STUDY ON THE SUSTAINABLE DEVELOPMENT OF CHINA'S EXPORT MANUFACTURING ENTERPRISES IN THE YANGTZE RIVER ECONOMIC BELT UNDER THE BACKGROUND OF "DOUBLE CARBON"

Tian Maoxian
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As a core part of the national economy, manufacturing is the key to achieving sustainable economic development. However, the development of China's manufacturing industry faces many problems, such as poor industrial structure, lack of key core technologies, and serious overcapacity, which seriously affect the quality of China's manufacturing industry. The Yangtze River Economic Belt not only has great strategic significance for coordinating the development of the east, middle and west China, but also a demonstration belt for the sustainable development of manufacturing industries. Amid the Chinese government's "double carbon" implementation in 2020, how to transform and upgrade these export manufacturing enterprises and find a path to sustainable development is a major challenge they will have to face. Therefore, on the basis of combing domestic and foreign literature, taking "quality-sustainable development-sustainable development of manufacturing industry" as the logic line, and combine the theory of sustainable development, environmental Kuznets curve theory, equatorial principle theory, and corporate governance theory. Second, it measures and evaluates the sustainable development of manufacturing industry in the Yangtze River Economic Belt from 2007 to 2019 through quantitative research. Conclusions: When assessing the status, the quality level of sustainable development of manufacturing industry in the Yangtze River Economic Belt has been steadily improving, more than 80% of the provinces and cities in the Yangtze River Economic Belt have high and medium quality. Finally, targeted countermeasures and proposals are put forward.

Keywords: Yangtze River Economic Belt; export trade mode; export commodity structure; high-quality economic development

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Introduction

Research background
China's manufacturing industry plays a key role in promoting social progress and stimulating the economy. Burgess & Paguio (2016) proposed "energy conservation and emission reduction": "Energy conservation and emission reduction, advanced environmental technologies, cutting-edge technologies, improved economic efficiency and realized a virtuous circle of industrial and social benefits.

After more than 40 years of development, the Yangtze River Economic Belt has become the center of gravity and the core economic belt of China's economy. Among the 11 provinces and cities, only Shanghai (6.0%) has a lower GDP growth rate than the whole country, and Anhui, Jiangxi, Hunan, Sichuan, Guizhou and Yunnan have lower GDP per capita than the national level.

Table 1 - The GDP and per capital GDP of 11 provinces and cities along the Yangtze River Economic Belt in 2019
(Source: China and provincial and municipal statistical bulletins from 2018 to 2019)

<table>
<thead>
<tr>
<th>Area</th>
<th>GDP (mil yuan)</th>
<th>GDP growth (%)</th>
<th>GDP per capita (yuan)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2018</td>
<td>2019</td>
<td>2018</td>
</tr>
<tr>
<td>Shanghai</td>
<td>32680</td>
<td>38155</td>
<td>6.6</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>92595</td>
<td>99632</td>
<td>6.7</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>56197</td>
<td>62352</td>
<td>7.1</td>
</tr>
<tr>
<td>Anhui</td>
<td>30007</td>
<td>37114</td>
<td>8.0</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>21985</td>
<td>24758</td>
<td>8.7</td>
</tr>
<tr>
<td>Hubei</td>
<td>39367</td>
<td>45828</td>
<td>7.8</td>
</tr>
<tr>
<td>Hunan</td>
<td>36426</td>
<td>39752</td>
<td>7.8</td>
</tr>
<tr>
<td>Chongqing</td>
<td>20363</td>
<td>23606</td>
<td>6.0</td>
</tr>
<tr>
<td>Sichuan</td>
<td>40678</td>
<td>46616</td>
<td>8.0</td>
</tr>
<tr>
<td>Guizhou</td>
<td>14806</td>
<td>16769</td>
<td>9.1</td>
</tr>
<tr>
<td>Yunnan</td>
<td>17881</td>
<td>23224</td>
<td>8.9</td>
</tr>
<tr>
<td>Yangtze river economic belt</td>
<td>402985</td>
<td>457806</td>
<td>7.7</td>
</tr>
<tr>
<td>Nationwide</td>
<td>900309</td>
<td>990865</td>
<td>6.6</td>
</tr>
</tbody>
</table>

The Chinese government will announce the "double carbon" goal to the world in 2020 (Tuffour et al, 2016). With China's accession to the WTO, the export manufacturing industry of the Yangtze River Economic Belt has made remarkable progress, contributing more than 50% of China's GDP. However, these export manufacturing industries have long adopted the extensive development model of rapid growth and high emissions, which have caused serious ecological and environmental problems.

Therefore, they hope to take the Yangtze River Economic Belt as a model and try other regions in China first, the green development practice of other industries has a demonstration effect.
Table 2 - Proportion of GDP of 11 provinces and cities in the Yangtze River Economic Belt from 2017 to 2019
(Source: China and provincial and municipal statistical bulletins from 2018 to 2019)

<table>
<thead>
<tr>
<th>Region</th>
<th>2017 year</th>
<th>2018 year</th>
<th>2019 year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GDP</td>
<td>Proportion</td>
<td>GDP</td>
</tr>
<tr>
<td></td>
<td>of GDP (%)</td>
<td></td>
<td>of GDP</td>
</tr>
<tr>
<td>Shanghai</td>
<td>30134</td>
<td>8.1</td>
<td>32680</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>85901</td>
<td>23.0</td>
<td>92595</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>51768</td>
<td>13.8</td>
<td>56197</td>
</tr>
<tr>
<td>Anhui</td>
<td>27519</td>
<td>7.4</td>
<td>30007</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>20819</td>
<td>5.6</td>
<td>21985</td>
</tr>
<tr>
<td>Hubei</td>
<td>36523</td>
<td>9.8</td>
<td>39367</td>
</tr>
<tr>
<td>Hunan</td>
<td>34591</td>
<td>9.3</td>
<td>36426</td>
</tr>
<tr>
<td>Chongqing</td>
<td>19500</td>
<td>5.2</td>
<td>20363</td>
</tr>
<tr>
<td>Sichuan</td>
<td>36980</td>
<td>9.9</td>
<td>40678</td>
</tr>
<tr>
<td>Guizhou</td>
<td>13541</td>
<td>3.6</td>
<td>14806</td>
</tr>
<tr>
<td>Yunnan</td>
<td>16531</td>
<td>4.4</td>
<td>17881</td>
</tr>
<tr>
<td>Yangtze river economic belt</td>
<td>373807</td>
<td></td>
<td>402985</td>
</tr>
<tr>
<td>Nationwide</td>
<td>827122</td>
<td></td>
<td>900309</td>
</tr>
<tr>
<td>Proportion</td>
<td>45.2%</td>
<td></td>
<td>44.8%</td>
</tr>
</tbody>
</table>

Research problems

In 2020, China solemnly promises the world to strive to achieve carbon peak by 2030 and carbon neutrality by 2060 (Tang et al, 2021). China's economy has moved from high-speed growth to high-quality, and the development of export manufacturing enterprises in the Yangtze River Economic Belt is facing many challenges. Every export manufacturing enterprise needs to carry out not only enterprise transformation and modernization, but also high-quality green development.

For a long time, export enterprises in the Yangtze River Economic Belt have developed rapidly with an extensive quantitative and rapid growth model, generating more than 40% of China's GDP (Jameel et al, 2017).

However, the next thing is overcapacity, and the problem of ecological environment has become more prominent, which has followed the old path of "development first and governance later", making the contradiction between ecological environment, governance and protection, the contradiction between unreasonable industrial structure and excess capacity, the contradiction between the domestic market and the international market (Goos et al, 2014).

To resolve these contradictions, we must change the industrial structure, reduce costs and improve efficiency, and increase investment in scientific and technological innovation to promote the innovative and environmentally sustainable development of export manufacturing enterprises.
Objective of the study
This paper takes the Yangtze River Economic Belt as a research object, carries out a comprehensive analysis of its export trade structure within the framework of the "dual carbon" goal, and proposes countermeasures (Burgess & Paguio, 2016).
And suggestions based on the current situation, providing a reference for optimizing and improving the export trade structure of the Yangtze River Economic Belt and other regions in China.
The objectives are:
1. The goal of managing and improving carbon emission reduction under the "dual carbon" goal will lead to green technological innovation, which will make a significant contribution to the high-quality development of export manufacturing policies in the Yangtze River Economic Zone.
2. The purpose is to promote the impact of the "dual carbon" goal on optimizing the policy structure of export manufacturing industry in the Yangtze River Economic Zone, thereby achieving green transformation.

Research significance
From a theoretical point of view, the relevant theories and methods on the green, low-carbon and high-quality development at home and abroad have become the focus of domestic and foreign scholars. Promoting technological innovation with low-carbon and clean manufacturing plant development.
Ahmed & Al-Kak (2019) noted that reducing energy consumption and carbon dioxide emissions through technological research and development contributes to the environmental transformation of the manufacturing industry.
Daske & Gebhardt (2006) conducted an empirical research from the perspective of energy efficiency, industrial competitiveness and technological innovation, and believed that the innovative combination is a strong incentive for the improving the manufacturing value chain in China. It is necessary to explore relevant improvement measures and criteria that will help to enrich the management theories and enrich research ideas.
From a practical point of view, China is currently at the historic stage of achieving the two centenary goals. The "double carbon" goal will have a profound impact on China's economic transformation and modernization, coordinated development of regional industries, adjustment of energy structure and improvement of technological innovation.
Fernandes & Tang (2012) believe that this will help the construction of China's ecological civilization and green and sustainable development of resources and environment ecology, as well as promoting environmentally friendly and high-quality development of the economy and society.
As China's economy accelerated the transition to green development during the "Fourteenth Five-Year Plan" period, exploring the high-quality development path of China's manufacturing industry under the "dual carbon" goal, it promoted the transition of the manufacturing industry to a low-carbon economy model, and promoted the vigorous development of the real economy.
Theoretical framework

The research results on export manufacturing policies in the Yangtze River Economic Zone under the "double carbon" goal are reviewed at home and abroad, and the current issues and challenges in China are summarized.

The purpose of the export production policy of the Yangtze River Economic Zone is empirically analyzed, and the relationship between them is analyzed, too. Finally, the hypotheses of this paper are empirically tested and some conclusions and opinions are obtained. Thus, the conceptual framework as follows:

![Figure 1 - Technology roadmap](image)

**Hypotheses**

**H1**: Reducing carbon dioxide emissions under the "double carbon" goal will lead to green technology innovation, which in turn will make a significant contribution to the high-quality development of export manufacturing policy in the Yangtze River Economic Zone.

**H2**: The "double carbon" goal helps optimize the policy structure of the export manufacturing industry in the Yangtze River Economic Zone, thereby achieving green transformation.

**Literatures review**

Manufacturing industry, as the core organ of the national economy, is the core of the industrial system of the Yangtze River Economic Belt (Thabit & Jasim, 2019). The Yangtze River Economic Belt Development Plan issued in 2016 proposed that the Yangtze River Economic Belt should develop world-class manufacturing clusters with international excellence in electronic information, high-end equipment, automobiles, household appliances, textiles and clothing.
However, at present, the manufacturing industry in the Yangtze River Economic Belt is characterized by a heavy and chemical structure (Andreoni & Levinson, 2001), severely homogenizing the industrial structure in some regions along the Yangtze River (Feenstra et al, 2015).

It is beyond the bearing capacity of resources and environment, which severely restricts its further development. Under the background of the deep implementation of the "Made in China 2025" strategy, choosing the path of "innovation, ten green" and comprehensive development is an important breakthrough for the manufacturing industry in the Yangtze River Economic Belt to solve the current dilemma, and also the inevitable choice to liberate and develop the productive forces.

Rekarti et al (2019) found that China's manufacturing industry development still faces challenges such as weak competitiveness in green development and relatively lagging quality brand construction, and proposed that the key to promoting high-quality manufacturing industry development is in the implementation of green manufacturing and smart manufacturing.

Pazhani & Abdullah (2019), who studied from Pasche (2002), explored the path of high-quality development of manufacturing industry in several areas such as scientific and technological innovation and institutional innovation.

Research methodology

This study mainly adopts quantitative analysis method. This paper focuses on the Yangtze River Economic Belt, including Shanghai, Jiangsu, Zhejiang, Anhui, Hubei, Hunan, Jiangxi, Chongqing, Sichuan, Yunnan, Guizhou, a total of nine provinces and two cities (Rekarti et al, 2019).

After all, the Yangtze River Economic Belt is rich in resources and has great potential for coordinated development. This paper mainly uses literature research, comparative analysis, empirical research and quantitative research.

(1) Quantitative research methods

The quantitative research method was used to determine the sample data, and the data analysis and research were conducted using SPSS software (Guiso et al., 2004). There are mainly four methods used in data model creation analysis: 1) Descriptive statistical analysis. The descriptive statistics in this paper selects 2007-2019 as the research period to ensure that the research results are more convincing. 2) Reliability analysis.

The indicators collected in this study refer to the existing manufacturing industry classification and the statistical yearbook of important data sources such as the Statistical Yearbook of Science and Technology of China and the Statistical Yearbook of High-tech (Shao, 2012).

(2) Comparative analysis method

This study by Raupach et al (2007) evaluates the level of export manufacturing policies and economic quality development system in 11 provinces of the Yangtze River Economic Belt under the "double carbon" goal, and describes the differentiated development path of each province over time.
Empirical research methodology

This paper collected relevant data from 2007-2019 from 11 provinces in the Yangtze River Economic Belt to create an indicator system to measure the level of export manufacturing policies and economic quality development in each province under the "double carbon" goal of the Yangtze River Economic Belt, where innovation is an important force for economic growth. In the Yangtze River Economic Belt, there is a strong positive correlation between innovation resources and economic construction, with a correlation coefficient of 0.89.

Finding and conclusion

Firstly, the relevant data for each province in the Yangtze River Economic Zone from 2007 to 2019 were collected. Secondly, the composite score was decomposed into two main indicators "export manufacturing policy" and "high-quality development level" by using factor analysis, and then synthesized.

Finally, the composite score of the high-quality economic development of each province in the Yangtze River Economic Zone was assessed by principal component analysis, indicating that the export manufacturing policies of each province in the Yangtze River Economic Zone have greatly improved the quality of their economies (Luo et al, 2020).

The verification of the new factor analysis is to test the hypothesis proposed by the researchers, test the matching measurement items at the level of theoretical relationship, and emphasize the reliability of the theoretical analysis results (Kromann et al., 2019).

This paper uses the experience of previous studies on the use intermediate inputs as production factors such as energy or other resources. This time, a total of 510 data are collected.

Reliability analysis of the scale:

Scholars often use the reliability coefficient to express the level of reliability of data or the measurement tool.

At present, Cronbach $\alpha$ is the most commonly used reliability measurement method. In general, the academic community believes that only KMO values greater than 0.7 can only be accepted (Graetz & Michaels, 2018).

Table 3 - Reliability analysis

<table>
<thead>
<tr>
<th>Item</th>
<th>CITC</th>
<th>Delete the Cronbach's $\alpha$ value for the item</th>
<th>Cronbach's $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under the &quot;double-carbon&quot; target, carbon emission reduction promotes green technology innovation, which then plays a significant role in promoting the high-quality development of export manufacturing policies in the Yangtze River Economic Belt.</td>
<td>0.783</td>
<td>0.869</td>
<td>0.889</td>
</tr>
<tr>
<td>The &quot;double-carbon&quot; goal is conducive to promoting the optimization of the export manufacturing policy structure in the Yangtze River Economic Belt, so as to realize the green transformation.</td>
<td>0.827</td>
<td>0.831</td>
<td></td>
</tr>
</tbody>
</table>
As can be seen from Tab. 3 above, Cronbach's 'α of this study is 0.889, which meets the criteria. In addition, most of the CITs between the observed variables and their latent variables are between 0.6 and 0.8, indicating that the export manufacturing policy and high-quality economic development level of the Yangtze River Economic Belt under the "double-carbon" goal affects the data model establishment reliability under the background of network economy. In conclusion, the data reliability coefficient values in this study are greater than 0.6, indicating an acceptable quality of data reliability.

Finally, using exploratory factor analysis for structural validity analysis, first according to the KMO value and the Bartlett's spherical test assessment scale is suitable for factor analysis, the KMO value between 0~1, the closer to 1, the stronger the correlation between variables, the better the effect of factor analysis, the feasibility test of exploratory factor analysis should meet two conditions: 1. KMO > 0.7; 2. Bartlett's spherical test is significant (Sig. <0.05), and the results are shown below.

Table 4 - KMO and Bartlett's Test
(made by the author)

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</th>
<th>0.842</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td></td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>10432.871</td>
</tr>
<tr>
<td>df</td>
<td>2983</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000</td>
</tr>
</tbody>
</table>

After passing the KMO test, it becomes clearer whether the financial data collected by this research is valid to conduct a good in-depth analysis. As can be seen from the above table, KMO is 0.842, which is greater than 0.6, meeting the premises of factor analysis and the validity of this study was tested using Spearman’s rank correlation analysis using the SC-RMDQ as a control.

The results showed that the economic data collected this time had a good correlation (r= -0.371, P <0.01).

The least square method is used to conduct regression analysis of the relationship between the export manufacturing policy of the Yangtze River Economic Belt and the development quality of high-quality economic development under the carbon emissions and the "double carbon" goal. The test results are shown in Tab. 4.

The least square method is used to conduct regression analysis of the relationship between the export manufacturing policy of the Yangtze River Economic Belt and the development quality of high-quality economic development under the carbon emissions and the "double carbon" goal. The results are shown in Tab. 5.

To measure the degree of improvement of the export manufacturing policies and the level of high-quality economic development in the Yangtze River Economic Zone under the 'double carbon' goal has been upgraded.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample numbers</th>
<th>Mean value</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>nmdl</td>
<td>510</td>
<td>0.3226</td>
<td>2.0349</td>
<td>-2.4753</td>
<td>2.9835</td>
</tr>
<tr>
<td>nmsol</td>
<td>510</td>
<td>0.2979</td>
<td>1.2619</td>
<td>0.2109</td>
<td>4.3552</td>
</tr>
<tr>
<td>Ince</td>
<td>510</td>
<td>0.8643</td>
<td>2.3676</td>
<td>1.6095</td>
<td>6.9283</td>
</tr>
<tr>
<td>ngti</td>
<td>510</td>
<td>0.9817</td>
<td>5.0804</td>
<td>2.8536</td>
<td>11.6151</td>
</tr>
<tr>
<td>nexp</td>
<td>510</td>
<td>-2.4273</td>
<td>1.0076</td>
<td>-5.4732</td>
<td>-0.0049</td>
</tr>
</tbody>
</table>

**Research conclusions**

Commitment to the harmonious coexistence of man and nature is the core strategy of socialism with Chinese characteristics in the new era (Al-Kake et al., 2019).

This paper analyzes the current situation of the Yangtze River Economic Belt, and believes that the problems of ecological environment protection are still serious. The synergy between ecological construction and economic construction is not strong. The relationship between innovative resources and economic construction and ecological construction is significantly different.

The gap between the three major plates of the Yangtze River Economic Belt is large, and the integration of the Yangtze River Economic Belt is low.

Specific activities are shown in Tab. 6.

**Table 6 - Study hypothesis validation table**

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypothesis</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Under the &quot;double-carbon&quot; target, carbon emission reduction promotes green technology innovation, which then plays a significant role in promoting the high-quality development of export manufacturing policies in the Yangtze River Economic Belt.</td>
<td>Establish</td>
</tr>
<tr>
<td>H2</td>
<td>The &quot;double-carbon&quot; goal is conducive to promoting the optimization of the export manufacturing policy structure in the Yangtze River Economic Belt, so as to realize the green transformation.</td>
<td>Establish</td>
</tr>
</tbody>
</table>

When combined with data analysis, the level of economic and social development of a region can, to a large extent, have a significant impact on regional green technology innovation. Regions with a higher level of economic development are able to raise the technological level of export manufacturing policies and the level of quality economic development in the Yangtze River Economic Zone under the regional "double carbon" goal through a series of large-scale governmental support for Rand D.

The Yangtze River Economic Zone has a better export product policy and higher quality of economic development than other regions (Ayre & Landis, 2012). The content of the hypothesis is found to have a positive impact and therefore H1-H2 are all valid.

Since this paper focuses on the impact of carbon emission reduction on the development of export manufacturing policy and economic quality development in the
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Yangtze River Economic Zone under the "double carbon" goal, the significance level of this result is also acceptable.

The structural optimization of export manufacturing policies and high-quality economic development in the Yangtze River Economic Zone under the "double carbon" goal suppressed carbon emissions to a greater extent than the quality of development of export manufacturing policies and high-quality economic development in the YREC under the "double carbon" goal.

**Recommendation**

It is necessary to expand the role of innovation as a source of strength in environmental, economic and social development.

Innovation is a fundamental power to promote industrial transformation and modernization. Umoren & Asogwa (2013) found that the manufacturing industry should pay attention to the ecological benefits of carbon emissions. Rezaee & Wang (2018) measured and decomposed the industrial structure of the manufacturing industry and found that the industrial structure of China's manufacturing industry has strong characteristics of "structural convergence", and shows obvious "structural convergence" effect, and also enhance the independent innovation capability of the Yangtze River Economic Belt.

It is also necessary to strengthen the top-level design and unlock the cooperation mechanism between entities.

The Yangtze River Economic Belt involves various administrative bodies such as provinces, counties and cities. Without orderly guidance, control and preferential policies at the national level, the development process will inevitably experience disorderly competition and games that create internal friction.

Wang & Li (2017) found that the spatial spillover effect of carbon emissions through the empirical analysis of carbon emissions in different regions has significant differences.

In addition, Yao (2019) combined the results of data analysis to indicate that China should make full use of its comparative advantages and optimize its industrial layout. Therefore, for the healthy and orderly development of the Yangtze River Economic Belt, overall coordination must be achieved. The coordination mechanism of regional economic development should also be improved.

**References:**


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