Research on the Eco-environmental effect of Manufacturing Transformation and Upgrading of Xijiang River Economic Belt based on Internet Background

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Abstract: Manufacturing industry is the pillar in the regional development whose impact on environment has been focused. The paper, using the data of 2008-2017 of Xijiang River Economic Belt, Construct comprehensive index of environmental effect for manufacturing transformation and upgrading and discuss the effect of transformation and upgrading on eco-environment. The result shows that while the economic developing, the Economic Belt’s environment is improving. And some advice about further manufacturing development based on ecological development and internet in the end.

1. Introduction
Guangxi government issued General plan for developing of Xijiang River Economic Belt in 2012. The plan puts forward goals of the belt as eco-priority, manufacturing leading industries, industries upgradation and social harmony and emphasizes the belt as the key role on the link between southwestern region and eastern coastal region. Xijing River, the mainstream of the Pearl River, evolves 7 cities, Nanning, Guigang, Wuzhou, Baise, Laibin, Liuzhou, Chonzuo, and accounts for 55% of Guangxi land area.

Since 2005, China’s industrial spatial distribution has changed significantly, manufacturing industry partly has transferred to central and western regions from eastern coastal regions, which leads to the structural reconstruction of manufacturing in central and western regions. It is the same with Xijiang River Economic Belt. its GDP reached 2.035251 trillion yuan in 2018, increasing by 6.8% on a year-on-year basis, and 5.6% for the first industry, 4.3% the second, 9.4% the third. The whole industry value added is 14.8%, 39.7% and 45.5% respectively, while the second industry has stayed the top list from 2007 to 2015. These show that although manufacturing industry has still hold a prominent part, its transformation and upgrading has come gradually. Meanwhile Internet technology, such as:cloud computing, big data and IOT(Internet of Things) quickens traditional industry’s transformation and creates new format, prompting further the reform of industrial structure, economic transformation and social development. The internet technology can accelerate improving, optimizing and upgrading of industry chain, so as to reconstruct the chain and improve manufacturing efficiency. Considering the coordinated development of eastern, central and western regions, Xijiang River Economic Belt is a critical area which could connect the developing region, Yun Nan, Gui Zhou and Guixi area, to the developed Pearl River Delta, Hong Kong and Macao, which makes eco-priority as the first consideration during the Belt developing. But in developing, lower resource utilization
efficiency and structural pollution have led to worsen eco-environment, highly consuming energy, water resource and emitting pollution like SO2. Has it improved the eco-environment that the Xijiang River Economical transforms and upgrade its Manufacturing industry based on Internet Background? How could developing pattern meet the plan’s eco-priority requirement?

A few studies have focused on relationship between manufacturing transformation and upgrading and eco-environmental effect. Zhang Baohua et al.[1] and Li Qiang[2] make empirical analysis based on the Yangtze River area. The results show that the manufacturing transformation and upgradation has a positive effect on eco-environment. Li Jie[3] proposes that Yangtze River Delta should narrow regional developing unbalance and emphasize industrial developing policy from the perspective of eco-environment. Their researches indicate that the transformation and upgrading has positive impact on improving eco-environment. While some studies imply that its also has negative effect, the findings of Hong Lianying[4] suggests through introducing FDI, eastern coastal region’s manufacturing industry has transformed and upgraded at the expense of eco-environment, which are the results from the extensive development: highly resource consumption. Shi Minjun[5] studied the spatial distribution and evolution of Chinese manufacturing industry and found that manufacturing structure evolution and transformation has aggravate regional environmental pollution. EKC analysis and other empirical researches in China, confirm economic scale, industrial agglomeration and technology improvement have played negative impact on eco-environment[6-9]. Nie Guoqing et al.[10] implied environmental regulation has a double effects of “positive and negative” on technology innovation of manufacturing industrial and these innovation themselves are transformation and upgrading. Gokmenoglu et al.[11], similarly, argued there is nonlinear relation between industrial upgrading and environmental pollution and the relation has been stable. The researches have indicated the different conclusions tend to be drawn from different research perspectives, showing the regional feature especial to the developing country like China.

2. Materials and Methods

2.1. Construct the environmental effect system for manufacturing transformation and upgrading
Known by the literature [12], according to National Economy Industrial Classification (GB/T4754-2017) and the interaction between manufacturing industries and their production, the manufacture industries are classified 10 sub sectors, shown by table1.

Table 1. manufacturing industries classification

| No. | Sub sectors                                                                 |
|-----|-----------------------------------------------------------------------------|
| 1   | Food and beverage Production; tobacco processing                            |
| 2   | Textile industry; Garments, shoes, leather, furs & related products          |
| 3   | Timber, bamboo products; manufacture of furniture                           |
| 4   | Paper making & Paper Products; printing, culture, education & entertainment goods manufacturing |
| 5   | Raw Chemical materials & chemical products                                  |
| 6   | Medical & pharmaceutical products                                           |
| 7   | Chemical fiber; plastic products                                            |
| 8   | Metal & nonmetal minerals products; smelting & pressing of ferrous metals    |
| 9   | Transportation equipment and electric instrument manufacturing              |
| 10  | Other manufacturing                                                         |

Following the researchers’ method, takes manufacturing environmental pollution per GDP as measures. According to the discharge amount of wastes per GDP, classifies the degree of eco-environmental effect as follows (table 2).
Table 2. eco-environmental effect index classification

| Environmental effect index classification | 1-2 | 2-4 | 4-6 | 6-8 | 8-10 |
|------------------------------------------|-----|-----|-----|-----|------|
| classification                            | weak | Comparatively weak | medium | Comparatively strong | strong |

The closer to 10, the stronger negative effects are. On the contrary, 1 means the negative effect is the weakest. Construct manufacturing sub sectors’ environmental pollution index \( P_i \) in order to consider eco-environmental issue from regional manufacturing transformation and upgrading.

\[
P_i = A[R(p_{ij})]
\]  

\((i = 1, 2, 3, ..., 10)\) means sub sector (shown by table 1); \( i \) is time dimension: year from 2008 to 2017; \( j \) three wastes, that is, waste water, exhaust gas and solid waste; \( p_{ij} \) refers to three wastes of the \( i \) per GDP in the \( t \); \( R(p_{ij}) \) is the rank of the \( j \) in the \( t \); \( A \) is Time-weighted average for classified pollution of the \( i \) from 2008 to 2017. The result is shown as follows (table 3).

Table 3. manufacturing sub sectors’ environmental pollution index

| Sub sectors | 1   | 2   | 3   | 4   | 5  | 6   | 7  | 8  | 9  | 10  |
|-------------|-----|-----|-----|-----|----|-----|----|----|----|-----|
| Environmental pollution index | 3.20 | 2.00 | 4.33 | 7.57 | 7.73 | 5.33 | 5.67 | 8.33 | 3.00 | 3.00 |

2.2. Construct index model of environmental effect for manufacturing transformation and upgrading
The manufacturing transformation and upgrading has impacted on the regional environment as well as the structure of manufacturing industry. So construct \( EI_{ct} \) for transformation and upgrade, and which includes the proportion of manufacturing industry sub sectors of Xijiang River Economical Belt as weight.

\[
EI_{ct} = \text{Pr}o_{ct} \times P_i
\]  

\( \text{Pr}o_{ct} \) refers to the sub sector \( i \) proportion accounting for the manufacturing total output value of city (Nanning, Guigang, Wuzhou, Baise, Laibin, Liuzhou and Chonzuo) at \( t \) (2008-2017). Accordingly, construct eco-environmental comprehensive index dynamically \( \text{Eco-enl} \), compare to gaps of industrial structure for eco-environmental comprehensive index at different period and know further the effect of the change of regional industrial structure on eco-environment.

\[
\text{Eco-enl} = \frac{EI_{ct} - EI_{ct-1}}{EI_{ct-1}}
\]  

\( \text{Eco-enl} \) is effect degree index of the change of industrial structure to eco-environment at a certain time. That the index is positive means the environmental effect of structure worsening. While negative means the effect tends to be better. According to (1), (2) and (3), the result is shown as follows (table 4).

Table 4 2008-2017 the effect of the change of manufacturing structure to eco-environment

|          | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------|------|------|------|------|------|------|------|------|------|------|
| \( EI_{ct} \) | 7.00 | 6.73 | 5.94 | 6.14 | 5.86 | 6.11 | 5.93 | 5.77 | 5.40 | 5.63 |
| \( \text{Eco-enl} \) | -0.03 | -0.11 | 0.03 | -0.04 | 0.04 | -0.02 | 0.02 | -0.06 | 0.04 |

3. Results and Discussion
(1) The negative effect has gradually improved from 2008 to 2017.
Manufacturing industry index $E^I_{t}$ fall to 5.63 in 2017 from 7.00 in 2008, which means the structure has changed to environment-friendly ecological industry. While during 2008-2013, $E^{−enl}$ index raised up to 0.04, that is, manufacturing industry had greatly damaged the regional eco-environment. From 2014, the effect value field of manufacturing development has decreased from comparatively strong to medium, and shrinking, which shows the structure proportion of manufacturing industry has adapted to eco-environment developing.

(2) The effect of the structure change of sub sectors has positive impact on environment as a whole.

The effect of structure change has been from worsen to better. The data in table 4 shows that the changes relates to the implement of regional “a five-year programme”. In 2010, the last year of “the eleventh five-year plan”, the effect degree index was -0.11, the environment wholly was improved. The air quality of the Economic Belt all reached national standard Level II. Compared with 2005, the emission of environmental pollution such as SO2 fell by 11.66%, while raised by 1.49% compared to 2009. However, 2013, the medium term of “the twelfth five-year plan”, in order to reach the economic development goal, witnessed the eco-environment worsening, and the three wastes emission increased compared to 2011and 2012, and as well the water quality, the success rate is 95.8% and decreased by 1.4% contrast with 2012[13]. In general, after 2012, the data changes show that the fluctuation is related to the practice of General plan for developing of Xijiang River Economic Belt (2012)and the Pearl River-Xijiang River Economic Belt Development Plan(2014), which put great emphasis on protecting and improving regional environment while developing economy and the transformation and upgrade of manufacturing industry has gradually optimized ecologically, which bring about a better eco-environmental effect.

4. Conclusions

The paper discusses the effect of manufacturing transformation and upgrading on eco-environment. From 2008 to 2017, the transformation and upgrading prompt the economy development and environment, meeting the requirement of the plan and achieving the goal of synergetic development between industries and eco-environment.

(1) Prompt ecologically further traditional industries’ transformation and upgrading based on the internet. Economic Belt should improve traditional product technology for food, metal, paper, wood, textile, automobile etc.. Decrease materials and energy consuming and combine deeply Industrialization and informatization, transform “Guangxi manufacture” into “Guangxi intelligent manufacture”, construct Liuzhou and Beibu Gulf Economic Zone as the advanced manufacturing base. Push forward Sugar and Alcoa innovative developing. In consumer products, prompt such automobile, furniture, food as manufacturing industries to develop new mode, such as customization, product trace-ability , social marketing,virtual Experience.All these should consider ecological idea, such as decrease the emission of environmental pollutant during production process and carry out ecological evaluation and environmental consequences’ harmless treatment.

(2) The government should improve manufacturing management system of ecological environment protection. Government must play a key role to achieve the goal of regional economic development based on ecological environment protection. As for supervision, it should issue the environment protection regulations, improve the rules of environmental monitoring system about industry. At the same time, put more emphasis on research of green technology and fiscal investment and strengthen industries and firms’ awareness of environmental protection by propaganda and education. In addition, by employing theory of industrial ecology, the government guides manufacturing industry to cluster. Construct industrial park’s green infrastructure and reform the well-established ones. Centralize pollution discharge process and enhance reuse efficiency of wastes, which could gain good ecological cycle among its surroundings.
Acknowledgments
This work was financially supported by the National Science fund: Research on Collaborative Innovation System of the Pearl River-Xijiang River Economic Belt under Supply-side Reform for supporting this research through Grant No.17XGL006, and Wuzhou University fund: Research on transformation and upgrading of manufacturing industry for the Pearl River-Xijiang River Economic Belt, No. 2017A002.

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