Comprehensive evaluation of urbanization development quality in Four East China Provinces

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Abstract. Urbanization is an inevitable route to modernization for any nation, its developing level is also a major sign of the prosperity of the country. However, the development of urbanization in China is rather fast but the quality of development is not high, and there are several problems in the development of urbanization with a large number of farmers swarming into the nearby city. Therefore, the main goal of urbanization in the new era is to speed up the urbanization of agricultural transfer population and improve the construction of urban basic security system. An attempt is made in this paper to construct a new evaluation index system of urbanization, and quantitatively analyze the development quality of urbanization in Shandong, Jiangsu, Zhejiang and Guangdong provinces by factor analysis using SPSS software. It is noteworthy to mention that at present, the factors such as the education level of the transferred population and the basic guarantee system of the city are important obstacles in the development of urbanization. In view of this, several countermeasures and suggestions are put forward from four aspects viz., promoting the development of industrial integration, strengthening the construction of urban infrastructure, overall planning and improving the urban and rural security system, and speeding up the education for the whole people.

1. Introduction

Urbanization refers to the historical process of a country or region gradually changing from its traditional rural agrarian society to a modern urban society based on non-agricultural industries such as goods and services, along with the development of social productivity, scientific and technological progress, and adjustment of the industrial structure [1]. The process of urbanization not only shows an increase in urban population, but also is accompanied by a series of changes in socio-economic, cultural and natural landscapes. However, it is a complex evolution process [2]. For any country, urbanization is the main indicator of its level of socio-economic development and the only way to achieve modernization [3].

China is a large country with a long history of farming. The rural population has always been far more than the urban population. The evolution of New China led to the expansion of erstwhile towns, emergence of new cities, substantial increase in industrial productivity and social economy resulting...
into a major migration of rural population to new urban areas, both cities and towns. Various studies [4][5][6][7][8], revealed that China's urbanization development process can be divided into five stages: The initial stage led the foundation of the PRC in 1949 ~ 1957, with a "transition from agrarian economy to industrialized economy" wherein, the process of industrialization and urbanization started. The second stage experienced the rash advance and adjustment of the Great Leap Forward in 1958 ~ 1965. The exaggeration of agriculture and the rash advance of industry however, have led to catastrophic consequences. On the other hand, the third stage was stagnant witnessing a Great Cultural Revolution in 1966 ~ 1977. A decade of turmoil has led to urban-rural division and urbanization was stalled. The fourth stage comprised of rapid initiatives through various reforms and opening-up of policies during 1978 ~ 2001. The advancement and guidance of related policies such as the family joint production contract responsibility system and the market economy have promoted urban and rural population mobility and accelerated urbanization. The fifth stage augmented development stage promoted by the "three rural" issues after 2002.

The rapid development of agricultural modernization has further promoted the transfer of surplus agricultural labor and promoted the civilization of the population. During the 70 years of development, China’s urban area has grown rapidly in terms of the number of cities and the city’s infrastructure systems, forming the “Wenzhou Model”, “South Jiangsu Model”, “Pearl River Model”, “Wujiang characteristic Towns Model” and other typical urbanization development models. In addition, the Beijing-Tianjin-Hebei, Yangtze River Delta, Guangdong-Hong Kong-Macao Greater Bay Area and other urban agglomerations substantially absorbed the surplus agricultural labor in the process of rural reform and promoting the development of secondary and tertiary industries [9][10][11][12]. Although China has achieved phenomenal results in the process of urbanization, a series of problems were encountered such as, "urban disease" in large cities, the uneven development of urbanization among regions, and the slow progress of the civilization of migrated agricultural population [11][13][14].

The 18th National Congress of the Communist Party of China in 2012, proposed to adhere to the road of new industrialization, informatization, urbanization, and agricultural modernization with Chinese characteristics, and for the first time proposed "new urbanization". The Third Plenary Session of the 18th CPC Central Committee in 2013 proposed to stick to the new urbanization road with Chinese characteristics. The Central Urbanization Working Conference in the same year further emphasized...
"taking a new urbanization path with Chinese characteristics and scientific development" [15]. The National New Urbanization Plan (2014-2020) however, clarified the development path, main goals and strategic tasks of new urbanization, and became a guiding document to promote the healthy development of urbanization in the country. Premier Li Keqiang proposed, in State Council government work report that it is necessary to reform and improve relevant mechanisms and policies to solve the problem of imbalanced and inadequate development, promote complementary regional advantages, integrate urban and rural development, promote coordinated regional development, and improve the development quality of the new-type urbanization on March, 2019 [16]. The National Development and Reform Commission issued the "Key Tasks for New-type Urbanization" in April 2019, emphasizing the need to implement a new type of urbanization strategy centered on promoting human urbanization and improving quality, providing a strong guarantee for the successful completion of the building of a moderately prosperous society in all respects[17]. As a sequel to the new urbanization development and upgrading strategy proposed by China in the new era, new-type urbanization has shifted from the one-sided pursuit of urbanization in the past to the greater emphasis on the humanities and ecology of cities, and the quality of urbanization. China's new-type urbanization is people-oriented with the promotion of new-type industrialization, informatization, industry-city interaction, conservation and intensiveness, ecological livability, urban-rural integration and harmonious development as the basic characteristics. China's new urbanization is a coordinated development and mutual progress of large, medium and small cities, and new rural communities. It is an urbanization with Chinese characteristics that fits China's national conditions [18][19][20].

Although the four provinces of Shandong, Jiangsu, Zhejiang, and Guangdong, have rapidly developed as major economic provinces in East China, but there are still many problems in the development of new-type urbanization, and the situation is grim. Therefore, this research focuses on the four provinces with high urbanization rates in East China as the research object, and uses qualitative and quantitative assessments of the current quality of new urbanization development to thoroughly explore the key and difficult problems in the process of urbanization development. We aim to comprehensively analyze the obstacles and put forward countmeasures and suggestions in terms of generating the employment of the transferred population, strengthening the public basic guarantee, improving the education level of the migrated population, and effectively promote the healthy and sustainable development of China's new urbanization.

2. Model building and sources of data

2.1. Model building

Based on the existing research results, the factor analysis method is used to quantitatively evaluate the quality of urbanization development. The factor analysis method [21][22] is based on the dependence relationship within the matrix between many indicators or factors. It further integrates variables with overlapping information and intricate complex relationships into a few unrelated comprehensive factors. Essentially, it is a multivariate statistical analysis method which reflects the majority of information in the original data. Its principle and mathematical model are as follows:

With $N$ sample and $P$ indicators, $X = (x_1, x_2, \cdots, x_p)^T$ is a random vector, and the common factor to find is $F = (f_1, f_2, \cdots, f_m)^T$, then the factor model is:

\[
X_1 = a_{11}F_1 + a_{12}F_2 + \cdots + a_{1m}F_m + \varepsilon_1
\]

\[
X_2 = a_{21}F_1 + a_{22}F_2 + \cdots + a_{2m}F_m + \varepsilon_2
\]

\[\cdots\]

\[
X_p = a_{p1}F_1 + a_{p2}F_2 + \cdots + a_{pm}F_m + \varepsilon_p
\]
The matrix $A = (a_{ij})$ is called a factor load matrix, $a_{ij}$ is a factor load, $\varepsilon$ is a special factor, and the special factors are not correlated with each other and with the factor $F_m$. $F_1$ is the score function of the first principal component factor, $F_2$ is the score function of the second principal component factor, $F_3$ is the score function of the third principal component factor, and so on.

2.2. Sources of data and pre-analysis processing

The purpose of this study is to assess the quality of new urbanization development in the four eastern provinces. Considering the availability and uniformity of the data, the statistical data from 2000 to 2017 were selected. All data were collected from China Statistical Yearbook (2001-2018), Shandong Statistical Yearbook (2001-2018), Jiangsu Statistical Yearbook (2001-2018), Zhejiang Statistical Yearbook (2001-2018), Guangdong Statistical Yearbook (2001-2018) and various Statistical bulletins. Missing data were supplemented by using the difference method, and conversion functions were used for normalization before the analysis to eliminate the dimensional differences. The conversion function is: $X^* = \frac{X}{\lambda_{max}}$, where $X_i$ is the positive indicator; $X^* = \frac{X_{min}}{X_i}$, $X_i$ is the negative indicator.

3. Construction of new urbanization evaluation index system

Constructing a scientific and reasonable indicator system presumes an important guiding role in evaluating the quality of new urbanization. Urbanization is an indicator that reflects the level of urban development and involves many aspects such as economic society, ecological environment, and population space. The development of urbanization in the new urban-rural relationship includes not only the development of cities and towns, but also the development of urban-rural integration. In order to reflect truly and comprehensively the basic situations of urbanization development in the four provinces, this study constructed an index system of six primary indicators including economy, population, society, space, life and environment and 24 secondary indicators for urbanization [20] [23] [24] [25] [26], as shown in Table 1.

### Table 1. Evaluation index system of new urbanization development level

| Guidelines layer (primary indicator) | Indicator layer (secondary indicator) | unit of measurement | Index property |
|--------------------------------------|---------------------------------------|---------------------|---------------|
| Economy urbanization                 | GDP per capita                         | Yuan                | Y11(+)        |
|                                     | Proportion of value added of secondary industry to GDP | %                   | Y12(-)        |
|                                     | Proportion of value added of tertiary industry to GDP | %                   | Y13(+/-)      |
|                                     | Energy consumption per 10,000 yuan of GDP (primary energy consumption / gross production value) | Tons of standard coal/10,000 yuan | Y14(-)        |
|                                     | Non-agricultural population as a percentage of total population | %                   | Y21(+)        |
| Population urbanization              | Proportion of non-agricultural employees to total employees | %                   | Y22(+)        |
|                                     | Proportion of employees in tertiary industry to total employees | %                   | Y23(+)        |
|                                     | Number of doctors per 10,000 people | NA                  | Y31(+)        |
|                                     | Number of hospital beds per 10,000 people | NA                  | Y32(+)        |
| Social urbanization                  | Libraries per million people          | NA                  | Y33(+)        |
|                                     | Proportion of education expenditures to local fiscal expenditures | %                   | Y34(+)        |
| Space urbanization                   | Buses per 10,000 people               | NA                  | Y41(+)        |
|                                     | Urban population density              | NA                  | Y42(+)        |
| Life urbanization                    | Road area per capita                  | m²                  | Y43(+)        |
|                                     | Per capita disposable income of urban residents | Yuan               | Y51(+)        |
4. Comprehensive evaluation of new urbanization development quality

4.1. Analysis of research results

The SPSS22 software [22] was used to perform non-positive definite test on the sample fitness measure (KMO). The indicators were simplified from 24 to 16 (Table 2). After retesting, the KMO values of Shandong, Jiangsu, Zhejiang, and Guangdong were 0.731, 0.749, 0.687, and 0.655, and the significances of the Bartlett sphericity test were all less than 0.05. From the KMO measurement method in factor analysis, it can be seen that when KMO> 0.5, factor analysis can be performed. If KMO> 0.7, the data is more satisfactory [27] and the spherical test results are significant, which shows that there are many related factors between the selected 16 variables and are suitable for factor analysis.

Table 2. Revised evaluation index system of new urbanization development level.

| Target layer | Guidelines layer (primary indicator) | Indicator layer (secondary indicator) | unit of measurement | Index property |
|--------------|--------------------------------------|---------------------------------------|---------------------|----------------|
| Economy urbanization | GDP per capita | Yuan | Y11(+) |
| Population urbanization | Proportion of value added of secondary industry to GDP | % | Y12(-) |
| Social urbanization | Proportion of non-agricultural employees to total employees | % | Y21(+) |
| Social urbanization | Doctors per 10,000 people | NA | Y31(+) |
| Social urbanization | Number of hospital beds per 10,000 people | NA | Y32(+) |
| Social urbanization | Libraries per million people | NA | Y33(+) |
| Urbanization evaluation | Proportion of education expenditures to local fiscal expenditures | % | Y34(+) |
| Space urbanization | Urban population density | NA | Y41(+) |
| Life urbanization | Per capita disposable income of urban residents | Yuan | Y51(+) |
| Life urbanization | Engel coefficient of urban residents | % | Y52(-) |
| Life urbanization | Per capita living area of urban residents | m² | Y53(+) |
| Life urbanization | Public green space per capita in cities | m² | Y61(+) |
| Environment urbanization | Green coverage in built-up areas | % | Y62(+) |
| Environment urbanization | Harmless treatment rate of domestic garbage | % | Y63(+) |
| Environment urbanization | Environment urbanization | % | Y64(+) |

The 16 variables were analyzed in SPSS, and the factor analysis method was used to obtain the analysis results of the urbanization factors in these four provinces. Principal factors with eigenvalues greater than 1 were extracted to participate in the comprehensive evaluation of development quality. The first principal component factor of new urbanization in Shandong, Jiangsu, Zhejiang, and Guangdong carried more than 70% of the information, (72.711% in Shandong, 77.053% in Jiangsu,
82.165% in Zhejiang, and 78.543% in Guangdong). In addition, the cumulative variance percentages explained by the first and second principal component factors in the four provinces exceeded 85%, which were 86.685%, 90.703%, 90.702%, and 88.441%. Therefore, it is accurate to select the first and second principal component factors as the principal factors to evaluate the urbanization development of Shandong, Jiangsu, Zhejiang, and Guangdong (Table 3).

| Table 3. Total number of variations that could be explained of four provinces. |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Shandong                                        | Jiangsu                                         | Zhejiang                                        | Guangdong                                       |
| **Initial eigenvalue**                          | **Retrieving the sum of squares**               | **Initial eigenvalue**                          | **Retrieving the sum of squares**               |
| **Total** | **Variance %** | **Cumulative %** | **Total** | **Variance %** | **Cumulative %** | **Total** | **Variance %** | **Cumulative %** | **Total** | **Variance %** | **Cumulative %** |
| 1        | 11.634         | 72.711  | 11.6   | 72.711         | 12.328  | 77.053  | 12.3   | 77.053         | 86.685   | 99.983  | 12.5   | 78.543            |
| 2        | 2.236          | 13.974  | 2.23   | 13.974         | 2.184   | 13.65   | 2.18   | 13.65          | 90.703   | 99.965  | 1.58   | 88.441            |
| 3        | 0.865          | 5.405   | 0.872  | 5.405          | 0.721   | 4.505   | 0.721  | 4.505          | 95.208   | 99.93  | 1.58   | 88.441            |
| 4        | 0.549          | 3.43    | 0.37   | 2.315          | 0.37    | 2.315   | 0.37   | 2.315          | 97.523   | 99.92  | 1.58   | 88.441            |
| 5        | 0.28           | 1.747   | 0.166  | 1.035          | 0.166   | 1.035   | 0.166  | 1.035          | 98.558   | 99.84  | 1.58   | 88.441            |
| 6        | 0.228          | 1.422   | 0.13   | 0.815          | 0.13    | 0.815   | 0.13   | 0.815          | 99.372   | 99.76  | 1.58   | 88.441            |
| 7        | 0.149          | 0.929   | 0.041  | 0.259          | 0.041   | 0.259   | 0.041  | 0.259          | 99.631   | 99.631 | 1.58   | 88.441            |
| 8        | 0.026          | 0.164   | 0.03   | 0.186          | 0.03    | 0.186   | 0.03   | 0.186          | 99.817   | 99.817 | 1.58   | 88.441            |
| 9        | 0.013          | 0.078   | 0.014  | 0.086          | 0.014   | 0.086   | 0.014  | 0.086          | 99.903   | 99.903 | 1.58   | 88.441            |
| 10       | 0.011          | 0.067   | 0.009  | 0.056          | 0.009   | 0.056   | 0.009  | 0.056          | 99.959   | 99.959 | 1.58   | 88.441            |
| 11       | 0.005          | 0.029   | 0.003  | 0.017          | 0.003   | 0.017   | 0.003  | 0.017          | 99.976   | 99.976 | 1.58   | 88.441            |
| 12       | 0.004          | 0.023   | 0.002  | 0.011          | 0.002   | 0.011   | 0.002  | 0.011          | 99.986   | 99.986 | 1.58   | 88.441            |
| 13       | 0.002          | 0.013   | 0.001  | 0.006          | 0.001   | 0.006   | 0.001  | 0.006          | 99.993   | 99.993 | 1.58   | 88.441            |
| 14       | 0.001          | 0.005   | 0.001  | 0.005          | 0.001   | 0.005   | 0.001  | 0.005          | 99.998   | 99.998 | 1.58   | 88.441            |
| 15       | 0              | 0.002   | 0      | 0.002          | 0      | 0.002   | 0      | 0.002          | 100      | 100     | 1.58   | 88.441            |
| 16       | 0              | 0.001   | 100    | 1.25E-03       | 7.80E-03| 100     | 100    | 1.25E-03       | 7.80E-03 | 100     | 1.58   | 88.441            |

| Extraction method: main component analysis |

The first public factor of the four provinces contains more information, mainly reflecting the information on indicators such as per capita GDP, the proportion of non-agricultural employees in the
total employees, the number of hospital beds per 10,000 people, disposable income of urban residents, per capita living area of urban residents, public green space per capita in cities, and sewage treatment rate. The second public factor mainly reflects information such as the proportion of the secondary industry to GDP, the number of doctors per 10,000 people, the number of libraries per 10,000 people, and the proportion of education expenditures to local fiscal expenditures (Table 4). The information reflected by these two factors mainly points to resources such as element configuration, infrastructure, and public services.

Table 4. The urbanization factor score coefficient matrix of four provinces.

| Factors | Shandong | Jiangsu | Zhejiang | Guangdong |
|---------|---------|--------|----------|-----------|
|         | 1       | 2      | 1        | 2         | 1        | 2 |
| Y11(+)  | 0.085   | 0.051  | 0.081    | 0.024     | 0.075    | 0.105  | 0.079  | 0.049  |
| Y12(-)  | 0.041   | 0.371  | 0.058    | 0.28      | 0.06     | 0.416  | 0.049  | 0.365  |
| Y21(+)  | 0.083   | -0.099 | 0.075    | -0.154    | 0.074    | -0.157 | 0.077  | -0.121 |
| Y31(+)  | 0.078   | 0.168  | 0.074    | 0.122     | 0.074    | 0.17   | 0.077  | 0.132  |
| Y32(+)  | 0.084   | 0.086  | 0.079    | 0.066     | 0.073    | 0.198  | 0.078  | 0.126  |
| Y33(+)  | 0.049   | -0.312 | 0.073    | 0.122     | 0.069    | -0.198 | -0.074 | 0.154  |
| Y34(+)  | 0.057   | 0.169  | 0.029    | 0.397     | -0.036   | 0.332  | 0.056  | -0.327 |
| Y41(+)  | 0.062   | -0.187 | 0.053    | -0.054    | 0.066    | -0.15  | 0.075  | -0.096 |
| Y42(+)  | 0.078   | -0.032 | 0.077    | -0.133    | 0.068    | -0.267 | 0.029  | 0.319  |
| Y51(+)  | 0.085   | 0.069  | 0.081    | 0.017     | 0.074    | 0.142  | 0.079  | 0.082  |
| Y52(-)  | 0.062   | 0.086  | 0.073    | 0.039     | 0.059    | 0.356  | 0.068  | 0.152  |
| Y53(+)  | 0.08   | -0.153 | 0.081    | -0.008    | 0.074    | -0.07  | 0.064  | -0.302 |
| Y61(+)  | 0.082   | -0.105 | 0.075    | -0.166    | 0.072    | 0.097  | 0.073  | 0.189  |
| Y62(+)  | 0.082   | -0.082 | 0.063    | -0.275    | 0.074    | -0.163 | 0.073  | -0.222 |
| Y63(+)  | 0.064   | 0.193  | 0.073    | 0.126     | 0.072    | -0.081 | 0.079  | 0.008  |
| Y64(+)  | 0.082   | -0.096 | 0.076    | -0.149    | 0.074    | -0.132 | 0.078  | -0.008 |

Extraction method: main component analysis

The regression method was used to estimate the factor score coefficients. Based on the principal factor coefficients and standardized data of the urbanization factor score coefficient matrix, we can obtain the scoring functions for each principal factor of urbanization in the four provinces:

1. Shandong Province

\[ F_1 = 0.085y_{11} + 0.041y_{12} + 0.083y_{21} + 0.078y_{31} + 0.084y_{32} + 0.049y_{33} + 0.057y_{34} + 0.062y_{41} + 0.078y_{42} + 0.085y_{51} + 0.062y_{52} + 0.080y_{53} + 0.082y_{61} + 0.082y_{62} + 0.064y_{63} + 0.082y_{64} + 0.051y_{11} - 0.099y_{21} + 0.168y_{31} + 0.086y_{32} - 0.312y_{33} + 0.169y_{34} - 0.187y_{41} - 0.032y_{42} + 0.069y_{51} + 0.086y_{52} - 0.153y_{53} - 0.105y_{61} - 0.082y_{62} + 0.193y_{63} - 0.096y_{64} \]

2. Jiangsu Province

\[ F_1 = 0.081y_{11} + 0.058y_{12} + 0.075y_{21} + 0.074y_{31} + 0.079y_{32} + 0.073y_{33} + 0.029y_{34} + 0.053y_{41} + 0.077y_{42} + 0.081y_{51} + 0.073y_{52} + 0.081y_{53} + 0.075y_{61} + 0.063y_{62} + 0.073y_{63} + 0.076y_{64} + 0.024y_{11} + 0.280y_{12} - 0.154y_{21} + 0.122y_{31} + 0.066y_{32} + 0.122y_{33} + 0.397y_{34} - 0.054y_{41} - 0.133y_{42} + 0.017y_{51} + 0.039y_{52} - 0.008y_{53} - 0.166y_{61} - 0.275y_{62} + 0.126y_{63} - 0.149y_{64} \]

3. Zhejiang Province
\[ F_1 = 0.075y_{11} + 0.060y_{12} + 0.074y_{21} + 0.074y_{31} + 0.073y_{32} + 0.069y_{33} - 0.036y_{34} + 0.066y_{41} \\
+ 0.068y_{42} + 0.074y_{31} + 0.059y_{32} + 0.074y_{33} + 0.072y_{61} + 0.074y_{62} + 0.072y_{63} + 0.074y_{64} \\
F_2 = 0.105y_{11} + 0.416y_{12} - 0.157y_{21} + 0.170y_{31} + 0.198y_{32} - 0.198y_{33} + 0.332y_{34} - 0.150y_{41} \\
- 0.267y_{42} + 0.142y_{31} + 0.356y_{32} - 0.070y_{33} + 0.097y_{61} - 0.163y_{62} - 0.081y_{63} - 0.132y_{64} \\
\]

(4) Guangdong Province

\[ F_1 = 0.079y_{11} + 0.049y_{12} + 0.077y_{21} + 0.077y_{31} + 0.078y_{32} - 0.074y_{33} + 0.056y_{34} + 0.075y_{41} \\
+ 0.029y_{42} + 0.079y_{31} + 0.068y_{32} + 0.064y_{33} + 0.073y_{61} + 0.073y_{62} + 0.079y_{63} + 0.078y_{64} \\
F_2 = 0.049y_{11} + 0.365y_{12} - 0.121y_{21} + 0.132y_{31} + 0.126y_{32} + 0.154y_{33} - 0.327y_{34} - 0.096y_{41} \\
+ 0.319y_{42} + 0.082y_{31} + 0.152y_{32} - 0.302y_{33} + 0.189y_{61} - 0.222y_{62} + 0.0081y_{63} - 0.008y_{64} \\
\]

Using the extracted principal factor and the weight of each variance contribution to calculate the comprehensive score of each province's urbanization, the comprehensive score function \( F \) can be obtained as:

\[ F_{Shandong} = 0.72711F_1 + 0.13974F_2 \\
F_{Jiangsu} = 0.77053F_1 + 0.13650F_2 \\
F_{Zhejiang} = 0.82165F_1 + 0.08536F_2 \\
F_{Guangdong} = 0.78543F_1 + 0.09898F_2 \]

Where, \( F \) is the comprehensive score of the quality of urbanization development, and \( F_1 \) and \( F_2 \) are the scores of the urbanization factors, respectively. The coefficients are the variance contribution rates of the corresponding factors.

Precise distinguishing the development stages of urbanization requires a certain basis for measurement. In view of the fact that the current theoretical research and empirical research have not proposed a unified standard for division, based on the relevant research results, we selected the actual development of urbanization in Shandong, Jiangsu, Zhejiang, and Guangdong as reference for evaluation. Taking 2000 as the base year and quality basis for evaluation, the evaluation criteria for this study were determined.

**Table 5.** Evaluation criteria of urbanization quality.

| Development Quality | Poor | Fair | Fine | Good | Excellent |
|---------------------|------|------|------|------|-----------|
| Comprehensive evaluation score (A) | 0≤A<0.4 | 0.4≤A<0.7 | 0.7≤A<0.8 | 0.8≤A<0.9 | A≥0.9 |

It can be observed from Table 6 that from 2001 to 2004, the urbanization of Shandong, Jiangsu, Zhejiang, and Guangdong showed a slow and steady development at a lower speed, and exhibited a straight upward trend after 2005. It is clearly evident that the quality of urbanization in Jiangsu Province is relatively high for all the years among the four provinces. This however, is attributed to the vanguard of development in Jiangsu in contrast to the rest three provinces. China’s Yangtze River Delta region includes Jiangsu Province that enjoys exceptional advantages such as a solid industrial foundation, the huge domestic market and reform and opening-up policies, is running on the fast track of integration. Shandong and Zhejiang are however, at an intermediate level, and there is not much difference between the two. The quality of urbanization development in Guangdong Province is relatively low among the four provinces but has been significantly increasing at a faster rate. Table 5 reveals that the quality of urbanization development in Jiangsu Province was in a fair state from 2000 to 2010, fine in 2011-2013 and good in 2014-2017. Whereas, the quality of urbanization in Shandong Province and Zhejiang Province from 2000 to 2012 was fair. Shandong Province was fine in 2013 ～ 2016, and has progressed to good in 2017. The development of Zhejiang Province was fine from 2013 to 2015 and progressed to
the good development trend in 2016, which in fact was one year earlier than Shandong Province. The quality of Guangdong’s urbanization development was fair from 2000 to 2013, and fine from 2014 to 2017. Table 6 and Figure 2 show that the quality of urbanization development in the four provinces has been progressing in a favorable direction in terms of the speed and quality of development over the period and all have entered in good state.

Table 6. Score table of quality evaluation of urbanization development about four provinces.

| Province | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Shandong | 0.4968| 0.4962| 0.5137| 0.5255| 0.5396| 0.5626| 0.5998| 0.6242| 0.6486| 0.6794| 0.7081| 0.7458| 0.7696| 0.7818| 0.8040| 0.8222| 0.8462|       |
| Jiangsu  | 0.5792| 0.5731| 0.5718| 0.5778| 0.5977| 0.6279| 0.6452| 0.6620| 0.6864| 0.7087| 0.7316| 0.7672| 0.7920| 0.8247| 0.8415| 0.8641| 0.8881|       |
| Zhejiang | 0.4561| 0.4739| 0.4749| 0.5027| 0.5304| 0.5557| 0.5953| 0.6063| 0.6260| 0.6554| 0.6783| 0.7037| 0.7300| 0.7568| 0.8085| 0.8349| 0.8591| 0.8877|
| Guangdong| 0.3825| 0.4168| 0.3966| 0.4121| 0.4443| 0.4684| 0.4968| 0.5115| 0.5338| 0.5677| 0.6018| 0.6298| 0.6734| 0.7067| 0.7152| 0.7397| 0.7680| 0.7926|

Figure 2. The score tendency of urbanization developing quality of four provinces.

4.2. Analysis of the key and difficult problems in the development of urbanization in the four provinces

Based on the new evaluation index system of urbanization, quantitative analysis and the research findings of the quality of urbanization development in the four eastern provinces under consideration, it is found that the obstacles in the development of new urbanization in China are mainly attributed to the following three aspects.

- Although the development of urbanization is fast, the quality of development needs to be improved. With the acceleration of the urbanization process, many rural surplus laborers left the land and flocked to towns. The multiple growth of the population and the inadequacy of urban planning and urban management have put tremendous pressures on urban resources and environments, resulting in environmental pollution, ecological damage, and traffic congestion. "Big city disease" issues are really serious in big cities. Due to the low level of industrial
development, low public services and public resources, the small and medium-sized cities and towns have weakened the attractiveness of the population resulting in population outflows, reduced their own development vitality, and thus, the quality of urbanization is not high.

- The urban-rural "dual" structural barriers still exist. The “dual” division system between urban and rural areas has solidified the different identities, rights and various social management systems of urban and rural residents, and has become a serious obstacle in the advancement of urbanization. Although, China has established a unified urban and rural household registration system, a significant number of agricultural migrants who are employed and living in cities have not yet achieved civilization. Compared with the urban residents, there still exists a large gap in basic public services in terms of access to medical care, social security, education, etc., which need to be really integrated into the city. It is necessary to ensure comprehensive old-age services, convenient medical services, sound social service security, modern education and training services. However, these goals are rather difficult to achieve in a short span of time.

- The migrated rural population has a low level of education to meet the employment needs of urbanization development. With the rapid integration of industrialization, urbanization, informatization and agricultural modernization, the surplus labor force in rural areas has been transferred to cities on a large scale to enter secondary and tertiary industries. With further advancement of the conversion of old and new kinetic energy and the continuous optimization and adjustment of the industrial structure, the original labor-intensive industry has gradually transformed into a knowledge-intensive industry, thereby increasing the comprehensive quality requirements of the employees. The proportion of rural transfer workers who have received high-level education is relatively low, which makes it difficult to meet the needs of jobs in the new situation. Although government departments have formulated a series of policies and measures to accelerate the employment retraining of rural migrants, the current implementation effect is not significant.

5. Countermeasures and Suggestions

The 19th National Congress of the Communist Party of China has made major decisions and plans to establish and improve the urban-rural integration development mechanism and policy system. It also issued the Opinions on Establishing and Perfecting the Urban-Rural Integration Development Mechanism and Policy System (hereinafter referred to as "Opinions"). The core requirements of the Opinions are: adhere to the priority development of agriculture and rural areas, eliminate the disadvantages of the system and mechanism that hinder the integration of urban and rural areas, gradually promote the equalization of public services and infrastructure between urban and rural areas, reshape the new urban-rural relationship, and accelerate the promotion of rural development and agricultural and rural modernization.

- The government should further increase its support to agriculture in terms of policies and finances, hasten urban-rural integration, promote free flow of urban and rural elements, equal exchange and rational allocation of public resources, and accelerate mutual industrial and rural promotion, urban-rural complementarity, comprehensive integration and common prosperity of the new type of urban-rural relationship between workers and farmers to accelerate agricultural and rural modernization.

- The government needs to change its traditional resource allocation policy of “emphasizing cities and neglecting rural areas”. It is necessary to establish institutions, improve the basic public service system with universal coverage, inclusive benefits, and urban-rural integration besides covering social undertakings in rural areas. It should also promote the unification of basic public service standards in urban and rural areas and the integration of systems, so that farmers can also enjoy public services of the same level and quality as that of urban residents.

- The government should strengthen the construction of urban infrastructure and promote the citizenization of migrated rural agrarian population. It is utmost important to strengthen mid-term and long-term planning for urban development, and accelerate the improvement of urban
management capabilities and levels. It is mandatory to improve the construction of facilities such as the urban transportation system and garbage disposal system, increase the urban environmental carrying capacity, and enhance the city's own sustainable development capacity.

- Local government departments have to actively formulate skills development policies for agricultural migrants such as migrant workers by type of work, institutionalize the work of transferring labor knowledge and skills, and strengthen vocational skills training for agricultural migrants such that they can serve the high-quality urbanization development.

References

[1] Jiang M Q 1988 Urbanism (Beijing: Science Popularization Press).
[2] Li F Y City and Urbanization[EB/OL]. [Institute of Urban Environment, Chinese Academy of Sciences]http://www. iue.cas.cn/kpjy/kpwz/200905/t20090531_1875262.html.
[3] Zhou X B 2019 Clarify the relationship between urbanization, rural revitalization and urban-rural integration development China Urban Rural Financial News, (A07).
[4] Yang F and Tao S W 2010 Development stage, trend and characteristics of urbanization in China Lanzhou J., 2010 (06): 75-8.
[5] Liu Y 2011 The course, problems and trend of China's urbanization development Res. Econ. Manag., 2011(03): 20-6.
[6] Gu J, Yue J and Chen X X 2015 Analysis of urbanization development stage and policy in new China. Planner, 31(10): 74-81.
[7] Liu Y and Li X China's urbanization development process and future strategic concept [EB/OL]. [sohu.com]http://www.sohu.com/a/225217615_673573.
[8] Fang C L, Liu X L and Lin X Q 2008 Revision and regularity analysis of urbanization development stage in China. Arid Area Geogr, 2008(04):512-23.
[9] Zhang Y, Li B B 2013 Enlightenment of overseas urbanization development mode on China's urbanization development. Anhui Agricul Sci, 41(30):12178-80.
[10] Lai G B 2015 Enlightenment of foreign urbanization development mode on China. Anhui Agricul Sci, 43(10): 356-8.
[11] Li W 2019 Evolution and development of urbanization with Chinese characteristics in the 70 Years of New China. China Party and Government Cadres Forum, 2019(06):6-10.
[12] Ni P F 2018 Experience and enlightenment of China's urbanization development in the 40 years of Reform and Opening Up. Smart China, 2018(12):11-3.
[13] He W D and Xin Y F 2014 Research on China's urbanization development. China Manag. Informatiz., 17 (03):103-5.
[14] Wang C N 2019. China's Urbanization: there is still more room to promote in the future. China economic times, September 20, 2019 (A01).
[15] Jia R X 2018 40 years of urbanization development in China: from high speed to high quality. China Develop. Obser., 2018 (24):17-21.
[16] Li K Q. Li Keqiang said that we should promote coordinated regional development and improve the quality of new urbanization.[EB/OL].[Central People's Government of the people's Republic of China]http://www.gov.cn/premier/2019-03/05/content_.htm.
[17] Notice of the development and Reform Commission on printing and distributing the key tasks of new urbanization construction in 2019. [EB/OL].[Central People's Government of the people's Republic of China]http://www.gov.cn/xinwen/2019-04/08/content_.htm.
[18] Shen C 2018 Mutual promotion and integration of new urbanization and rural revitalization. Fujian Daily, May 21, 2018(009).
[19] Su X and Jin Y P, Experience of urbanization development abroad and new urbanization construction in China. World Agricul., 2013(10):36-8.
[20] Zhang Y C 2016 Study on the new urbanization index system of Shandong Province. Market Weekly (Theoretical Research), 2016(07): 16-7.
[21] Yuan J W and Zheng W 2015 Analysis and suggestions on the comprehensive development level
of urbanization in Guangdong Province based on factor analysis. Urban Develop. Strategy, 2015(10): 24-9.
[22] Zhang W T, Zhong Y F 2013 The essence of IBM SPSS data analysis and mining cases (Beijing: Tsinghua University Press).
[23] Han Z Y and Wang J 2016 Construction of a new urbanization index system under the new normal: a case study of Nanjing, Jiangsu Province. Business Econ. Res., 2016(08):146-8.
[24] Wang B Y, Xie F J and Huang X J, Construction of a new urbanization evaluation index system -- Taking Jiangxi as an Example. Jiangxi Social Sci, 2013(08):72-6.
[25] Jing G W. Study on the construction and level measurement of new urbanization index system in Shanxi Province. J. Shanxi Finan Taxation College, 2017(19):52-8.
[26] Cui Q D 2014 Study on the evaluation index system of urbanization in Anhui Province Shaanxi: Chang'an University.
[27] Gao X B and Dong H Q 2007 Data analysis and spss application (Beijing: Tsinghua University Press).