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Retraction

Retracted: Technical Level Assessment Method of Digital Silk Road Development Based on Intelligent Algorithm

Mobile Information Systems

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] H. Li and W. Xue, "Technical Level Assessment Method of Digital Silk Road Development Based on Intelligent Algorithm," *Mobile Information Systems*, vol. 2022, Article ID 4101397, 10 pages, 2022.

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Research Article

Technical Level Assessment Method of Digital Silk Road Development Based on Intelligent Algorithm

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The construction of the Digital Silk Road is an inherent requirement for the Silk Road Economic Belt to break through the global trade barriers and build new international trade cooperation relations. In order to seek the organic integration of open and shared development and correctly deal with the relationship between regional economic and social development and resources and the environment, it is imperative to assess the development technology level of the Digital Silk Road. This paper simultaneously incorporates economic, energy, and environmental systems into the Digital Silk Road development assessment system, uses intelligent algorithms to establish a super-efficient SBM model with green development efficiency as the Silk Road development index, and objectively evaluates the current situation in China. It finds that the overall development technology index of the Silk Road has increased by about 10 percentage points in the last decade from 2007 to 2016, and this feedback indicates that the Silk Road countries along the route are steadily improving.

1. Introduction

The Silk Road has a very long history, since its inception in the Han Dynasty, as a trade route that spans three continents: Asia, Africa, and Europe [1]. However, with the passage of time and the influence of human activities, the ecological environment along the Silk Road has changed greatly over the years, especially due to serious land degradation and an increase in the desert area, which have become serious and prominent environmental problems along the route. Therefore, to redevelop the economy along the Silk Road, the environment and energy are the most prominent issues at this stage [2–4]. Therefore, before full-scale construction of the Silk Road belt, it is necessary to break through the obstacle of environmental and energy problems in development and to plan a development strategy to meet possible challenges [5].

Nowadays, economic globalization and trade liberalization are gradually increasing, and traditional trade barriers such as tariffs, quotas, and licenses are being weakened, followed by a rapid momentum of trade protectionism based on trade barriers, which increasingly affects the smooth flow of economic trade [6–9]. Some developed countries take advantage of differences between themselves and developing countries in terms of environmental standards and technology levels and set up harsh, complicated, and unfair product standards and import and export regulations to restrict the introduction of products from other countries, forming a tight and comprehensive trade protection network [10]. In the name of protecting the global ecological environment, trade barriers are intentionally used by some developed countries to disguise trade barriers as complex but reasonable and legal forms of national trade protection. Some developed countries take advantage of the deficiencies of developing countries in science and technology and set up product standards that developing countries' products cannot reach as trade barriers so that some products of developing countries suffer certain losses and obstacles in export trade [11]. So, it seems that the continuous establishment of trade barriers will have a great negative impact on the export of our products, which has become one of the most serious problems of trade barriers encountered by China since its accession to the WTO. Therefore, in the face of the growing trend of trade barriers, how to achieve production, improve the level of sustainable development, and breakthrough restrictions and losses brought about by trade barriers in developed countries has become an important issue facing China in the current international trade activities and urgently needs to be resolved. With the gradual development of the Silk Road, how to promote countries along the route to break through global trade barriers and realize the development of the Silk Road is a pressing issue now [12–14].

2. Related Work

According to their respective definitions of the meaning of green development, domestic and foreign scholars have proposed green development indexes and their evaluation index systems from different perspectives. Foreign global institutions have already incorporated theories of a sustainable economy and green development at an early stage and analyzed green development levels and green development level assessment models. Reference [15] proposed an eco-efficiency index system to determine the relationship between economic development, natural resources, and the ecological environment in the Asia-Pacific region. Reference [16] proposed the DPSIR assessment model to evaluate sustainable development. This model is based on economic, social, and cultural contexts and completes a causal chain of drivers (D), pressures (P), conditions (S), effects (1), and responses ®, and examines the impact of the environment and people's lives as the economy and society change. The United Nations Bureau of Statistics (1993) (28) has published a handbook for calculating the overall environmental economy, which includes environmental economic balance, degree of exploitation of natural resources, and degree of environmental damage [17]. The environmental resource utilization rate, living standards, economic development potential, government policies, and natural resources are the first level of assessment indicators, and there are 14 secondary coefficients and 23 tertiary coefficients, which together build a sustainable development monitoring coefficient model that includes economic, social, and living aspects. On the basis of the OECD's green development monitoring coefficient model, many countries have continuously improved the coefficient model in line with their actual situation.

Nowadays, most of China's green development models focus on economic growth, resource development, and natural ecology. Reference [18] proposed a green development index for China, which is a multifactor assessment model covering 9 secondary parameters and 55 basic parameters in terms of economic growth sustainability, resource and environmental affordability, and government support, with a focus on the balance of green and development with the power of government, market, and social rules. The KEPI was developed to control and study the status of resource development and utilization as well as pollution emissions in each province and city in China. Reference [19] focuses on an in-depth analysis of the safety and service level of resource development and utilization, and on this basis, also quantifies and evaluates management norms, laws, and regulations, as well as financial, legal, and educational services of natural resource development and utilization. Reference [20] further proposed a resource-environment elasticity decoupling index to analyze the relevance of the resource environment and the economy in depth. [21] With the DEA-RAM model, an efficiency model of industrial economic transformation was established. The estimation results showed that the green scientific research and innovation capacity of different provinces and cities in China has uneven development. The green scientific research and innovation rate in the central and eastern regions is more variable, and the efficiency growth rate in the western region is not high [22–25].

This paper clarifies the current development status of the Silk Road by summarizing the current status of research on the Silk Road; subsequently, a super-efficient SBM model is used to construct the Silk Road Green Economic Belt Development Index and assess the development technology level of countries along the route, so that we can explore spatial and temporal differences in the development of the Silk Road in each region, and find that construction of the Silk Road increased by five percentage points between 2013 and 2016. This means that the "Belt and Road" has brought a positive impact, promoting the economic development of countries along the route while simultaneously promoting the environmental development of countries.

3. Silk Road Economic Belt Structure

Economic development is bound to cause energy consumption, and under the current energy use structure, energy consumption is also bound to cause environmental pollution. The relationship between the environment, energy, and economy has been studied for a long time and is generally referred to as the 3Es problem, the core of which is the inverse relationship between environmental protection, energy use, and economic development [26, 27]. This is one of the reasons why, in the following, we summarize the environment, energy, and economy in one system and use an advanced model of the DEA method, which has the property of a "black box" (no need to explore internal logical relationships). A super-efficient SBM model, as shown in Figure 1 below:

The energy economy subsystem and environmental subsystem in integrated green development are used to build a green Silk Road development system. First of all, in an energy economy system, it is necessary to input indicators required for production, including capital, human resources, technology, energy, etc., which will be transformed into production and finally obtain economic benefits, and form undesired output, i.e., environmental pollution, and pass them to the environmental management system. This system can meet the various material and spiritual needs of people in all aspects of life and is the basis of social development. Second, in the environmental governance system. Due to the

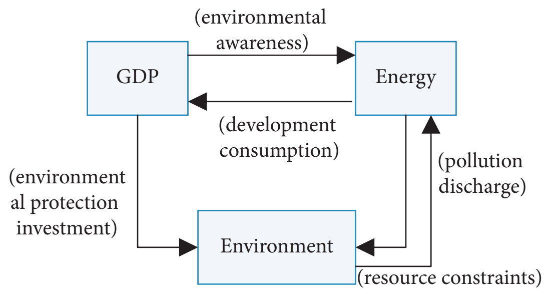

FIGURE 1: Relationship among economy, energy, and environment (3Es).

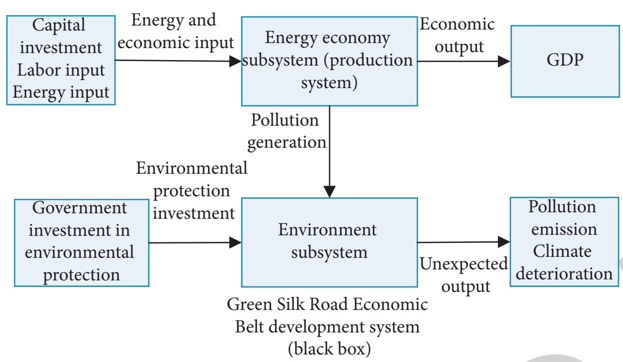

FIGURE 2: Development system of Green Silk Road Economic Belt.

current neglect of clean production, not all resources invested in social production will be transformed into valuable outputs, and various pollutants and other non-desired outputs will inevitably appear. However, since pollutants are socially harmful, every year the government invests part of its GDP in environmental protection, and we invest a certain number of resources in reprocessing them to obtain some relatively less polluting or useful goods. Finally, the energy economic system transmits pollution to the environmental management system, and together they form the framework of the Green Silk Road development. The structural framework of the Green Silk Road development system is shown in Figure 2 below:

The structure of the support system for the construction of the Digital Silk Road is shown in Figure 3. In the past, China and countries along the "Belt and Road" were mainly engaged in transnational cooperation through direct cooperation agreements and memoranda between governments, but with the introduction of the "Digital Silk Road" initiative, international conferences and forums related to it were held one after another. At the same time, more and more enterprises are involved in the construction of digital public service platforms, which can not only support interaction and collaboration between domestic governments and enterprises but also effectively connect with governments of countries along the "Belt and Road" to support communication and cooperation between domestic enterprises and host countries for mutual benefit and a win-win situation [28, 29].

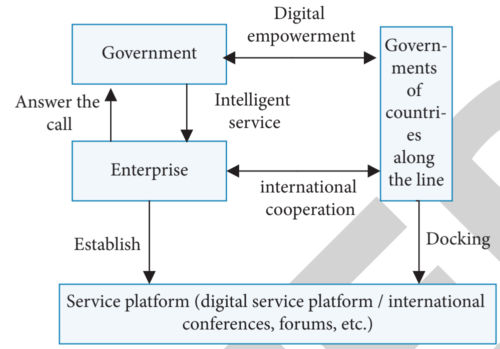

FIGURE 3: Supporting system for construction of the "Digital Silk Road."

Figure 4 shows value co-creation mechanism of the Digital Silk Road initiative.

The shared vision of the Digital Silk Road initiative with countries along the Belt and Road, the construction of digital infrastructure for domestic and foreign residents, the establishment of bilateral and multilateral strategic relationships, and the deepening of trust among partners are all examples of value sharing. The shared value of the Digital Silk Road, as well as the expansion of foreign exports, growth of profitability, and increase in the market value of domestic enterprises through the Digital Silk Road initiative are also manifestations of value sharing. The logic of governance in the construction of the Digital Silk Road is shown in Figure 5.

4. SBM Model

Green development is reflected in the utilization of resources, which means using minimum resources to seek maximum economic benefits. This paper analyzes the development index of the Green Silk Road from the perspective of green development, so as to judge the green efficiency of production and sales along the Silk Road and aims to provide a theoretical basis for the development of the Green Silk Road [30]. The index method and the efficiency method are mainly used to measure the green development index, but the index method is more subjective, and the results obtained are not accurate enough. The efficiency method has two types: parametric and nonparametric. The parametric method requires high technical content and requires the setting of production functions, which is more complicated to operate, so it is not used very often. However, the nonparametric method does not need to set production function, it is less subjective, and the results will not have great errors, so the nonparametric method is mainly used in measuring green development efficiency. In this paper, the linear nonparametric programming method is used by constructing a super-efficient SBM model to analyze the development index of the Silk Road.

The CCR model assumes that return to scale (CRS) remains unchanged, and the resulting technical efficiency includes a component of scale efficiency, which is usually called comprehensive technical efficiency, as shown in formula (1).

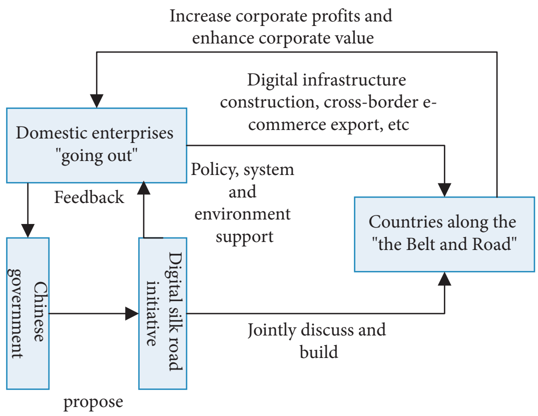

Figure 4: Value co-creation mechanism of construction of the "Digital Silk Road."

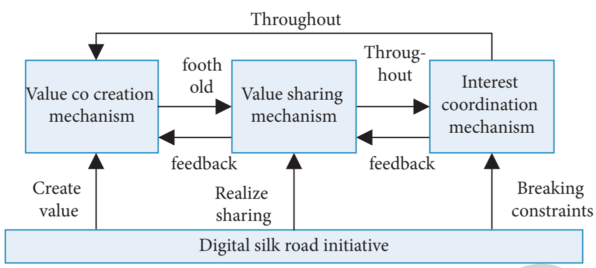

Figure 5: Governance logic in co-construction of the "Digital Silk Road."

$$\min\theta\ \text{s.t.}\ \sum_{j=1}^{n}\lambda_j x_{ij} + s_i^- = \theta x_{jk},$$
$$\sum_{j=1}^{n}\lambda_j y_{rj} - s_r^+ = y_{rk}\lambda \geq 0. \tag{1}$$

A represents different linear combination coefficients of DMU; θ° is an optimal solution that can be obtained by this model and represents efficiency value.

As we mentioned above, the DEA model is a radial model. In the process of measuring the inefficiency level, only a proportional increase or decrease of all inputs or outputs can be measured. However, since there is a certain gap between DMU and its effective target value, not only proportional improvement should be included, but also slack improvement should be covered; that is, slack improvement should also be included in the process of efficiency measurement. Slack Based Measure (SBM).

In (2), there are n hypothetical DMUs, and each DMU has its own input vector and output vector; the former is expressed as $x \in R^m$, and the latter is expressed as $y \in q^1$. Therefore, matrix $X = [x_1, \ldots, x_n] \in R^{m\times n}$, $Y = [y_1, \ldots, y_n] \in R^{q_1\times n}$, in this matrix, X and y are greater than 0, respectively; input relaxation variables and output relaxation variables are represented by the letter S; λ represents the weight vector. This model uses $\rho^*\ (0 \leq \rho^* \leq 1)$to represent the efficiency value of the DMU. This model can measure inefficiency from the perspective of input and output, so it is also called a non-oriented model. Therefore, in (2), input inefficiency and output inefficiency can be expressed as $x9s/y$, respectively $1/\text{m}\sum_{i=1}^{m}s_i^-/x_{ik}, 1/q\sum_{r=1}^{q}s_i^+/y_{rk}$:

$$\begin{aligned}\min\rho &= \frac{1-\left(1/\text{m}\sum_{i=1}^{m}s_i^-/x_{ik}\right)}{1+\left(1/q\sum_{r=1}^{q}s_i^+/y_{rk}\right)},\\ \text{s.t. } X\lambda + s^- &= x_{k},\\ Y\lambda - s^+ &= y_{k},\\ \lambda, s^-, s^+ &\geq 0.\end{aligned} \tag{2}$$

The SBM model proposed by scholar tone is shown in (3).

$$\begin{aligned}\min\rho &= \frac{1-\left(1/m\sum_{i=1}^{m}s_i^-/x_{ik}\right)}{1+\left(1/q_1+q_2\right)\left(\sum_{r=1}^{q_1}s_r^+/y_{rk}+\sum_{i=1}^{q_2}s_i^{b-}/b_{rk}\right)},\\ \text{s.t. } X\lambda + s^- &= x_k,\\ Y\lambda - s^+ &= y_k,\\ B\lambda + s^{b-} &= b_k,\\ \lambda, s^-, s^+ &\geq 0.\end{aligned} \tag{3}$$

In (3), it is a nonlinear programming model, which can find a final solution according to a certain transformation mode. In this formula, assuming a total of N decision-making units, a DMU has three different input-output vectors where $x \in R^m$ represents the input vector, $y \in q^1$ represents the expected output vector, and $b \in q^2$ represents the undesired output vector. Therefore, matrix X can be expressed as $X = [x_1, \ldots, x_n] \in R^{m\times n}$, $Y = [y_1, \ldots, y_n] \in R^{q_1\times n}$, $B = [b_1, \ldots, b_n] \in R^{q_2\times n}$ where x, y, and B are greater than 0, respectively. In measured DMU, if only ρ^* is less than 1, the evaluated DMU is determined to be invalid, which means that input and output should be adjusted.

The advantages of the SBM model are that, firstly, it effectively avoids the problem of measuring slack variables that cannot be solved by a radial model; secondly, it can also handle efficiency evaluation of those nonexpected outputs; and thirdly, because the SBM model is a nonradial and nonangular measurement model, it is naturally free from measurement bias caused by radial factors and different angular factors. However, the SBM model is not flawless and has many shortcomings, for example, the minimization efficiency value in its objective function is p, which means inefficiency between input maximization and output. Therefore, if we look at the distance function, the projection point of the DMU being evaluated should be located at the farthest point from the DMU on the frontier; however, from the perspective of the evaluator, it is obvious that the distance to the frontier is expected to be shortened as much as possible, so there is an irreconcilable contradiction with the SBM model.

From the perspective of functional characteristics, there are five main types of Tobit models, namely, restricted dependent variable models, censored dependent variable models, transformed regression models, selected generation models, and nonmarket equilibrium models. Only the first type is a typical Tobit model, while the other four types are all generalized Tobit models. The author adopts a restricted dependent variable model from the characteristics of the data sample, and a specific formula is shown in (4)

$$y_i^* = x_i\beta + \mu_i \quad \mu_i \sim N\left(0, \delta^2\right),$$
$$y_i = \begin{cases} y_i^* \left(y_i^* > 0\right), \\ 0\left(y_i^* < 0\right). \end{cases} \tag{4}$$

In this study, in order to analyze the influence of diversified factors on the development of the Green Silk Road, the Green Silk Road Development Index mentioned above is taken as an explained variable in the study, and influencing factors are taken as explanatory variables to establish the Tobit standard model. On this basis, a detailed study is carried out. The formula can be seen in (5)

$$\begin{aligned} &\theta_{it}^* = f\left(q_{it}, \beta\right) + v_{it}, \\ &\theta_{it} = \theta_{it}^*, 0 < \theta_{it}^* \leq 1\theta_{it} = 0, \\ &\theta_{it}^* \leq 0\theta_{it} = 1, \theta_{it}^* > 1. \end{aligned} \tag{5}$$

The expression formula is shown in (6)

$$\begin{aligned} Y_{it} = {} & \beta_0 + \beta_1 RJ_{it} + \beta_2 JG_{it} + \beta_3 CX_{it} + \beta_4 DW_{it} + \beta_5 ZY_{it} \\ & + \beta_6 NY_{it} + \beta_7 HJ_{it} + \varepsilon_i + e_{it}. \end{aligned} \tag{6}$$

In publicity, Y_{it} represents the Green Silk Road Development Index for the first region in T year; RJ_{it} meets per capita regional GDP of I region in T year; JG_{it} represents the proportion of total output value of heavy industry in T year of I region in total industrial output value; CX_{it} represents the full-time equivalent of scientific and technological R & D personnel in T year of X region; DW_{it} represents the proportion of total import and export trade in I region in GDP; ZY_{it} represents the proportion of total amount of actually utilized foreign capital in GDP in ith year; NY_{it} represents the proportion of total energy consumption in GDP in year t of first regression; HJ_{it} represents the proportion of total investment in environmental pollution control in ith year to GDP; ε_i is individual effect that will not change over time; e_{it} is perturbation term that changes due to time and individual changes; β_0 is an intercept item; β_i is a parameter to be estimated.

5. Results

The rapid development of regions along the Silk Road, heavy polluting industries, and sprawling use of energy have led to poor air quality and excessive emissions of gases that can pose health risks to humans. This paper examines specific elements of air pollutant emissions along the Silk Road, as shown in Table 1. The atmospheric circulation in the Silk Road region leads to the transfer and circulation of gas pollution in the region, dusty weather is very common throughout the economic zone, and sand and dust can spread along the west wind from North Africa and West Asia to China, with the most severe sand and dust in desert areas of Africa. Air pollution in the atmosphere is mainly distributed in East Asia, India, and Europe. In East Asia, Western Europe, the eastern coast of China and the western parts of Russian countries are the main places of sulfur dioxide emissions, followed by India in Southeast Asia, where emissions are also relatively large. In the context of green governance, countries along the route should actively manage to minimize the emission of pollutants.

The rivers and lakes along the Silk Road are the main sources of water for the people of the region, mainly the Volga, Danube, Mediterranean, Caspian Sea, Black Sea, Yangtze, and Yellow River. After measuring water samples from main water bodies, it was found that, among rivers, the Danube has the lowest heavy metal content and best water quality, followed by the Volga, the longest river in Europe, and the Yangtze River in China, which has the worst water quality. This reflects that pollution emissions in East Asia are much higher than in Europe. The water quality of the interior sea is very poor, and the heavy metal content of the Caspian Sea, Black Sea, and Middle Sea are more than 10 times that of the Yangtze River, which is the worst among rivers due to the different mobility of rivers and oceans, as shown in Table 2.

During the period 2007–2016, total energy consumption along the Silk Road varied greatly, with China and India, as developing countries with large population bases, having the largest total energy consumption, which has exceeded 500 million tons of oil equivalent. Developed countries such as Germany, Britain, France, Italy, etc., and some crude oil producing countries such as Iran, Saudi Arabia, Turkey, etc. also have a total energy consumption of more than 100 million tons of standard coal. Some countries with less developed economies, such as Mongolia, Kyrgyzstan, Jordan, and Georgia, do not consume more than 10 million tons of standard coal but have lower total energy consumption. Other countries along the Silk Road consume between 1000 and 100,000 tons of standard coal, as shown in Table 3. Although there are individual differences in some countries and the total energy consumption of countries along the Silk Road is polarized, in general, total energy consumption along the Silk Road is huge. Among them, most developing countries (e.g., China and India) have been on an upward trend in total energy consumption during the period of 2007–2016, while the total energy consumption of Germany, the UK, France, and Italy has been on a downward trend.

The real situation of energy consumption in countries along the Silk Road is examined in terms of energy consumption structure, and the green development of the Silk Road is assessed in terms of energy renewability. Due to the increased cost of long-distance transportation, countries along the Silk Road currently consume energy mainly through their own production, supplemented by small amounts of imported energy, such as petroleum products. China is the largest consumer of energy, and it consumes most of its energy in oil, coal, and thermal energy. The energy consumption structure of South Asian countries is

Table 1: Emission of major air pollutants along the Silk Road Economic Belt in 2016.

Index	Average annual concentration (μg/m^3)	Average annual value (μg/m^3)	Daily average concentration (μg/m^3)
SO_2	2–124	34	98.2
NO_2	14–68	37	96.9
CO_2	0.9–5.5	2.1	99.2

Table 2: Determination results of water samples in main water bodies along the Silk Road Economic Belt (U//).

Water quality parameters	Upper Volga River	Middle Volga River	Lower Volga River	Romanian section of Danube River	Iran section of Caspian Sea	Black Sea	Mediterranean Sea	Tongling section of Yangtze River
Cd	0.09–0.21	<0.02–0.62	0.02–0.27	<0.026	—	—	—	0.21–0.09
Pb	0.03–0.09	—	1.00–3.3	0.03–0.11	7.15	19.57	25.87	0.96–3.85
Al	190.0–400.0	8.3–71.1	440.0–1482.0	—	—	—	—	—
Sr	84.9–122.0	95.87–288.0	468.0–568.0	—	—	—	—	—
Mn	73.0–150.0	13.0–112.0	22.8–35.8	—	—	—	—	—
Zn	1.30–5.50	<1.00–5.12	2.61–8.80	0.09–0.68	26.98	69.80	115.2	21.3–15.4
Cu	1.3–3.9	0.95–5.68	1.3–2.4	0.05–0.67	12.00	31.0	89.57	2.17–15.3

Table 3: Total energy consumption of countries along the Silk Road Economic Belt (unit: 10000 tons of oil equivalent) (2007–2016).

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
China	202306	214475	221482	235748	257846	265871	247892	287951	265415	298712
Kazakhstan	5402	6074	5025	5475	6547	5879	6321	5247	6225	6584
Uzbekistan	5987	5247	5287	4527	4891	5874	5325	5924	5120	4982
Kyrgyzstan	324	358	421	369	358	547	528	478	498	369
Tajikistan	352	358	287	269	367	324	387	359	287	293
Russia	64210	62347	59871	63247	65523	64214	71024	74125	76312	71245
Mongolia	356	367	358	396	432	489	503	487	526	507
Britain	20358	20341	15879	16874	18472	15874	18523	15781	17562	17892
Germany	31487	32587	25871	33697	25947	32574	35687	37458	36549	25478
Italy	19587	19824	18654	15882	19587	20146	19872	13668	19587	15471

Table 4: Energy consumption structure of countries along the Silk Road (2014) (unit: %).

	Petroleum	Petroleum products	Coal	Natural gas	Bioenergy	Power	Solar energy, tidal energy, wind energy	Heat energy
China	0.2	21.5	387	5.7	9.9	0.3	1.0	25.7
Kazakhstan	0.3	30.0	29.8	7.8	0	16.4	0	20.0
Uzbekistan	0.3	7.5	19.0	80.5	0	15.4	0	8.7
Kyrgyzstan	0	12.6	2.0	25.5	0.7	5.7	0	4.7
Tajikistan	0	16.8	35.7	16.5	7.9	0	47.2	0
Russia	0	14.2	29.2	0	60.7	1.7	30.5	1.4
Mongolia	0	42.3	2.9	28.8	2.9	0.1	35.8	0
Britain	0	41.9	3.1	28.3	6.7	23.2	0.3	1.2
Germany	0	41.1	1.5	37.1	6.2	0.1	0.2	1.5
Italy	0	52.1	0.1	35.7	0	1.0	11.0	3.3

dominated by bioenergy. Countries such as Uzbekistan and Armenia consume energy mainly in natural gas, largely due to the abundance of natural gas production in these countries. The main energy consumption of relevant oil-rich countries, developed economies of Europe (e.g., Iraq, UK, Libya, Germany, Italy, and France), is in oil, which accounts for more than 40% of total energy consumption. The differences in the structure of energy consumption not only affect the efficiency of national energy inputs but also show the environmental impact they will cause, as shown in Table 4.

The energy consumption intensity along the route is related to the level of the national economy and technology. The energy consumption intensity of Uzbekistan, Kyrgyzstan, Tajikistan, and other countries exceeds 3 tons of standard coal, and energy efficiency is relatively low, see Figure 6. The high energy consumption intensity of these countries is either due to excessive total energy consumption

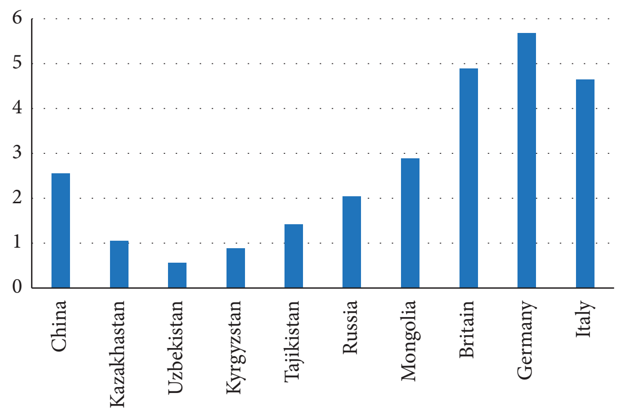

Figure 6: Energy consumption intensity (terminal energy consumption intensity) of countries along the Silk Road Economic Belt in 2016.

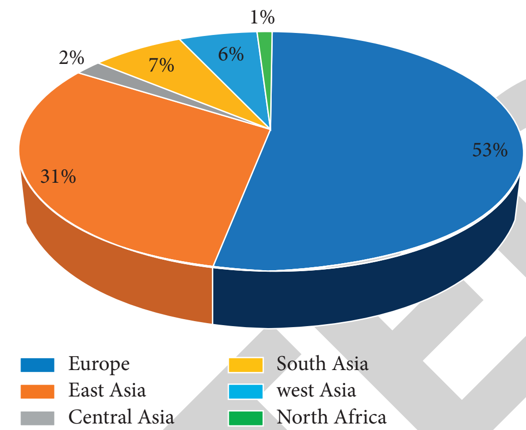

Figure 8: Proportion of regional GDP in the Silk Road Economic Belt (2017).

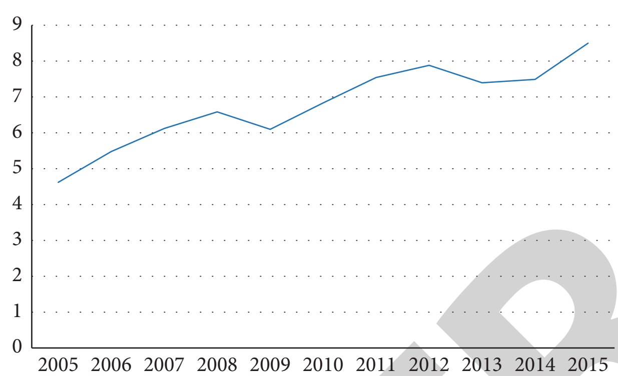

Figure 7: Total GDP of countries along the Silk Road (US $100 million) (2005–2015).

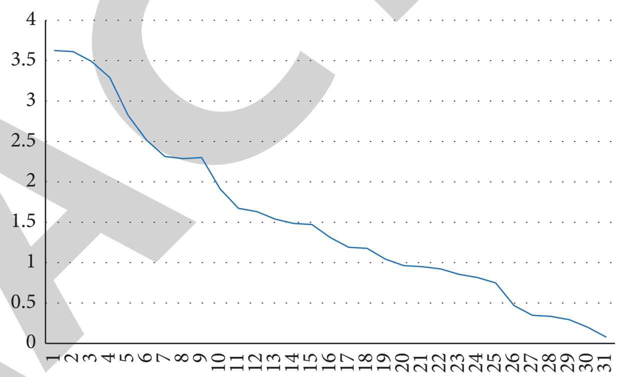

Figure 9: Percentage of R & D expenditure in GDP of countries along the Silk Road.

or relatively unreasonable energy consumption structures, while some are caused by other reasons, such as level of science and technology, total factor productivity, level of economic development, energy prices, and openness of the market. These constraints have led to relatively high energy consumption and relatively low energy efficiency in these countries. More developed countries such as Germany, the UK, France, Italy, and Poland have energy consumption intensities of less than 2 tons of standard coal per US dollar of GDP and have high energy consumption efficiency. The advanced technology, economic development level, energy consumption price, openness to the outside world, and reasonable energy consumption structure of these countries lead to high efficiency of energy consumption.

From 2005 to 2017, the GDP of 95 countries along the Silk Road tended to increase. In 2015, regional GDP reached 50.1 trillion USD, as shown in Figure 7. Among them, from 2005 to 2008, from 2009 to 2014, and from 2016 to 2017, all maintained a continuous upward trend. Only in 2009 and 2015, there was a certain decline in GDP. The 2009 GDP decline was due to the impact of the global financial crisis in 2008. The 2015 GDP decline was partly due to the impact of the global economic situation in 2015, such as the continued decline in commodity prices, the slowdown in global price levels, deflationary pressures faced by some economies, etc., but in general, economic aggregates along the Silk Road show a relatively good trend.

In terms of the proportion of GDP value of each region in the Silk Road, Europe has the largest share with 52%, followed by East Asia with 32%, and finally Central Asia with only 1%. As shown in Figure 8 below:

"Science and technology are the first productive forces." In the process of green development, we should focus on the development of green technology, actively use clean production technology, use new technologies and new processes that are nonhazardous or low-hazardous, so as to achieve a reduction in the consumption of raw materials and energy, achieve low input, high production, low pollution, and cultivate as many possible industries to avoid environmental pollutants, such as ecological agriculture, forest tourism, clean energy development, and new manufacturing industries. Green technology is a kind of resource-saving and environmental protection technology. The development of green technology is conducive to the development and utilization of new energy, the purification of harmful substances, and the recycling of waste. The percentage of R&D expenditure to GDP is generally used to measure technological innovation capacity along the Silk Road. In some countries, due to the weak R&D capacity of domestic

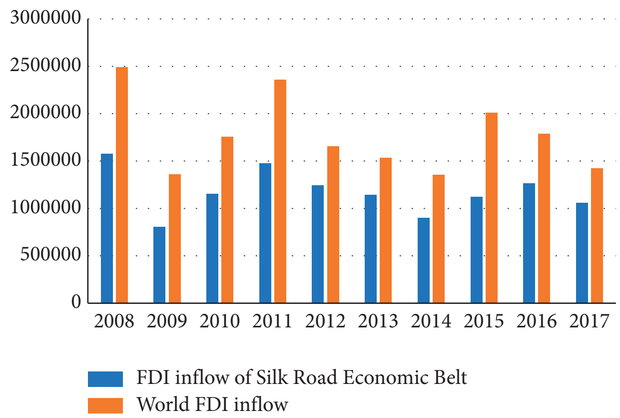

Figure 10: Comparison between foreign direct investment along the Silk Road and the world.

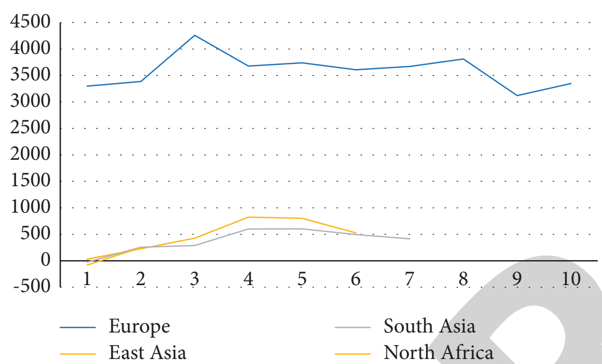

Figure 11: Investment in environmental protection in various regions along the Silk Road.

enterprises, they often adopt supportive policies and tax incentives to support research programs. For countries with stronger R&D capacity, they tend to support special industries and special targets, such as small and medium-sized enterprises, high-technology enterprises, new businesses, or enterprises that can provide employment opportunities for technology employees. The R&D expenditures as a share of GDP for Silk Road countries are shown in Figure 9.

With continuous and steady development of many developing countries on the Silk Road and the gradual opening of markets of developed countries, the economy of the Silk Road has been developing rapidly and the level of foreign direct investment has been rising. Although the total amount of actual foreign investment utilized has fluctuated, the overall proportion of the world has increased, see Figure 10. In addition to the resource price advantage and policy support of developing countries, the economic development level of developed countries is also an important factor in attracting foreign investment.

In terms of regional distribution, environmental investments in Western and Northern Europe have been much higher than those in other regions. Before the Silk Road Initiative in 2013, environmental investments in various regions tended to be stable, while after the Silk Road was

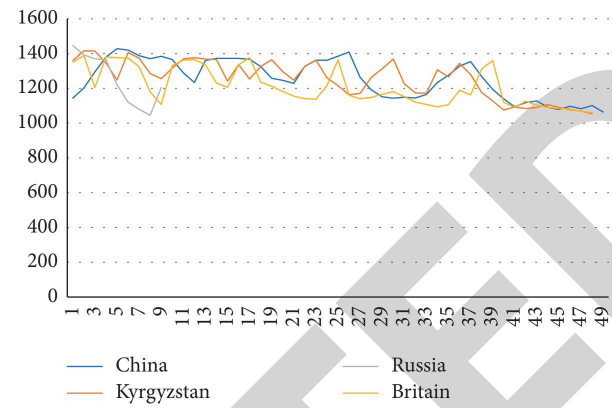

Figure 12: Change trend of development index of the Green Silk Road Economic Belt.

proposed in 2013, environmental investments in Northeast Asia, Central and Eastern Europe, and other regions have increased to varying degrees, see Figure 11.

Using input-output data of Silk Road countries for the decade 2007–2016, the development index of Silk Road for each country from 2007 to 2016 is measured according to the nonradial, nonangle SBM model that considers nondesired outputs shown in (3), and to simplify graphs, the results of four years 2007, 2010, 2013, and 2016 are intercepted for trend analysis, as shown in Figure 12.

Between 2007 and 2016, the average value of the Silk Road Development Index increased from 0.586 in 2007 to 0.638 in 10 years, then to 0.621 in 2013, and finally to 0.652 in 2016. The Silk Road Development Index as a whole rose by about 10 percentage points during the decade and remained stable, which gives us feedback that the green development level along the route is steadily improving. The index decreased by three percentage points between 2010 and 2013, and increased by five percentage points between 2013 and 2016, implying that “Belt and Road” has had a positive impact on economic development along the route and on environmental development along the route. The Silk Road policy will force countries along the route to converge on a green economy target, and a majority of them will have a higher green development index than before. When the pace of Internet upgrading accelerates, international ecological problems become more prominent, and green industries are more capable of being built, thus triggering a change in world market orientation. People in all countries are generally aware of the value of environmental protection, and governments are also committed to building a long-term construction path and creating an ecologically energy-efficient economy. In a few countries, the rate is showing signs of decline, mainly in Europe. This is due to the fact that the rate of economic growth has decreased after economic development has been improved and ecological quality has been secured, so there is not enough room for further development. Based on ranking information, we can see that rankings change little. The Green business is a long-term construction task that requires continuous investment.

6. Conclusions

In this paper, we mainly study the development status of the Digital Silk Road countries and their green development technology assessment, evaluate and analyze social, environmental, economic, and resource aspects along the route, respectively, and find that the overall development index of the Digital Silk Road has raised about 10 percentage points during the decade of 2007–2016 and remained stable, which gives us feedback that the level of green development along the route is steadily improving. This feedback shows us that the green development level along the route is steadily improving. Therefore, in the subsequent development process, China should persevere and make further efforts to build the Digital Silk Road.

Data Availability

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Conflicts of Interest

The authors declare that this article has no conflicts of interest.

Acknowledgments

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