural resources to develop their economy, which resulted in resource shortage and an energy crisis; 2) Consumption demands. Consumption patterns and tastes of consumers has changed significantly. They are more likely to choose natural and green organic foods because of their increasing green consciousness; 3) Governmental support. Under demands for sustainable development, governments worldwide have successively adopted various kinds of industrial policies that favor green industry. Domestic and foreign scholars define green industry from many perspectives. However, the five main perspectives are sustainable development (Hall et al., 2002), industrial composition (The World Bank, 2010), emission reduction (Najam and Selin, 2011), combination of different benefits (United Nations Development Programme, 2012) and output (NEXT10, 2012), respectively.

Very few studies on direct methods and applications delimitate the contribution rate of green industry. Scholars have conducted researches in some specific fields from their own perspectives. For example, Singh (1999) took floriculture and environmental horticulture as “green industry” and examined the structure and contribution of the green industry as well as the technological developments, marketing research, and issues facing the industry. Xie (2006) in her master's dissertation noted that the tea industry is the important pillar of industry of the country economy in North Fujian province and an effective way to increase the farmers' income under the green management system. Based on green conception, Wang (2009) used analytic hierarchy process, principle component analysis and BP neural network to establish an indicator system, build a model of coordinated relationship between port industry and city development of Dalian and forecast the development trend. She found out that port industry had obvious direct and indirect contributions to economic development and even there was a cyclic relationship between them. But the relationship was still subject to the lack of resources and more serious environmental problems.

However, more researches tend to take forest industry as “green industry”. Whiteman and Lebedys (2006) researched the economic contributions of forestry to African areas based on data from 1990 to 2000 on factors such as forestry employment and trade output value. Cox and Munn (2001) measured the contributions of forest industry enterprises to the economy of countries along the South American and Northwestern coasts of the Pacific Ocean by analyzing the marginal effects of every output value of forest industry enterprise on local total economic output value, social employment, and resident incomes. Wang et al. (2013) demonstrated the contribution of employment in forestry to the green economy from four aspects, total employment in forestry; national forestry land use scale, afforestation scale, and employment potential in forestry; forestry economic and employment growth and employment structural changes; and employment multiplier of forestry and other relevant industries. Xun (2013), using data on Jiangxi province as an example, evaluated and measured the contribution rate of forestry development to the regional economy, employment, and general financial revenue through qualitative and

quantitative evaluation systems by employing the input–output, graphical representation, and regression analysis methods.

For other industries, there is inadequate closely related literature on their green contribution to economy. More emphases are put on industry transformation with green practices to make more environmental and economic progress. Song (2013) addressed that being green of Chinese printing is very meaningful for global printing given the fact that China accounts for almost one fifth of the annual printing industry output values and answered to a series of problems about green printing industry in China, including “why to be green?”, “can it be green?” “what level of the green?” and “how to be greener?”. For industrial green transformation, one mean that is widely advocated for an industry to be green is to exercise green supply chain management (GSCM), which is introduced in various industries, such as furniture industry (Susanty et al., 2016), mining industry (Kusi-Sarpong et al., 2016), automobile industry (Luthra et al., 2016), and power industry (Soda et al., 2016), for a better green development.

There are some scholars who pay attention to a more comprehensive system to explain the contribution of green industry to economy growth. Zhu and Ma (2011) built an index system with 26 indicators covering economic, social and environmental dimensions, and used improved analytic network process (ANP) approach to evaluate effects of regional green industry development, which aimed to help policy-makers to achieve multilateral wins of regional economy, industry, resource and environment. Wang et al. (2005) defined green contribution as comparison between the ratio of local GDP and national GDP and the ratio of local resource consumption or pollutant emissions and national resource consumption or pollutant emissions, then calculated green contribution of energy use, COD emission, SO₂ emission and water resource of 30 provinces in China and ranked them.

China's future economic development needs green revolution for the reason that green industry is very important for China's long-term development. It is hoped to make greater progress on environmental protection, alleviation of the resource crisis and energy use. In China, green development or green management methods or technologies are nationwide spread and operated. But, how green the industry become and how many contributions the industry make to the society are not clear from current literature. In general, current research aimed at economic contribution of green industry is still in the exploratory stage. Therefore, in this paper, we focus on the development status and socio-economic contribution of China's green industry, which would be helpful for policy and decision makers to stipulate more detailed policies in order to stimulate the healthy and orderly development of green industry in China in the future.

2. Materials and methods

Logically, we firstly described the development status of China's green industry. Secondly, we used proportion, grey correlation and elastic correlation methods to assess their socio-economic contributions to economy, environment and society.

2.1. Research methods

The methods used in this paper are as follows:

- (1) Statistical description method: it is used to present the development status and trend of China's green industry.
- (2) Proportion method: it is the most direct method to measure a contribution rate. The economic value added by green industry and the ratio of employment to total economic aggregate and to total employment in the society are

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