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Ecological Well-Being Performance Evaluation of Chinese Major Node Cities along the Belt and Road

Jing Bian [1,2], Feng Lan [1,2,*], Zhao Hui [1], Jiamin Bai [1] and Yuanping Wang [3]

1 School of Management, Xi'an University of Architecture and Technology, Xi'an 710055, China
2 Research Center of Green Development and Mechanism Innovation of Real Estate Industry in Shaanxi Province, Xi'an University of Architecture and Technology, Xi'an 710055, China
3 School of Civil Engineering, Chongqing University of Science and Technology, Chongqing 401331, China
* Correspondence: lanfeng@xauat.edu.cn

Abstract: Under the constraints of resources and the environment, improving the urban ecological well-being performance (*EWP*) is a fundamental requirement and inevitable choice for urban ecological civilization construction and sustainable development. In this paper, 36 Chinese major node cities along the Belt and Road were selected as the research area, and an *EWP* evaluation index system was constructed. The two-stage Super Network Slack-based measure (Super-NSBM) model was used to evaluate the static *EWP* from 2011 to 2018, and the Malmquist–Luenberger productivity index was used to evaluate the dynamic *EWP*. It was found that: (1) The *EWP* value of 36 Chinese major node cities along the Belt and Road from 2011 to 2018 did not reach effectiveness, with Sanya, Shenzhen, and Haikou being the top three performers. (2) In terms of two-stage efficiency, the ecological economic efficiency in the first stage was significantly lower than the economic well-being efficiency in the second stage, which indicated that the low ecological economic efficiency was the main reason for the low average value of the *EWP*. (3) From the dynamic analysis results, the Malmquist–Luenberger productivity index experienced a fluctuating upward trend, and the technical change was the main factor for the improvement in the *EWP*. Finally, policy recommendations were proposed based on the above findings. This study will contribute to the sustainable development of Chinese major node cities along the Belt and Road, and can provide a reference for other Belt and Road regions.

Keywords: ecological well-being performance; the Belt and Road; Chinese major node cities; Super-NSBM model; Malmquist–Luenberger productivity index

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1. Introduction

The "Silk Road Economic Belt" and "21st Century Maritime Silk Road" (short for the B&R) are major initiatives for China to build a new pattern of all-round opening up and to deeply integrate into the world economic system. It is an important initiative to strengthen mutually beneficial cooperation among regions along the route and promote regional stability and development [1]. The Chinese major node cities along the B&R have geographical location advantages and have the ability to gather and radiate international and domestic elements, which are important economic, trade, and cultural hubs within the Belt and Road regions [2]. However, these cities are at different levels of economic development, facing the serious situation of ecological degradation and urban diseases, as well as the burden of promoting the development of environmental industries and the ecological transformation of industries [3,4].

China has issued the Guidance on Promoting Green Belt and Road Construction, the Belt and Road Ecological Environmental Protection Cooperation Plan, and other documents in recent years, which have made green development the core status and important task of the Belt and Road construction. Green development not only reflects the process of adapting natural environment protection to economic and social development, but it also reflects the process of transforming natural resources into economic benefits and human well-being [5]. The *EWP* refers to the efficiency of converting natural consumption into a well-being level [6–8]. The *EWP* mirrors the sustainable development degree of a region or country, which shows that the paradigm of sustainable development has changed from weak sustainable development to strong sustainable development [9,10]. To avoid the phenomenon of the inefficiency of converting natural consumption into a well-being level in the urbanization process, an effective and comprehensive urban *EWP* evaluation is required [11]. It is of great practical significance to evaluate the *EWP* of Chinese major node cities along the B&R to improve the level of green development and promote the implementation of the Belt and Road initiative.

The existing research on the *EWP* mainly focuses on two aspects: (1) As for the *EWP* evaluation, the evaluation methods mainly include the ratio method, data envelopment model (DEA) [6], stochastic frontier approach (SFA) [12], and other methods. (2) The relationship between the *EWP* and other influencing factors [13–16]. To sum up, the relevant literature has rich research achievements; however, there are still some shortcomings. Most of the literature is focused on the static measurement and single-stage evaluation research of the *EWP*, and few studies conducted a multi-stage and dynamic evaluation of the *EWP*. In addition, the existing literature mainly studied the country as a whole or on a province scale, while rarely exploring the *EWP* of Chinese major node cities along the Belt and Road.

Therefore, the objectives of this paper are: (1) to construct an *EWP* evaluation indicator system by selecting a sample of 36 Chinese major node cities along the B&R, and to conduct a static evaluation of the *EWP* by using the two-stage Super-NSBM model with undesirable output; (2) to conduct a dynamic evaluation of the *EWP* by using the Malmquist–Luenberger productivity index; and (3) to propose the countermeasures and relevant policy references for improving the *EWP*.

The contributions of this study are as summarized. First, the two-stage Super-NSBM method with undesirable output was used to evaluate the static *EWP* of Chinese major node cities along the Belt and Road, which can solve the problems that the "black-box operation" of the traditional DEA method. Second, the Malmquist–Luenberger productivity index was used to compare the *EWP*, which can help to explore the dynamic changes in urban *EWP*. Third, 36 Chinese major node cities along the B&R were selected as the research object, which, to a certain extent, makes up for the lack of research on the *EWP* in this region. This paper provides recommendations for the construction and sustainable development of urban ecological civilization, which can promote the high-quality economic and green development of Chinese major node cities along the Belt and Road.

2. Literature Review

Daly first proposed the *EWP* as the ratio of services to throughput [17–19]. The *EWP* reflects the efficiency of converting ecological resources into human well-being [20], which is an effective tool for measuring sustainable development [21]. The *EWP* integrates economic growth, ecological protection, and social well-being improvement, and the essence of the *EWP* lies in obtaining the maximum social well-being with the least transformation of ecological resource inputs [22,23].

In the evaluation system structure of the *EWP*, an important problem is the measurement of the well-being level. Generally speaking, well-being mainly includes objective well-being and subjective well-being [24]. Objective well-being usually involves economic stability, education, and medical security, which reflects people's basic economic and environmental needs. In contrast, subjective well-being reflects people's views and feelings about their environment. In the existing relevant literature, objective well-being indicators are mainly divided into three types: the first type is the indicator based on gross domestic product (GDP). The second type is a single indicator, such as life expectancy at birth, infant mortality, and so on. The third type is the human development index (HDI) issued by the United Nations Development Programme. The HDI is one of the most widely used objective well-being indicators, including education, health care, and economic dimensions.

Regarding the evaluation of the *EWP*, there are three main methods, namely, the ratio method, the DEA method, and the SFA method. For example, Moran et al. chose the ratio of ecological footprint (EF) per capita to the HDI for characterizing the *EWP*, and then measured the sustainable development level between low-income countries and high-income countries [25]. The *EWP* was commonly measured as the ratio of subjective well-being to the EF [26]. Zhang et al. used the ratio method for measuring the *EWP* of 82 countries [20]. Long et al. evaluated the sustainability level of the four island regions in China based on the EF and HDI [27]. Feng et al. used the ratio method to analyze the *EWP*, and they explored the relationship between the *EWP* and industrial structure green adjustment and green total factor productivity in China [28]. Wang et al. [29] used the ratio method, the Dagum Gini coefficient, and the Logarithmic Mean Divisia Index method to explore the *EWP* trend of 30 Chinese provinces and its influencing factors.

Many scholars used the DEA method to evaluate the *EWP*. For example, Iram et al. used the DEA model to study energy efficiency and its impact on carbon dioxide emissions and the economic environmental efficiency in some countries of Economic Co-operation and Development (OECD) economies [30]. Cracolici et al. adopted the DEA model to evaluate the level of sustainable development of Italian regions [31]. Yao et al. studied the spatiotemporal evolution and trend prediction of the *EWP* in China's 30 provinces [32]. Zhou et al. adopted the Super-slack-based measure (Super-SBM) model, the spatial Durbin model, and the Tobit regression model to study the *EWP* of 30 Chinese provinces [33]. Wu et al. used the Super-SBM model and entropy weight models to access the *EWP* of 78 cities in western China [34]. Hu et al. used the Network DEA to explore the urban *EWP* of the spatio-temporal trend of the Yangtze River Delta [35]. Song et al. utilized the Super-SBM model to study the *EWP* of 30 Chinese provinces, and used the spatial Durbin model to explore the relationship between the digital economy, environmental regulations, and the *EWP* [36]. Wang et al. used the Super-NSBM model and DEA window analysis to evaluate the *EWP* of Poyang Lake Area [37].

The SFA model and other methods are usually used for evaluating the *EWP*. For example, Dietz et al. used the SFA model to analyze the *EWP* of 135 nations [38]. Xiao et al. selected 30 provinces in China as research objects, and measured the *EWP* through the improved SFA model [12]. Xu et al. took 57 cities in the Yellow River basin as geographical units, and revealed the evolution of the *EWP* from the provincial and municipal levels by using the SFA method [39]. Some scholars also used the regression method. Knight and Rosa used the non-standardized residual term of the regression function to measure the *EWP* [40]. There are also other evaluation methods of the *EWP* such as the vertical and horizontal opening grade method [41] and so on.

The literature has discussed the indicators and methods of measuring the *EWP*, but there are still the following shortcomings. (1) From the perspective of research objects, most previous studies on the *EWP* have focused on countries and provinces, but there are few studies focused on the *EWP* of Chinese major node cities along the B&R. (2) From the aspect of method, although some studies have used the DEA methods to evaluate the *EWP*, the traditional DEA models treat the whole *EWP* transformation process as a "black box", and usually conduct single-stage DEA efficiency measurements without identifying the effectiveness of each stage. (3) From the aspect of study contents, most of the studies only analyze the statical *EWP* evaluation, but few studies conduct dynamic analyses of the *EWP*.

Therefore, the two-stage Super-NSBM model with undesirable output and the Malmquist–Luenberger productivity index were selected to evaluate the *EWP* of Chinese major node cities along the B&R from 2011 to 2018. The references and policy suggestions were provided for the green construction of the Belt and Road.

3. Methods and Materials

3.1. Methods

3.1.1. Super-NSBM Model Considering Undesired Outputs

The traditional DEA model is based on a radial perspective for efficiency evaluation. It requires all inputs and outputs to be scaled down or expanded in the same proportion and cannot cover slack variables, which usually leads to high measurement results. In order to address this shortcoming, Tone proposed the SBM model considering slack variables in 2001, which can realize the specific slack degree of each input–output indicator in the single-stage DEA efficiency evaluation [42]. The non-angle and non-radial characteristics of the SBM model avoid the bias brought in by the angle and radial selection [43,44]. Then, the Super-SBM model was constructed to solve the problem of effective sorting. However, the traditional DEA model and the SBM model for single-stage efficiency measurement are to evaluate the production process as a "black box", which cannot effectively evaluate the real efficiency of the system operation [45].

The Super-NSBM model with undesired output can evaluate the efficiency of overall decision-making unit and sub-stage efficiency. It distinguishes output into desirable and undesirable output, and provides an effective method to solve the undesirable output problem [46]. Therefore, this paper applies the Super-NSBM model with undesirable outputs to measure the *EWP*. The equations are as follows:

$$\rho_{se}^{*} = \min \frac{\sum_{k=1}^{K} w^k [1 + \frac{1}{m_k} (\sum_{i=1}^{m_k} \frac{s_i^{k-}}{x_{i0}^k})]}{\sum_{k=1}^{K} w^k [1 + \frac{1}{v_{1k}+v_{2k}} (\sum_{r=1}^{v_{1k}} \frac{s_r^{gk}}{y_{r0}^{gk}} + \sum_{r=1}^{v_{2k}} \frac{s_r^{bk}}{y_{ro}^{bk}})]} \quad (1)$$

$$\text{s.t.} \begin{cases} \sum_{j=1,\neq 0}^{n} x_{ij}^k \lambda_j^k + s_i^{k-} = \theta^k x_{i0}^k, i = 1, \cdots, m_k, k = 1, \cdots, K \\ \sum_{j=1,\neq 0}^{n} y_{rj}^{gk} \lambda_j^k + s^{gk} = \varphi^k y_{r0}^{gk}, r = 1, \cdots, s_k, k = 1, \cdots, K \\ \sum_{j=1,\neq 0}^{n} y_{rj}^{bk} \lambda_j^k - s^{bk} = \delta^k y_{r0}^{bk}, r = 1, \cdots, s_k, k = 1, \cdots, K \\ \varepsilon \leq 1 - \frac{1}{v_{1k}+v_{2k}} (\sum_{r=1}^{v_{1k}} \frac{s_r^{gk}}{y_{r0}^{gk}} + \sum_{r=1}^{v_{2k}} \frac{s_r^{bk}}{y_{r0}^{bk}}) \\ z^{(k,h)} \lambda^h = z^{(k,h)} \lambda^k, \sum_{j=1,\neq 0}^{N} \lambda_j^k = \sum_{k=1}^{K} w^k = 1 \\ \lambda^k \geq 0, s^{k^-} \geq 0, s^{gk} \geq 0, s^{bk} \geq 0, w^k \geq 0 \end{cases} \quad (2)$$

In Equations (1) and (2), m_k and v_k denotes the number of inputs and outputs of the k stage, respectively. ϕ_k denotes the number of intermediate indicators. (k, h) denotes the connection from k stage to h stage. x represents the input, y represents the output, z represents the intermediate output, λ^k represents the model weight of the k stage, and ω_k represents the weight of the k stage. s^{k-} denotes the slack variables of input indicators, s^{gk} and s^{bk} denote the slack variables of desirable and undesirable outputs, respectively. The two-stage efficiency evaluation was chosen for this study, so that $k = 2$. At the same time, the weights of each stage are set equally since the first and second stages are equally important.

3.1.2. Malmquist–Luenberger Productivity Index

The Super-NSBM model can evaluate the *EWP* statically for production technologies over a period of time. However, the production process is a long-term continuous activity, where the production technology is constantly changing. The Malmquist index has many advantages, such as the possibility of decomposition and so on. However, the Malmquist index cannot effectively calculate the efficiency of production with undesirable outputs. Chung et al. proposed the Malmquist–Luenberger productivity index (MLPI) [47], which is an extension of the Malmquist index and includes the directional distance function of undesirable outputs. Therefore, the MLPI is chosen for dynamic evaluation of the *EWP*. The MLPI from period t to period $t+1$ is calculated as follows:

$$ML_t^{t+1} = \left[\frac{1 + \vec{D}_o^t(x^t, y^t, b^t; y^t, -b^t)}{1 + \vec{D}_o^{t+1}(x^{t+1}, y^{t+1}, b^{t+1}; y^{t+1}, -b^{t+1})} \times \frac{[1 + \vec{D}_o^t(x^t, y^t, b^t; y^t - b^t)]}{[1 + \vec{D}_o^t(x^{t+1}, y^{t+1}, b^{t+1}; y^{t+1}, -b^{t+1})]} \right]^{\frac{1}{2}} \quad (3)$$

where (x^t, y^t) and (x^{t+1}, y^{t+1}) denote the input and output of t and t + 1 period as the desirable output and the undesirable output, respectively; D_o^t and D_o^{t+1} denote the distance function of t period and $t+1$ period, respectively.

The MLPI can be decomposed into the Malmquist–Luenberger Efficiency Change (EC) and the Malmquist–Luenberger Technical Change (TC):

$$ML_t^{t+1} = EC_t^{t+1} \times TC_t^{t+1} \quad (4)$$

If $ML > 1$, it indicates that the efficiency of the production unit is increasing in both periods (period t to period t + 1). If $ML < 1$, it indicates the efficiency of the production unit is decreasing. If $ML = 1$, it indicates that there is no change in the efficiency of the production unit during this period. If $EC > 1$, it indicates that technical efficiency is improved, and vice versa. If $TC > 1$, it indicates that the technical level is improved, and vice versa.

3.1.3. The Overall Research Method

The overall research method mainly includes three research phases. Firstly, the index system for evaluating the *EWP* was constructed. Secondly, the two-stage Super-NSBM model was selected to statically evaluate the *EWP* of 36 Chinese major node cities along the B&R from 2011 to 2018. Finally, the MLPI was adopted to conduct a dynamic evaluation of the *EWP*. The flow chart of the research methods is shown in Figure 1.

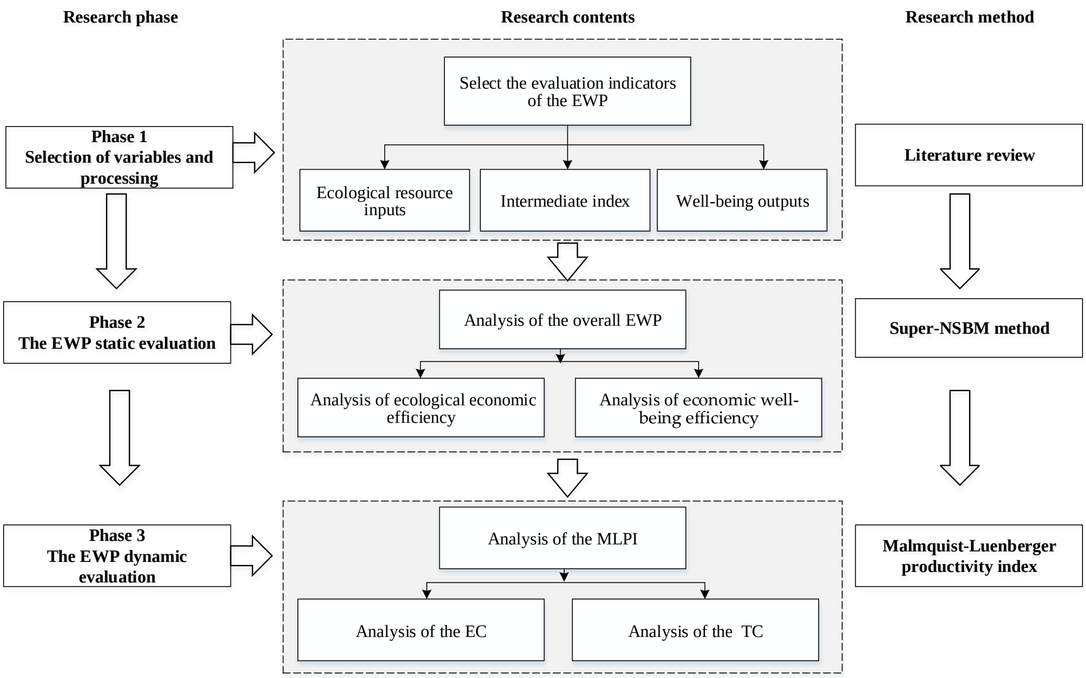

Figure 1. The flowchart of the research methods in this study.

3.2. *Indicator Selection of the* EWP

3.2.1. Indicator System Structure

The *EWP* means obtaining the maximum level of human well-being with the minimum resource and environmental consumption. Figure 2 reflects the *EWP* relationship of two-stage input–output, namely the composition of the ecological economic transformation system and economic well-being transformation system. In the first stage (ecological economic efficiency), ecological inputs are transformed by the ecological economic transformation system to obtain the output. Economic growth is only an intermediate means, not the ultimate goal [48]. In the intermediate indicators, the economic development level is the desirable output of the first stage and the input of the second stage, which is represented by per capita *GDP*. The wastewater, waste gas, and solid waste are selected as undesirable outputs of intermediate indicator. In the second stage (economic well-being efficiency), the final output of economic well-being transformation system is the human well-being level.

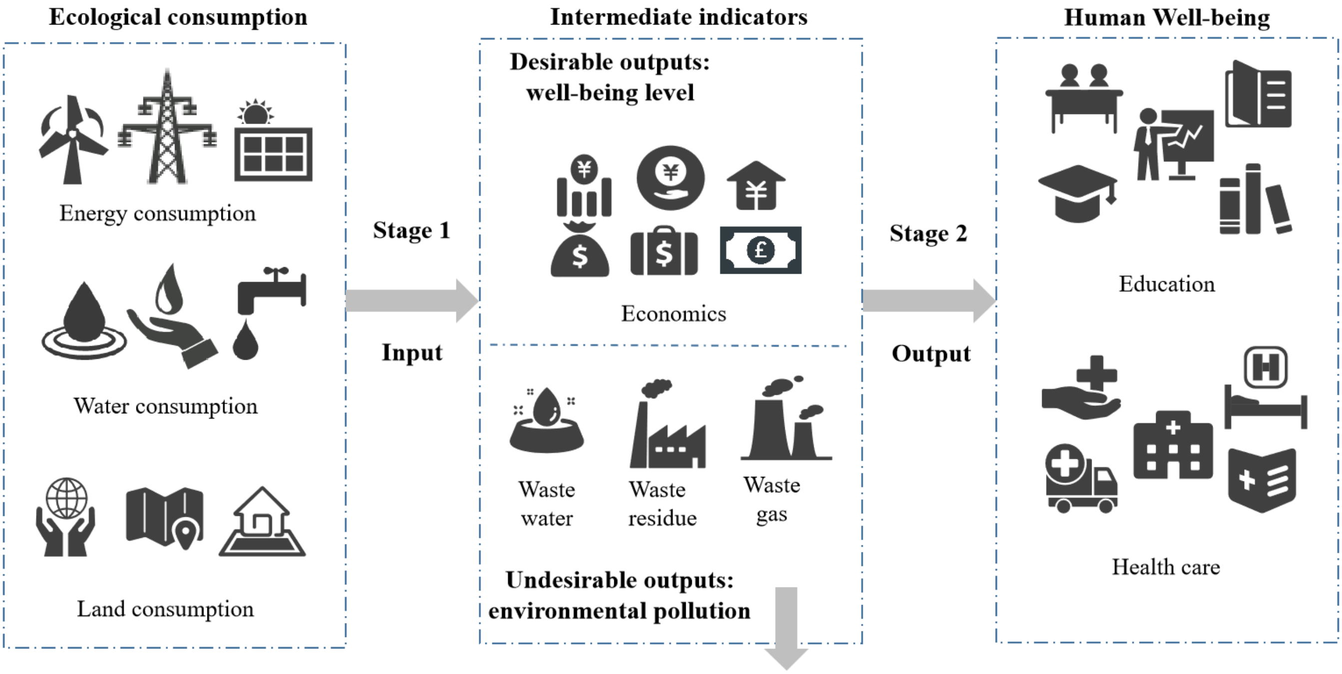

Figure 2. Network structure of two-stage ecological well-being transformation system considering undesirable outputs.

According to the study of Fu et al. [49], the *EWP* consists of two parts: ecological economic efficiency (GDP/EI) and economic well-being efficiency (WB/GDP), indicating that both ecological economic efficiency and economic well-being efficiency should be emphasized in the construction of ecological civilization. Referring to previous literature [50,51], the *EWP* can be expressed by the following formula:

$$EWP = \frac{WB}{EI} = \frac{GDP}{EI} \times \frac{WB}{GDP} \quad (5)$$

where EWP denotes ecological well-being performance. WB denotes well-being. EI denotes ecological input, namely, the amount of resource and environmental consumption. GDP denotes the level of economic development.

3.2.2. The *EWP* Evaluation Index System

(1) Input indicators

Considering the increasingly prominent problems of land resources, water resources, and energy supply in the current urbanization process, land, water, and energy consumption are included in this paper. In the selection of ecological input indicators, the total urban water supply and the total social electricity consumption are selected to measure the urban water resources and energy input indicators [52]. The area of urban construction land is selected to reflect the land resource input indicator.

(2) Intermediate indicators

Due to economic growth being only an intermediate means [51], the *GDP* per capita is represented to reflect the desirable output of the intermediate indicator, which is characterized by per capita *GDP*. The undesirable outputs mainly consider the three indicators, and wastewater discharge, sulfur dioxide (SO_2), and soot/dust are chosen to reflect the environmental pollution of the city.

(3) Output indicators

The output indicators of well-being are evaluated from the dimensions of education development level and health care level [11]. The number of college students is chosen to characterize the education level, and the average life expectancy is selected to measure the health care level [53].

Taking into account the availability and continuity of data, the indicator system of the *EWP* is constructed, as shown in Table 1. Per capita consumption of each city is used in the empirical for eliminating the effect of scale. Referring to the relative literature [54,55], all economic data are converted into comparable prices based on the year 2011 in order to reflect the authenticity of the data.

Table 1. The indicator descriptions of the *EWP*.

Stage	Category	Dimension	Secondary Indicators	Unit
Input indicators	Resource inputs	Water consumption	Per capita water consumption	Ton
		Energy consumption	Per capita urban electricity consumption	Kw·h
		Land consumption	Per capita urban construction land area	m^2
Intermediate indicators	Desirable outputs	Economic development	Per capita GDP	Yuan
	Undesirable outputs	Wastewater discharge	Per capita wastewater discharge	Ton
		Exhaust gas emission	Per capita SO_2	kg
		Waste emission	Per capita Soot/dust	kg
Output indicators	Well-being outputs	Education development	The number of college students enrolled per 10^4 persons	Person
		Health care development	The average life expectancy	Year

3.3. Study Area and Data Sources

According to "the Vision and Action to Promote the Joint Construction of the Silk Road Economic Belt and the 21st Century Maritime Silk Road" issued by the Chinese government in 2015, 36 Chinese major node cities along the B&R (Lhasa is not analyzed because of the lack of data) are selected in this paper. The study area is shown in Figure 3. The 36 Chinese major node cities along the B&R have high economic levels and openness, strong functions such as gathering and radiating, as well as have advantages in terms of data availability and comparability. The ecological well-being status of the Chinese node cities along the B&R can reflect the scale and quality of sustainable development. The optimization of the *EWP* of node cities plays an important role in promoting the green Belt and Road initiative, so as to provide a basis for formulating and improving the sustainable development quality policies.

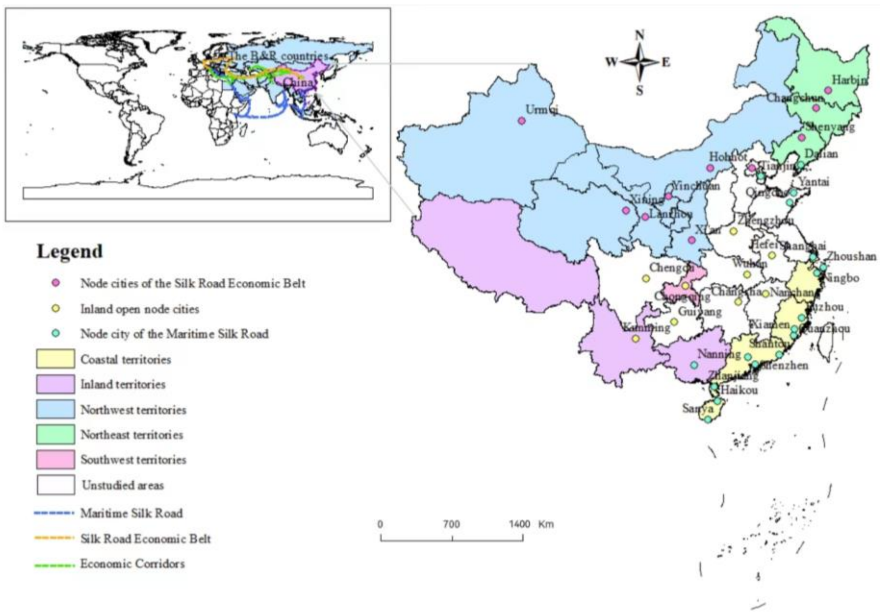

Figure 3. The study area.

According to the national elaboration of the Belt and Road initiative, the Chinese major node cities along the B&R are classified into three categories according to their opening directions and roles: node cities of the Silk Road Economic Belt, node cities of the Maritime Silk Road, and inland open node cities, and the classification is shown in Table 2. Considering that the statistical caliber of some indicators such as water resource consumption has changed since 2019, the study period from 2011 to 2018 is selected in this paper. The study period has experienced the Belt and Road initiative proposed in 2013, the "12th Five Year Plan", "13th Five Year Plan", and "new urbanization construction", which has important research value. Furthermore, the relative changes in the *EWP* of node cities before and after the Belt and Road initiative can be compared and analyzed. The data of indicators were obtained from the China Urban Statistical Yearbook, China Statistical Yearbook, and environmental status bulletins of each city, and so on. Since life expectancy at birth is not included in the statistical yearbooks of most cities, data were collected through the internet or relevant health statistics bulletins. The data source of the HDI was collected from China Human Development Report Special Edition 2019.

Table 2. Classification of Chinese major node cities along the B&R.

Category	Number	Cities
Node cities of Silk Road Economic Belt	10	Beijing, Hohhot, Shenyang, Changchun, Harbin, Xi'an, Lanzhou, Xining, Yinchuan, Urumqi
Node cities of Maritime Silk Road	17	Tianjin, Dalian, Shanghai, Ningbo, Zhoushan, Fuzhou, Xiamen, Quanzhou, Qingdao, Yantai, Guangzhou, Shenzhen, Shantou, Zhanjiang, Nanning, Haikou, Sanya
Inland open node cities	9	Kunming, Hefei, Nanchang, Zhengzhou, Wuhan, Changsha, Chongqing, Chengdu, Guiyang

4. Results

4.1. The EWP Scores and Its Two-Stage Efficiency

The input–output data of Chinese major node cities along the B&R during the period of 2011–2018 were analyzed based on the Super-NSBM model, and MaxDEA software was used to evaluate the *EWP*. The *EWP* scores are shown in Table 3. On the whole, the average *EWP* was 0.901, and the average *EWP* values of 12 cities reached effectiveness (Figure 4). These cities are the most competitive and green development potential cities, with a strong agglomeration effect and scale benefit. Sanya, Shenzhen, and Haikou are the top three performers in terms of the *EWP* value. However, the average *EWP* values of 24 cities were less than one, which did not achieve DEA effectiveness. The cities with relatively low *EWP* values include Xining, Ningbo, and Urumqi, indicating that the transformation of the *EWP* in these cities is not satisfactory and needs to reduce resource waste and environmental pollution for promoting the improvement of the *EWP*.

Table 3. The *EWP* of 36 Chinese major node cities along the B&R from 2011 to 2018.

Category	City	2011	2012	2013	2014	2015	2016	2017	2018	2011–2018
Node cities of Silk Road Economic Belt	Beijing	1.010	0.710	1.000	1.020	1.040	1.030	1.060	1.140	1.001
	Hohhot	1.060	1.040	1.030	1.010	1.000	0.730	1.100	1.030	1.000
	Shenyang	0.720	0.600	0.670	0.660	0.660	0.620	0.670	0.690	0.661
	Changchun	0.810	0.760	0.820	1.020	0.850	1.020	1.120	1.030	0.929
	Harbin	1.040	0.810	1.120	1.060	1.110	1.110	1.060	1.170	1.060
	Xi'an	1.050	1.060	1.100	1.090	1.120	1.320	1.260	1.180	1.148
	Lanzhou	0.690	0.670	1.040	1.010	1.010	1.020	0.800	0.710	0.869
	Xining	0.580	0.580	0.590	0.600	0.620	0.600	0.620	0.530	0.590
	Yinchuan	0.550	0.640	1.910	0.640	0.640	0.620	0.550	0.530	0.760
	Urumqi	0.510	0.410	0.530	0.560	0.560	0.500	0.540	0.530	0.518
Node cities of- Maritime Silk Road	Tianjin	0.670	0.610	0.640	0.630	0.610	0.580	0.670	0.670	0.635
	Dalian	0.540	0.540	0.590	0.590	0.630	0.580	0.580	0.690	0.593
	Shanghai	0.590	0.540	0.600	0.600	0.630	0.570	1.060	0.520	0.639
	Ningbo	0.510	0.490	0.530	0.540	0.530	0.520	0.620	0.480	0.528
	Zhoushan	0.610	0.590	0.560	0.580	0.610	0.610	1.010	1.050	0.703
	Fuzhou	0.860	0.740	0.850	1.010	1.010	1.020	1.030	0.800	0.915
	Xiamen	0.660	0.670	0.680	0.580	0.610	0.650	0.670	0.850	0.671
	Quanzhou	0.720	1.010	1.040	1.030	1.090	1.060	1.070	1.020	1.005
	Qingdao	0.790	0.710	0.750	0.720	0.690	0.770	1.090	1.090	0.826
	Yantai	0.780	0.740	0.780	0.790	0.860	0.770	1.070	1.070	0.858
	Guangzhou	0.640	0.710	0.710	0.730	0.720	0.660	0.750	0.740	0.708
	Shenzhen	1.200	1.240	1.240	1.270	1.240	1.160	1.190	1.260	1.225
	Shantou	1.030	1.000	1.020	1.030	1.020	1.140	1.190	1.040	1.059
	Zhanjiang	1.170	1.220	1.170	1.180	1.180	1.160	1.180	1.180	1.180
	Nanning	0.760	0.760	1.010	0.800	0.900	1.000	1.060	1.030	0.915
	Haikou	1.110	1.120	1.160	1.430	1.340	1.110	1.130	1.250	1.206
	Sanya	1.440	1.570	1.580	1.660	1.620	1.530	1.830	1.750	1.623
Inland Open node cities	Kunming	0.740	1.010	1.000	1.040	1.050	1.070	1.000	0.770	0.960
	Hefei	1.040	1.040	1.020	1.030	1.020	1.030	0.930	0.810	0.990
	Nanchang	1.070	1.060	1.030	1.060	1.050	1.040	1.080	1.080	1.059
	Zhengzhou	1.020	1.050	1.090	1.110	1.070	1.100	1.160	1.120	1.090
	Wuhan	1.000	0.850	0.950	1.030	1.080	1.060	0.800	0.710	0.935
	Changsha	1.110	1.120	1.100	1.080	1.110	1.050	1.110	1.040	1.090
	Chongqing	0.820	0.750	0.650	0.650	0.610	0.580	0.610	0.610	0.660
	Chengdu	0.930	0.850	0.960	1.010	1.010	0.890	1.000	1.010	0.958
	Guiyang	1.070	1.080	1.020	0.840	0.840	0.760	0.700	0.740	0.881
Average value		0.858	0.843	0.931	0.908	0.909	0.890	0.955	0.915	0.901

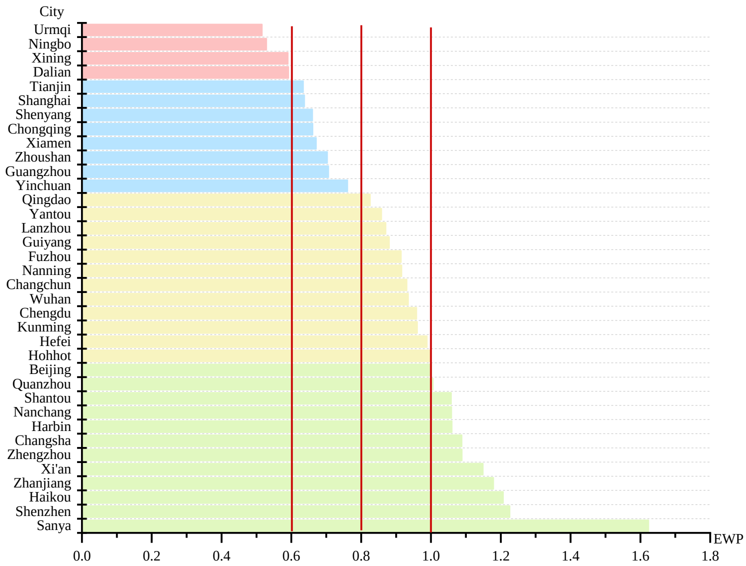

Figure 4. Ranking of the average *EWP* of Chinese major node Cities along the B&R.

From the aspect of the trend, the average *EWP* of 36 Chinese node cities along the B&R in 2011 was 0.858, and the average *EWP* in 2017 was 0.955, which was higher than that in 2011. Especially after 2013, the average *EWP* had a significant decline, and then steadily improved. However, the average *EWP* slightly decreased in 2018, indicating that 2017 was not an inflection point for the continuous improvement of the *EWP*, and the urban development model for the continuous improvement of the *EWP* had not yet been formed.

The level of *EWP* depends on the ecological economic efficiency in the first stage and the economic well-being efficiency in the second stage. Appendix A shows the decomposition of the *EWP* from 2011 to 2018. It can be seen that only Changsha, Sanya, Shenzhen, and Zhengzhou achieved DEA effectiveness, and the efficiency values in the two stages were consistently greater than one. It shows that most node cities failed to achieve the coordinated development of ecology, economy, and well-being during the study period. The average ecological economic efficiency in the first stage was 0.91. Shenzhen, Sanya, Changsha, Beijing, Quanzhou, Zhanjiang, Zhengzhou, Hohhot, and Haikou had an average ecological economic efficiency greater than one. It indicates that the nine cities achieved better-coordinated development of ecological environment and economic growth.

The average economic well-being efficiency in the second stage was 1.09. From Appendix A, 12 cities of economic well-being efficiency achieved DEA effectiveness, among which Haikou, Sanya, Changsha, Xiamen, Zhengzhou, Hefei, Chongqing, Yinchuan, Nanning, Beijing, Kunming, and Lanzhou all had economic well-being efficiency greater than one. It indicates that the ecological civilization construction of these cities promotes the growth of ecological well-being while boosting the development of the ecological economy. Twenty-three cities in both 2014 and 2017 had economic well-being efficiency greater than one. However, cities such as Lanzhou, Yinchuan, and Xining continue to have low economic well-being efficiency, which has become a shortcoming for these cities to improve people's well-being.

4.2. Analysis of the MLPI and Its Decomposition

Based on the static analysis of the Super-NSBM model, the MLPI approach was used to study the dynamic trend of the *EWP*. The average values of the MLPI of 36 node cities, and its efficiency change (EC) and technological change (TC) were obtained by using MaxDEA 8 Ultra software, as shown in Table 4. As a whole, the MLPI of Chinese node cities along the B&R ranged from 1.065 to 1.088 during the study period, and the average value of the MLPI was 1.048. Specifically, 2012–2013 was a period of accelerated growth. 2013–2014 was the recession stage of the MLPI, and 2014–2018 was a rising period of the MLPI.

Table 4. MLPI and its decomposition of 36 Chinese major node cities along the B&R from 2011 to 2018.

City	MLPI	EC	TC	City	MLPI	EC	TC
Changsha	1.025	1.039	1.063	Shenzhen	1.007	1.020	1.027
Changchun	1.043	1.067	1.105	Shenyang	0.994	1.035	1.024
Changsha	0.990	1.017	1.007	Tianjin	1.018	1.145	1.143
Chengdu	1.020	1.038	1.048	Urumqi	1.013	1.083	1.082
Dalian	1.028	1.079	1.109	Wuhan	0.969	1.053	1.005
Fuzhou	1.021	1.058	1.057	Xi'an	1.012	1.019	1.031
Guangzhou	1.035	1.083	1.090	Xining	0.994	1.017	1.007
Guiyang	0.952	1.063	1.012	Xiamen	1.028	1.149	1.173
Harbin	1.028	1.043	1.054	Yantai	1.009	1.022	1.032
Haikou	1.013	1.018	1.028	Yinchuan	1.167	1.030	1.156
Hefei	0.971	1.034	1.002	Zhanjiang	1.001	1.004	1.006
Hohhot	0.991	1.019	1.010	Zhengzhou	1.007	1.024	1.031
Kunming	1.031	1.026	1.042	Chongqing	0.976	1.039	1.006
Lanzhou	1.045	1.057	1.091	Zhoushan	1.080	1.106	1.193
Nanchang	1.002	0.999	1.000	2011–2012	1.065	1.008	1.068
Nanning	1.077	0.965	1.038	2012–2013	1.076	1.140	0.955
Ningbo	1.087	1.104	1.162	2013–2014	0.976	0.975	1.004
Qingdao	1.023	1.062	1.080	2014–2015	1.066	1.015	1.053
Quanzhou	0.999	1.051	1.051	2015–2016	1.068	0.972	1.107
Sanya	0.954	1.017	0.967	2016–2017	1.054	1.038	1.017
Shantou	1.005	1.148	1.148	2017–2018	1.088	0.964	1.133
Shanghai	0.955	0.995	0.946	Average value	1.056	1.016	1.048

The MLPI and its decomposition are further explored, as shown in Figure 5. The MLPI of Chinese node cities along the B&R has obvious regional characteristics. The MLPI growth rates of the node cities of the Maritime Silk Road and inland open node cities from 2011 to 2018 were 6.034% and 0.837%, respectively. The MLPI decline rate of node cities of the Silk Road Economic Belt was 2.931%. The EC reflects the resource allocation capacity, resource use efficiency, and scale agglomeration changes in cities. The average value of EC from 2011 to 2018 was 1.016. In 2012–2013, the average value of EC had improved obviously. This confirmed the proposal and promotion of the ecological civilization strategy in China. The average values of EC of nine cities, namely, Quanzhou, Xining, Shenyang, Hohhot, Changsha, Chongqing, Hefei, Wuhan, Shanghai, Sanya, and Guiyang had not achieved DEA effectiveness, indicating that the resource utilization rates of these node cities need to be further strengthened.

The TC reflects the impact brought about by new processes and innovative technologies, such as energy conservation and emissions reduction, on the *EWP*. The average value of TC from 2011 to 2018 was 1.04. It indicates that the TC plays a major role in the development process of urban *EWP* and is an important driver of *EWP* improvement. There was a decline in 2012–2013, showing a convergence trend, and it reached a maximum in 2017–2018. Except for Nanchang, Ningbo, and Nanning, the average TC values of the other 33 cities achieve DEA effectiveness. The most obvious growth of TC was Xiamen, which showed that Xiamen's technological progress and innovation have developed rapidly in recent years.

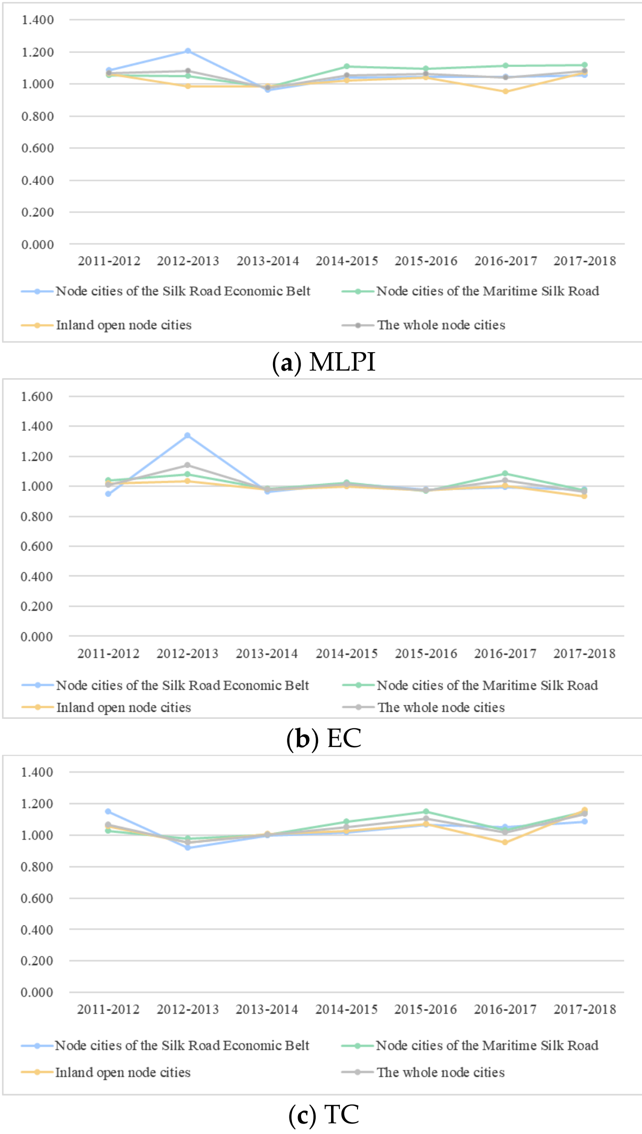

Figure 5. The trend comparison of MLPI and its decomposition of Chinese major node cities along the B&R.

5. Discussion

5.1. Static Analysis on the EWP

The results in Section 4 have revealed the *EWP* and its two-stage efficiency. From a general perspective, the overall average *EWP* of 36 Chinese node cities along the B&R had not reached effectiveness. Sanya, Shenzhen, and Haikou ranked among the top three in terms of average *EWP*. They have some common characteristics in terms of economic development and environmental protection. These node cities are developed port cities along the east coast, with a high level of economic development and scientific and technological innovation. The industries are mainly high-end manufacturing and service industries and have formulated strict regulations on pollutant control, with strong green development capacity and potential [53]. Green construction of the B&R should consider the major Chinese node cities as a key breakthrough, and should focus on the public–private leading toward integrated management for the Belt and Road region [56].

In terms of the two-stage efficiency evaluation on the *EWP*, the ecological economic efficiency in the first stage was significantly lower than the economic well-being efficiency in the second stage. It indicates that the low ecological economic efficiency was the main reason for the low overall level of the *EWP*. The average ecological economic efficiency of the remaining nine cities achieved DEA effectiveness. Especially in some western node cities, low ecological economic efficiency is the main reason for the low overall level of the *EWP*, and these cities should focus on improving ecological economic efficiency. The economic well-being efficiency of 12 cities achieved DEA effectiveness. In particular, the economic well-being efficiency of the eastern developed node cities was at a low level such as in Ningbo. These node cities should broaden the transformation path of the ecological economy, promote ecological industrialization and industrial ecological development, and increase objective well-being.

5.2. *Dynamic Analysis of the* EWP

The dynamic change of the MLPI in Table 4 shows that the MLPI has shown a fluctuating upward trend from 2011 to 2018. This was achieved by the node cities, which successively issued a number of policies and regulations in recent years. This observation mirrored that of Zhang [57], China's "12th Five Year Plan" and "13th Five Year Plan" vigorously promoted the construction of ecological civilization, and 10 of the 36 major node cities of the B&R were approved as the first batch of the ecological civilization construction demonstration areas in 2013. Under the constraint of resources and the environment, protecting the natural environment and ecological resources has gradually become an important task of the state and local governments. The node cities of the Maritime Silk Road ranked first (1.074), and the node cities of the Silk Road Economic Belt (1.062) and inland open node cities (1.017) ranked second and third according to the MLPI, respectively. The MLPI of the node cities of the Maritime Silk Road was significantly higher than the whole average value, and its change trend was the closest to the overall average value. It indicates that the node cities of the Maritime Silk Road have a prominent leading position. As shown in Figure 5, the MLPI of the node cities of the Silk Road Economic Belt in 2013–2014 had significantly declined, which shows that these cities in the northwest and northeast region are more sensitive to the impact of policies.

The average EC of the node cities of the Silk Road Economic Belt ranked first (1.031) and the node cities of the Maritime Silk Road ranked second (1.020), while the inland open node cities ranked third (0.991). The basis of resource allocation capacity and resource use efficiency in the Silk Road Economic Belt is better than that of the Maritime Silk Road node cities, and technical efficiency grows significantly. Moreover, the average TC of the Maritime Silk Road node cities, Silk Road Economic Belt node cities, and inland open node cities were 1.060, 1.041, and 1.033, respectively. This is because the technological innovation levels of the Maritime Silk Road node cities are relatively high. These cities rely on the natural geographical advantages of the coastal areas, and they form a superior cumulative effect of human and capital as well as technology, which has less pressure on the resources and environment [58]. The TC of the inland open cities was the lowest, and these cities need to further promote scientific and technological innovation and technological progress.

5.3. *Comprehensive Comparative Analysis Based on the* EWP *and HDI*

To achieve high-quality urban development, it is necessary not only to improve the efficiency of transforming ecological resources into human well-being, but also to improve the human well-being level. The high *EWP* values of some cities have low natural consumption, but the well-being levels of these cities are not high. For example, Sanya, Haikou, and other cities are of the environmentally dominant type. In this study, the relationship between the *EWP* and HDI was comprehensively analyzed by using a quadrant scatter chart. $EWP \geq 0.8$ donates a city with a good *EWP* level in this study. According to the classification criteria of the Human Development Report, HDI ≥ 0.8 represents a high level of human development. The quadrant scatter chart based on the *EWP* and HDI of Chinese node cities along the B&R is shown in Figure 6.

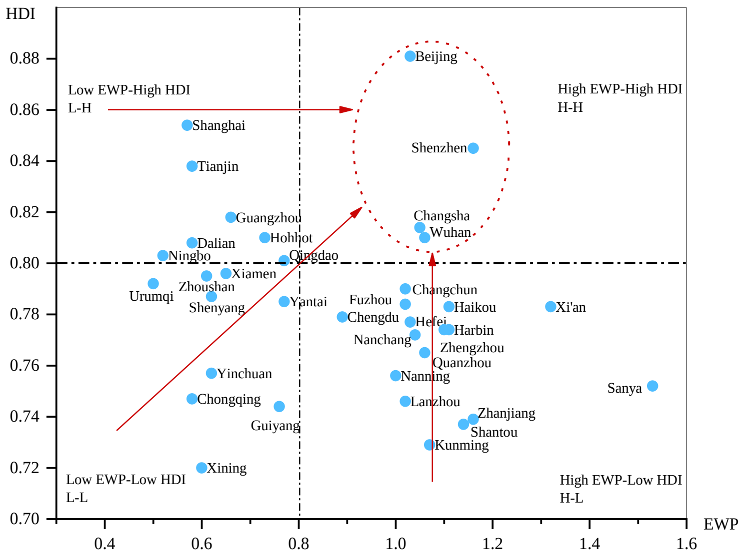

Figure 6. The quadrant scatter chart of *EWP* and HDI of Chinese major node cities along the B&R.

There are four cities of the high efficiency and high well-being (H-H) type, including Beijing, Shenzhen, Changsha, and Wuhan. Among them, Beijing has the best coordination between the *EWP* and HDI. In recent years, the economic aggregate of Beijing and Shenzhen has taken the lead in China. The growth rate of well-being has caught up with the consumption rate of ecological resources. This shows that the efficiency of the transformation of ecological resources into people's well-being in such cities has reached a high level, and that the economy, society, and environment developed in relative coordination. These cities are the ideal state of the sustainable development model, but their proportion is relatively small.

Low efficiency and high well-being (L-H) cities are Shanghai, Tianjin, Guangzhou, Dalian, Ningbo, Hohhot, and Qingdao. The typical feature of these cities is that the well-being level has reached a high level, but the efficiency of transferring ecological resources into well-being is relatively low. For example, Guangzhou has a high HDI level, but this progress is achieved by using a lot of ecological resources. These cities should combine efficiency enhancement and pollution control, promote the advanced and rational development of industries, build a new and diversified industrial structure, and establish an environmentally friendly green economic development model.

Low efficiency and low well-being (L-L) cities include nine cities, namely, Urumqi, Zhoushan, Yantai, Yinchuan, Chongqing, Xiamen, Shenyang, Guiyang, and Xining. The development characteristics of such cities are that the HDI has not reached a high level of development as a whole, and the efficiency of transforming ecological resource inputs into well-being level is low. These cities have relatively large spaces to improve their sustainable development, and the improvement path of capacity expansion, efficiency enhancement, and pollution control should be adopted. In particular, Urumqi, Xining, and other cities belong to underdeveloped regions in western China, which are remote and underdeveloped in the economy, information, and technology.

High efficiency and low well-being (H-L) cities include 16 cities, namely, Changchun, Chengdu, Fuzhou, Haikou, Sanya, Hefei, Nanchang, Harbin, Quanzhou, Nanning, Lanzhou, Shantou, Zhanjiang, Kunming, Xi'an, and Zhengzhou. The development of these cities is characterized by high *EWP*, but the HDI is low. In particular, Sanya has an advantage in the ecological environment, but it still needs to improve its medical, educational, and economic levels.

6. Conclusions and Policy Recommendations

6.1. Conclusions

The two-stage Super-NSBM model was used to evaluate the static *EWP* of 36 Chinese node cities along the B&R from 2011 to 2018. Then, this paper decomposed the *EWP* into two stages, ecological economic efficiency and economic well-being efficiency, and opened the "black box" of the transformation process of urban *EWP*. Finally, the MLPI was applied to conduct the dynamic evaluation of the *EWP*. The following conclusions are obtained.

(1) The overall average *EWP* of 36 Chinese major node cities along the B&R was 0.901, indicating that the overall production frontier had not reached effectiveness. The average *EWP* values of 12 cities achieved DEA effectiveness, and Sanya, Shenzhen, and Haikou were the top three performers. The cities with relatively low-efficiency values include Xining, Ningbo, and Urumqi.

(2) The ecological economic efficiency in the first stage was significantly lower than the economic well-being efficiency in the second stage. It shows that low ecological economic efficiency is the main reason for the low comprehensive level of the *EWP* from 2011 to 2018. Only Changsha, Sanya, Shenzhen, and Zhengzhou achieved DEA effectiveness in two stages, whereas most other node cities along the B&R failed to achieve effectiveness in two stages.

(3) From the dynamic analysis, the average values of the MLPI were all greater than 1. The MLPI from 2011 to 2018 experienced a fluctuating upward trend. The node cities of the Maritime Silk Road ranked first, and node cities of the Silk Road Economic Belt and inland open node cities were ranked second and third according to the MLPI, respectively. From the further decomposition of the MLPI, technological change was the main factor to improve the *EWP* of node cities along the B&R.

Nonetheless, this study has some inadequacies, and it needs further research. Concerning the *EWP* evaluation, there are some limitations in data collection at the city scale. The evaluation indicators need to be improved in the next study, such as residents' subjective perception of the ecological well-being indicator and so on. In addition, the spatio-temporal evolution of the *EWP* of Chinese major node cities along the B&R should be treated as extensions of this study.

6.2. Policy Recommendations

First, it is necessary to consider fully the comparative advantages of Chinese major node cities, which strengthen the interaction and cooperation between the coastal, inland, northwest, northeast, and southwest territories in China. The node cities of the Maritime Silk Road should take advantage of participating in and leading international cooperation and competition. These node cities should reduce their ecological resource consumption and undesirable outputs, promote green and low-carbon development, strengthen resource utilization economization, reduce pollutant emissions, and establish a long-term monitoring mechanism for production pollution and environmental health. The node cities of the Silk Road Economic Belt and inland open node cities should make full use of ecological resources, improve technologies to enhance ecological economic efficiency, actively cooperate with the eastern coastal cities, and promote these cities to be deeply integrated into the Belt and Road construction.

Second, it is crucial to accurately orient and narrow the differences between node cities along the B&R. The cities with high efficiency and high well-being should focus on reducing the input of ecological resources, improving the utilization rate of resources and energy, and reducing pollution emissions. The cities with low efficiency and high well-being need to increase environmental pollution control, strengthen environmental pollution supervision, and control pollutant emissions. The cities with low efficiency and low well-being need to continue to promote economic development, improve the level of education and health care, and improve the quality of life of residents. At the same time, it is also necessary to improve the utilization efficiency of resources and energy, and control the emissions of pollutants. The cities with high efficiency and low well-being should comprehensively improve their economic, medical, and educational service capabilities.

Finally, the Chinese major node cities along the B&R should strengthen the driving role of scientific and technological innovation on green development, and improve the efficiency of resource allocation. The node cities of the Silk Road Economic Belts and inland open node cities should solve the environmental pollution problem in economic development, accelerate industrial transformation and upgrading, and gradually achieve a cleaner production process and green industrial structure. The node cities of the Maritime Silk Road should strengthen the transformation and utilization of scientific and technological innovation, promote the marketization of innovative achievements, establish an incentive and restraint mechanism for scientific and technological innovation, and accelerate the maximization of ecological well-being.

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Appendix A. Decomposition of The *EWP* of Chinese Node Cities along the B&R during the Period of 2011–2018

City	2011		2012		2013		2014		2015		2016		2017		2018	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Beijing	1.16	1.02	0.99	0.56	1.15	1.01	1.15	1.04	1.16	1.09	1.13	1.06	1.06	1.12	1.19	1.33
Changchun	0.75	1.00	0.67	0.97	0.75	1.00	1.07	1.05	0.87	0.91	1.09	1.04	1.09	1.27	1.09	1.04
Changsha	1.17	1.25	1.17	1.27	1.16	1.21	1.14	1.16	1.12	1.24	1.14	1.10	1.07	1.24	1.13	1.08
Chengdu	0.89	1.00	0.78	1.00	0.98	1.00	1.00	1.02	0.95	1.03	0.92	0.82	0.97	1.01	1.06	1.02
Dalian	0.81	0.42	0.74	0.46	0.88	0.46	0.77	0.50	0.72	0.64	0.65	0.60	0.70	0.56	0.82	0.65
Fuzhou	0.82	1.00	0.67	0.92	0.81	0.97	1.06	1.01	1.09	1.01	1.11	1.04	1.09	1.06	0.79	1.00
Guangzhou	0.72	0.68	0.70	0.91	0.73	0.86	0.76	0.88	0.80	0.78	0.81	0.60	0.81	0.80	0.83	0.78
Guiyang	0.87	1.07	0.79	1.17	0.85	1.04	0.77	1.00	0.78	1.00	0.68	1.00	0.63	0.79	0.67	0.92
Harbin	1.01	1.08	0.72	1.00	0.99	1.27	1.01	1.10	1.05	1.26	1.03	1.24	1.03	1.12	1.05	1.42
Haikou	1.00	1.26	1.02	1.26	0.99	1.39	0.99	2.49	0.93	2.02	1.07	1.13	1.02	1.21	0.99	1.67
Hefei	0.99	1.09	0.94	1.07	1.00	1.03	1.02	1.05	0.99	1.04	0.96	1.06	0.88	1.00	0.78	1.00
Hohhot	1.13	1.13	1.09	1.08	1.12	1.05	1.08	1.03	1.09	1.00	0.70	0.92	1.03	1.22	1.04	1.07
Kunming	0.60	0.96	1.01	1.01	0.94	1.00	0.89	1.09	0.90	1.11	0.98	1.16	0.96	1.00	0.75	0.77
Lanzhou	0.57	0.73	0.69	0.60	0.79	1.09	0.89	1.02	0.92	1.02	0.87	1.03	0.76	0.87	0.66	0.73
Nanchang	0.96	1.14	1.03	1.14	0.97	1.07	0.88	1.12	0.90	1.09	0.92	1.09	1.01	1.17	1.00	1.18
Nanning	0.62	0.91	0.61	0.93	0.80	1.02	0.64	0.97	0.76	1.00	0.88	1.00	0.95	1.13	0.97	1.06
Ningbo	0.84	0.40	0.79	0.38	0.82	0.42	0.85	0.42	0.76	0.45	0.86	0.40	0.91	0.52	0.84	0.36
Qingdao	0.79	0.93	0.72	0.80	0.91	0.72	0.87	0.71	0.84	0.66	1.00	0.69	1.12	1.20	1.11	1.20
Quanzhou	0.74	0.86	1.14	1.02	1.16	1.07	1.15	1.07	1.18	1.21	1.19	1.14	0.85	1.16	1.14	1.05
Sanya	1.25	2.29	1.23	3.66	1.25	3.74	1.27	4.93	1.25	4.25	1.22	3.25	1.30	4.72	1.27	4.07
Shantou	0.97	1.06	0.95	1.01	0.78	1.04	0.92	1.06	0.96	1.04	0.89	1.31	1.19	1.46	0.80	1.09
Shanghai	0.93	0.45	0.91	0.40	0.77	0.53	0.72	0.56	0.81	0.56	0.77	0.51	1.16	1.14	0.80	0.41
Shenzhen	1.28	1.49	1.30	1.64	1.30	1.63	1.31	1.76	1.30	1.63	1.24	1.39	1.23	1.47	1.29	1.69
Shenyang	0.70	0.82	0.74	0.52	0.78	0.64	0.73	0.65	0.70	0.69	0.65	0.65	0.65	0.76	0.67	0.76

City	2011		2012		2013		2014		2015		2016		2017		2018	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Tianjin	0.83	0.59	0.81	0.51	0.89	0.54	0.79	0.60	0.77	0.58	0.93	0.43	0.90	0.59	0.89	0.57
Urumqi	0.70	0.38	0.57	0.29	0.78	0.37	0.70	0.46	0.77	0.42	0.65	0.38	0.66	0.45	0.74	0.36
Wuhan	0.93	1.00	0.80	0.95	1.00	0.99	1.11	1.06	1.13	1.17	1.04	1.13	0.79	0.97	0.67	0.92
Xi'an	0.98	1.11	0.88	1.13	1.06	1.23	0.92	1.19	0.98	1.28	0.99	1.95	0.98	1.69	1.10	1.44
Xining	0.66	0.53	0.58	0.60	0.55	0.62	0.55	0.64	0.65	0.61	0.64	0.58	0.69	0.62	0.63	0.45
Xiamen	0.70	0.75	0.70	0.79	0.74	0.75	0.67	0.60	0.72	0.60	0.76	0.61	0.70	0.67	0.79	0.96
Yantai	0.78	1.00	0.73	1.00	0.81	0.92	0.79	1.00	0.89	1.00	0.85	0.84	1.06	1.14	1.17	1.15
Yinchuan	0.63	0.48	0.71	0.63	1.32	20.78	0.68	0.63	0.71	0.61	0.68	0.61	0.66	0.45	0.65	0.44
Zhanjiang	0.95	1.41	1.16	1.58	1.02	1.40	1.06	1.43	1.04	1.43	1.04	1.39	1.06	1.44	1.04	1.43
Zhengzhou	1.04	1.04	1.07	1.10	1.02	1.20	1.07	1.24	1.05	1.15	1.05	1.21	1.01	1.37	1.01	1.28
Chongqing	0.78	0.88	0.69	0.93	0.73	0.62	0.75	0.60	0.74	0.54	0.72	0.50	0.79	0.54	0.82	0.50
Zhoushan	0.98	0.46	0.79	0.53	0.86	0.45	0.95	0.44	0.78	0.56	0.93	0.49	1.04	1.02	1.19	1.11

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