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# Evaluation of Development Level of Urbanization in County in Henan

**Xuke Li*, Yue Zhang, Yuqi Shi**

*School of Mathematics and Statistics, Pingdingshan University, Pingdingshan, 467000, China*
**Corresponding author*

***Abstract:*** *From the three dimensions of economic urbanization, population urbanization and land urbanization, this paper uses the entropy TOPSIS model to comprehensively evaluate the county urbanization development level of Henan Province. The results show that the county urbanization level of Henan Province increases year by year, but the county urbanization development level is uneven. Cities with high urbanization development level have weak radiation, which can't better drive the urbanization development of surrounding small and medium-sized cities. Then based on this, this paper puts forward targeted improvement suggestions in order to promote the development of urbanization in Henan Province.*

***Keywords:*** *level of urbanization development, counties in Henan Province, entropy TOPSIS model*

## 1. Introduction

The report to the 19th National Congress of the CPC pointed out that the principal contradiction facing Chinese society has evolved into one between unbalanced and inadequate development and the people's ever-growing needs for a better life. With the function of boosting domestic demand, optimizing industrial structure, promoting coordination between urban and rural areas, and stimulating economic growth. Urbanization becomes an important driving force for addressing the problem of unbalanced and inadequate development. At present, the development direction of urbanization in provinces has changed from blindly pursuing the scale and quantity of urbanization to the quality of urbanization development. As a province with a large population, Henan province plays an important role in promoting national economic and social development by accelerating urbanization construction and improving the quality of urbanization development, Moreover, Henan province has jurisdiction over 17 prefecture-level cities and more than 100 counties (county-level cities), which are different in population, economy, geographical location, resources and other aspects and have their own characteristics. So in order to promote the urbanization development level of each county, it is necessary to deepen the study of the urbanization development status of each county.

Throughout the existing literature, Zhou Nannan, Zhang Ke[1] evaluated the green urbanization level of 31 provinces in China using factor analysis and cluster analysis; Hu Guangwei[2] constructed an evaluation index system from five aspects of economic urbanization, life urbanization, social development urbanization, ecological environment urbanization and urban-rural overall planning, and calculated the comprehensive level of development quality of all cities in Hunan Province. Zhu Sujia[3] used unitary linear regression method to measure the effectiveness of county urbanization in Hebei Province. Zhou Zhengzhu and Wang junlong[4] explored the comprehensive development level and spatial and temporal differences of urbanization and ecological environment using factor analysis, comprehensive development index; Li Qianqian and Dong Huizhong[5] constructed an evaluation index system of urbanization based on the theory of extension model based on entropy weight, and evaluated the development of urbanization level in Shandong Peninsula Blue Economic Zone; Du zhiguo[6] measured the development level of new urbanization in Shanxi province, and explored the main influencing factors affected urbanization development by component analysis; Yi Jinxiu[7] analyzed the layout and spatial characteristics of new towns in Jiangsu province using the comprehensive index system and principal factor method; Yang Peiqing[8] evaluated the new-style urbanization development level of 11provinces and cities of the western region by PCA; Liu Zunfeng, Liu Qiuling and Zhang Chunling[9] used AHP and entropy method to comprehensively weigh the index, and taking Hebei Province as an example, evaluated the development of new-type urbanization in the country by using the multi-index comprehensive evaluation model. Additionally, the results of

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the evaluation of urbanization development level in Henan province are as follows: Yan Fang and Tang Zhenxing[10] adopted analytic hierarchy process to construct a comprehensive evaluation index system of new urbanization development level of Henan province based on industrial agglomeration, and evaluated the urbanization development of Henan province from the qualitative and quantitative aspects; Shen Xin and Liu Shuli[11] used the improved entropy method to calculate the new-type urbanization rate of 18 cities in Henan Province, and comprehensively and systematically monitor and evaluated the development level of new-type urbanization in Henan Province. So far, the research on the level of urbanization development in Henan Province has not taken county area as the research object.

In this paper, to comprehensively evaluate the comprehensive development level of county urbanization in Henan Province, counties were selected at the research level.

## 2. Establishment of evaluation model of county urbanization development level in Henan

### *2.1 Evaluation indicators and data sources*

The study selects three dimensions of economic urbanization, population urbanization and land urbanization. Considering that Henan Province is a large agricultural and populous province in China, and one of the provinces with the largest number of counties in China, The population urbanization level, economic urbanization level and land urbanization level are expressed by the proportion of non-agricultural population, per capita GDP and the proportion of built-up areas respectively.

The determination of the weight of the evaluation index needs to be considered after determining evaluation index. The entropy weight method objectively determines the weight according to the information provided by each evaluation index. The entropy weight as a weight can not only objectively reflect the importance of an index in the index system during decision-making, but also highlight the change of index weight with time. Therefore, the entropy weight assignment method is selected to determine the index weight, and constructs the evaluation model of urbanization development level combined with TOPSIS method.

### *2.2 Entropy-TOPSIS model*

TOPSIS method is a commonly used comprehensive evaluation method, which is proposed by C.L.Hwang and K.Yoon in 1986. It can be widely applied to various samples with less information loss in data processing. Therefore, this paper selects TOPSIS method to evaluate the development level of county urbanization in Henan Province. However, the determination of each index weight in TOPSIS model is often subjective, that is, the default weight of all indexes is the same, which affects the objectivity of problem analysis. Contrarily, the entropy method can objectively give the weight of each index and reflect the evaluation system more scientifically and reasonably [12]. Therefore, this paper uses the entropy method to modify the TOPSIS model, that is, determines the weight through the entropy weight method, and then constructs the weighted TOPSIS model to avoid the influence of subjective factors.

#### *2.2.1 Basic principle of entropy method*

The entropy method determines the objective weight according to the index variability. Generally speaking, the smaller the information entropy of an index is, the greater the variation degree of the index is, the more information it provides, and the greater the role it can play in the comprehensive evaluation, and the greater its weight will be. On the contrary, the higher the information entropy of an index is, the smaller the variation degree of the index is, the less information it provides, the smaller the role it plays in the comprehensive evaluation, and the smaller its weight is.

The specific steps are as follows[13,14]:

(1) Collection and processing of index data

Firstly, a decision matrix $X = \left(x_{ij}\right)_{n\times m}$ with n rows and m columns is constructed by using the original index data. Where n=104 represents the number of counties in Henan province, and m represents the number of evaluation indexes 3. In order to avoid the impact caused by inconsistent data units, dimensionless processing is carried out on the original data. And the formulas used are as follows:

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$$y_{ij}=\frac{x_{ij}-\min\left\{x_{ij}\right\}}{\max\left\{x_{ij}\right\}-\min\left\{x_{ij}\right\}}\quad\left(i=1,2,\cdots n,\ j=1,2,\cdots m\right)\tag{1}$$

$$p_{ij}=\frac{y_{ij}}{\sum_{i=1}^{n}y_{ij}}\tag{2}$$

Now the normalized decision matrix $P=\left(p_{ij}\right)_{n\times m}$ after transformation is obtained.

(2) Determination of entropy

According to the definition of entropy, the entropy formula of the JTH evaluation index is:

$$e_j=-k\sum_{i=1}^{n}p_{ij}\ln\left(p_{ij}\right),\quad j=1,\cdots,m\tag{3}$$

where $k=\frac{1}{\ln n}>0$, and $e_j$ satisfies $e_j\geq 0$.

(3) Calculation of the information entropy redundancy (difference degree) of the JTH indicator

(4) The formula is as follows:

$$d_j=1-e_j,\ \ j=1,2,\cdots,m\tag{4}$$

(5) Calculation of the weight of evaluation indicators

$d_j$ in (3) is normalized as the weight of each indicator, and the formula is

$$w_j=d_j/\sum_{j=1}^{m}d_j,\ j=1,2,\cdots m\tag{5}$$

where $w_j$ satisfies $\sum_{j=1}^{m}w_j=1$.

***2.2.2 The basic principle of TOPSIS method***

TOPSIS method is to sort the evaluation objects by detecting the distance between them and the ideal solution and negative ideal solution. To comprehensively evaluate the objects, the positive and negative ideal solution are firstly determined as the evaluation standard, where the positive ideal solution is the optimal solution in theory, while the negative ideal solution is the opposite. Secondly, the alternatives are sorted by detecting the distance between them and the optimal solution and the worst solution, the best alternative is the one that is closest to the ideal solution and far away from the negative ideal solution. The specific practices are as follows:

(1) Construct the weight matrix

$$W=\begin{pmatrix}w_1 & 0 & \cdots & 0\\ 0 & w_2 & \cdots & 0\\ \cdots & \cdots & \cdots & \cdots\\ 0 & 0 & \cdots & w_m\end{pmatrix}\tag{6}$$

(2) Construct the weighted normalized decision matrix:

$$Z=\left(z_{ij}\right)_{n\times m}=\left(p_{ij}w_j\right)_{n\times m}$$

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(3) Identify positive ideal solution $Z^+$ and negative ideal solution $Z^-$.The formulas are as follows:

$$Z^+ = \left(Z_1^+, Z_2^+, \cdots, Z_m^+\right) = \left(\max\left\{z_{11}, z_{21}, \cdots z_{n1}\right\}, \max\left\{z_{12}, z_{22}, \cdots z_{n2}\right\}, \cdots, \max\left\{z_{1n}, z_{2n}, \cdots z_{nn}\right\}\right) \quad (7)$$

$$Z^- = \left(Z_1^-, Z_2^-, \cdots, Z_m^-\right) = \left(\min\left\{z_{11}, z_{21}, \cdots z_{n1}\right\}, \min\left\{z_{12}, z_{22}, \cdots z_{n2}\right\}, \cdots, \min\left\{z_{1n}, z_{2n}, \cdots z_{nn}\right\}\right) \quad (8)$$

(4) Identify the distance between evaluation objects and positive ideal solution $d_i^+$ and negative ideal solution $d_i^-$. The formulas are as follows:

$$d_i^+ = \sqrt{\sum_{j=1}^{m}\left(Z_j^+ - z_{ij}\right)^2} \quad (9)$$

$$d_i^- = \sqrt{\sum_{j=1}^{m}\left(Z_j^- - z_{ij}\right)^2} \quad (10)$$

(5) Calculate the score $S_i$ of the i-th evaluation object, and the formula is as follows:

$$S_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad (11)$$

(6) Normalize the scores in (5) by using the following formula

$$s_i = S_i \Big/ \sum_{i=1}^{n} S_i \quad (12)$$

Finally, according to the score of evaluation objects, the urbanization level of each county in Henan province is ranked, and then the comprehensive evaluation is carried out.

## 3. Empirical analysis of county urbanization development level in Henan Province

To comprehensively evaluate the county urbanization development level of Henan Province. The paper studies from the three dimensions of economic urbanization, population urbanization and land urbanization, and the dimensions are respectively represented by the proportion of non-agricultural population, GDP per capita and the proportion of built-up areas. Additionally, the index data used in the analysis are mainly from The Statistical Yearbook of Henan Province from 2014 to 2019 and the statistical yearbooks of various municipal levels.

Because of the similarity of the analysis from year to year, the following empirical analysis takes the comprehensive evaluation of urbanization development level of each county in Henan Province in 2018 as an example.

Firstly, the weight matrix of the three indices: proportion of non-agricultural population, per capita GDP and the proportion of built-up areas is obtained by Formulas (1)-(5), and the result which the form is the same with Formula (6) is

$$W_{2018} = \begin{pmatrix} 0.4594 & 0 & 0 \\ 0 & 0.2013 & 0 \\ 0 & 0 & 0.3374 \end{pmatrix}.$$

Based on the weight matrix above, the weighted normalization matrix

$$Z = \left(z_{ij}\right)_{n\times m} = \left(p_{ij}w_j\right)_{n\times m}$$

is obtained. And then the optimal solution $Z^+$ and the worst solution $Z^-$ of the weighted normalized decision matrix Z are determined by Formulas (7) and (8). The result for 2018 is

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$$Z^{+} = \left(Z_1^{+}, Z_2^{+}, Z_3^{+}\right) = \left(0.4608, 0.2065, 0.3327\right)$$

$$Z^{-} = \left(Z_1^{-}, Z_2^{-}, Z_3^{-}\right) = \left(0.0922, 0.0413, 0.0665\right)$$

*Table 1 The results of $d_i^+$, $d_i^-$, the comprehensive score of urbanization development level of each county, and the Ranking of urbanization development level of each county obtained by scores*

| County | $d_i^+$ | $d_i^-$ | Score | Ranking | County | $d_i^+$ | $d_i^-$ | Score | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| Zhongmou | 0.2057 | 0.3128 | 71.77 | 5 | Xiangcheng | 0.3291 | 0.1612 | 38.49 | 46 |
| Gongyi | 0.1411 | 0.3830 | 72.60 | 4 | Yuzhou | 0.2671 | 0.2609 | 57.19 | 17 |
| Xingyang | 0.1452 | 0.3638 | 58.09 | 14 | Changge | 0.1636 | 0.3650 | 76.49 | 3 |
| Xinmi | 0.1400 | 0.3674 | 67.18 | 8 | Wuyang | 0.3677 | 0.1594 | 37.40 | 50 |
| Xinzheng | 0.0977 | 0.4429 | 79.51 | 2 | Linying | 0.3457 | 0.1798 | 41.41 | 41 |
| Dengfeng | 0.1595 | 0.3367 | 51.75 | 25 | Mianchi | 0.2905 | 0.2148 | 31.51 | 64 |
| Qixian | 0.4340 | 0.0539 | 12.95 | 99 | Lushi | 0.4345 | 0.0582 | 14.97 | 96 |
| Tongxu | 0.3700 | 0.1172 | 26.07 | 79 | Yima | 0.1052 | 0.4093 | 81.56 | 1 |
| Weishi | 0.3681 | 0.1249 | 29.87 | 69 | Lingbao | 0.2584 | 0.2335 | 42.09 | 39 |
| Lankao | 0.3742 | 0.1105 | 28.82 | 72 | Nanzhao | 0.4295 | 0.0675 | 16.52 | 95 |
| Mengjin | 0.2169 | 0.3285 | 63.13 | 12 | Fangcheng | 0.3810 | 0.2434 | 45.19 | 33 |
| Xinan | 0.1442 | 0.3983 | 71.21 | 6 | Xixia | 0.2606 | 0.2676 | 53.00 | 21 |
| Luanchuan | 0.2782 | 0.2461 | 57.85 | 15 | Zhenping | 0.3679 | 0.1965 | 39.23 | 44 |
| Songxian | 0.3754 | 0.1472 | 32.14 | 62 | Neixiang | 0.3605 | 0.17348 | 38.46 | 47 |
| Ruyang | 0.3500 | 0.1979 | 41.17 | 42 | Xichuan | 0.3604 | 0.17885 | 38.07 | 48 |
| Yiyang | 0.3274 | 0.1899 | 40.09 | 43 | Sheqi | 0.3725 | 0.24293 | 44.67 | 34 |
| Luoning | 0.3458 | 0.1585 | 33.40 | 59 | Tanghe | 0.3855 | 0.17996 | 37.30 | 52 |
| Yichuan | 0.2966 | 0.2626 | 52.29 | 23 | Xinye | 0.3488 | 0.154 | 32.36 | 61 |
| Yanshi | 0.1420 | 0.3793 | 66.70 | 9 | Tongbai | 0.3254 | 0.2085 | 43.46 | 37 |
| Baofeng | 0.2736 | 0.2264 | 46.28 | 32 | Dengzhou | 0.3681 | 0.2117 | 42.34 | 38 |
| Yexian | 0.3990 | 0.1325 | 28.35 | 73 | Minquan | 0.3775 | 0.1451 | 34.45 | 58 |
| Lushan | 0.4518 | 0.0471 | 10.90 | 100 | Suixian | 0.4518 | 0.0331 | 10.23 | 102 |
| Jiaxian | 0.3848 | 0.1370 | 30.50 | 68 | Ningling | 0.4392 | 0.0628 | 17.31 | 93 |
| Wugang | 0.3232 | 0.2043 | 43.66 | 36 | Zhecheng | 0.4068 | 0.0900 | 22.37 | 84 |
| Ruzhou | 0.3034 | 0.2477 | 49.77 | 27 | Yucheng | 0.4319 | 0.0532 | 14.28 | 97 |
| Anyang | 0.3421 | 0.1899 | 35.45 | 55 | Xiayi | 0.4160 | 0.0852 | 21.62 | 86 |
| Tangyin | 0.2956 | 0.2511 | 46.37 | 31 | Yongcheng | 0.3231 | 0.2266 | 48.34 | 28 |
| Huaxian | 0.4079 | 0.1592 | 34.46 | 57 | Luoshan | 0.3579 | 0.1582 | 35.37 | 56 |
| Neihuang | 0.3998 | 0.1069 | 21.49 | 88 | Guangshan | 0.4193 | 0.0672 | 17.11 | 94 |
| Linzhou | 0.2165 | 0.3266 | 60.77 | 13 | Xinxian | 0.3934 | 0.1066 | 23.58 | 83 |
| Xunxian | 0.3666 | 0.2321 | 46.69 | 30 | Shangcheng | 0.3753 | 0.1297 | 30.61 | 67 |
| Qixian | 0.1735 | 0.3285 | 65.73 | 11 | Gushi | 0.3847 | 0.1371 | 31.46 | 65 |
| Xinxiang | 0.2802 | 0.2450 | 53.32 | 19 | Huangchuan | 0.3610 | 0.1367 | 31.92 | 63 |
| Huojia | 0.3789 | 0.19601 | 41.77 | 40 | Huaibin | 0.4205 | 0.0664 | 17.63 | 91 |
| Yuanyang | 0.4648 | 0.01974 | 10.21 | 103 | Xixian | 0.4334 | 0.0542 | 14.24 | 98 |
| Yanjin | 0.4393 | 0.0445 | 10.49 | 101 | Fugou | 0.3869 | 0.1293 | 27.30 | 76 |
| Fengqiu | 0.4188 | 0.1371 | 30.65 | 66 | Xihua | 0.3906 | 0.1188 | 27.71 | 74 |
| Changyuan | 0.3074 | 0.2421 | 52.96 | 22 | Shangshui | 0.4071 | 0.1094 | 26.45 | 78 |
| Weihui | 0.4217 | 0.0855 | 21.75 | 85 | Shenqiu | 0.3812 | 0.1763 | 37.37 | 51 |
| Huixian | 0.3320 | 0.1587 | 32.50 | 60 | Dancheng | 0.4296 | 0.0672 | 17.89 | 90 |
| Xiuwu | 0.3124 | 0.1734 | 37.79 | 49 | Taikang | 0.4078 | 0.1255 | 29.37 | 71 |
| Boai | 0.2411 | 0.2526 | 55.45 | 18 | Luyi | 0.3611 | 0.1595 | 36.85 | 53 |
| Wuzhi | 0.3298 | 0.1570 | 39.13 | 45 | Xiangcheng | 0.3462 | 0.2734 | 51.06 | 26 |
| Wenxian | 0.2416 | 0.2612 | 53.24 | 20 | Xiping | 0.3915 | 0.1070 | 23.67 | 82 |
| Qinyang | 0.1674 | 0.3233 | 65.75 | 10 | Shangcai | 0.4247 | 0.0945 | 21.50 | 87 |
| Mengzhou | 0.1802 | 0.3321 | 68.90 | 7 | Pingyu | 0.3753 | 0.1643 | 35.65 | 54 |
| Qingfeng | 0.4423 | 0.0564 | 6.50 | 104 | Zhengyang | 0.4268 | 0.0677 | 18.28 | 89 |
| Nanle | 0.3937 | 0.0946 | 17.53 | 92 | Queshan | 0.3166 | 0.2803 | 52.02 | 24 |
| Fanxian | 0.3645 | 0.1292 | 27.66 | 75 | Qinyang | 0.3869 | 0.1126 | 27.19 | 77 |
| Taiqian | 0.3855 | 0.1369 | 29.73 | 70 | Runan | 0.3658 | 0.2243 | 44.45 | 35 |
| Puyang | 0.3666 | 0.1274 | 23.86 | 81 | Suiping | 0.3021 | 0.2343 | 47.96 | 29 |
| Yanling | 0.2801 | 0.2950 | 57.77 | 16 | Xincai | 0.4219 | 0.1063 | 24.79 | 80 |

The next process is identifying the degree of similarity expressed by $d_i^+$ and $d_i^-$ between the weighted normalization matrices $Z$ and $Z^+$ and $Z^-$ by (9)-(10). At last, Formula (11) and (12) , along with the results of $d_i^+$ and $d_i^-$ are used to calculate the comprehensive score of urbanization development level of each county. The results for 2018 are shown in the Table 1 below.

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In order to get the level of urbanization development of each county, we divide the urbanization development of each county into three levels based on the average of the comprehensive score of all counties in Henan province in 2018, the specific classification method is as follows:

*Table 2 The classification method of urbanization development level of each county by their respective score*

| Level | Score |
|---|---|
| Senior | >60 |
| Intermediate | ≥40&≤60 |
| Low | <40 |

The classification results of urbanization development of counties according to Table are shown in Table 3.

*Table 3 Levels of urbanization development of each county by Table 2*

| Score | Level | County |
|---|---|---|
| >60 | Senior | Zhongmou, Gongyi, Xingyang, Xinmi, Xinzheng, Dengfeng, Mengjin, Xinan, Yanshi, Linzhou, Qixian, Qinyang, Mengzhou, Changge, Yima |
| ≥40&≤60 | Intermediate | Luanchuan, Ruyang, Yiyang, Yichuan, Wenxian, Yuzhou, Baofeng, Wugang, Ruzhou, Anyang, Tangyin, Xunxian, Xinxiang, Yanling, Changyuan, Xixia, Xiuwu, Boai, Queshan, Runan, Suiping, Mianchi, Lingbao, Fangcheng, Dengzhou, Xiangcheng, Sheqi, Yongcheng, Tongbai |
| <40 | Low | Qixian, Luoning, Tongxu, Huojia, Yushi, Huixian, Lankao, WuZhi, Songxian, Yexian, Lushan, Xiangcheng, Jiaxian, Huaxian, Neihuang, Yuanyang, Yanjin, Fengqiu, Weihui, Qingfeng, Nanle, Fanxian, Taiqian, Puyang, Wuyang, Lushi, Xinye, Linying, Nanzhao, Minquan, Suixian, Zhenping, Huangchuan, Ningling, Neixiang, Shenqiu, Zhecheng, Xichuan, Luyi, Yucheng, Tanghe, Pingyu, Xiayi, Guangshan, Xinxian, Shangcheng, Gushi, Huaibin, Xixian, Fugou, Xihua, Shangshui, Dancheng, Taikang, Xiping, Shangcai, Zhengyang, Qinyang, Xincai, Luoshan |

The comprehensively evaluation of the county urbanization development level of the other years were analyzed in the same way as 2018. Here we only show the final score and ranking of each county.

It can be seen from the comprehensive evaluation score in Table 4 that: Yima, Xingyang, Xinzheng, Gongyi, Xinmi, Qinyang, Yanshi, Zhongmou, Qixian and Xinan are in the top 10 in the comprehensive level of urbanization development for 6 consecutive years, among which five counties are under the jurisdiction of Zhengzhou. This makes sense as Zhengzhou is an important central city in central China and a core city in the Central Plains Economic Zone. Additionally, Yuanyang,Yanjin, Lushan, Qixian, Zhengyang, Yucheng, Suixian, Xixian are in the bottom 10 for at least five years. The previous study found that none of these cities had a non-agricultural population of more than 35 percent, and the proportion of non-agricultural population is an index to evaluate the level of urbanization.

It is known that Shangcai, Zhengyang, Queshan and Suiping are belong to Zhumadian city, but it is shown Shangcai and Zhengyang rank below 100 in overall urbanization level, while Queshan and Suiping rank around 30 in Table 4. This reflects that there are obvious differences and unbalanced development in the quality of urbanization development among counties in the same city.

*Table 4 The score and ranking of urbanization development quality by county in Henan Province from 2014-2019*

| | 2014 | | 2015 | | 2016 | | 2017 | | 2019 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | score | ranking | score | ranking | score | ranking | score | ranking | score | ranking |
| Zhongmou | 66.81 | 6 | 68.26 | 9 | 63.81 | 13 | 60.69 | 13 | 71.77 | 5 |
| Gongyi | 67.84 | 4 | 71.21 | 5 | 70.46 | 5 | 71.60 | 5 | 72.60 | 4 |
| Xingyang | 72.26 | 2 | 76.59 | 3 | 75.90 | 3 | 75.76 | 3 | 58.09 | 14 |
| Xinmi | 67.34 | 5 | 73.09 | 4 | 71.77 | 4 | 70.19 | 7 | 67.18 | 8 |
| Xinzheng | 69.22 | 3 | 81.66 | 2 | 81.51 | 2 | 81.98 | 1 | 79.51 | 2 |
| Dengfeng | 58.01 | 13 | 64.92 | 13 | 66.51 | 11 | 67.85 | 10 | 51.75 | 25 |
| Qixian | 11.19 | 100 | 13.37 | 96 | 14.05 | 95 | 13.71 | 95 | 12.95 | 99 |
| Tongxu | 24.00 | 65 | 27.36 | 54 | 27.14 | 57 | 26.20 | 59 | 26.07 | 79 |
| Weishi | 26.22 | 59 | 27.26 | 56 | 26.77 | 59 | 26.23 | 58 | 29.87 | 69 |
| Lankao | 15.78 | 86 | 22.16 | 72 | 24.95 | 63 | 24.67 | 64 | 28.82 | 72 |
| Mengjin | 54.06 | 16 | 56.56 | 15 | 55.33 | 14 | 56.55 | 14 | 63.13 | 12 |

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| | 2014 | | 2015 | | 2016 | | 2017 | | 2019 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | score | ranking | score | ranking | score | ranking | score | ranking | score | ranking |
| Xinan | 63.41 | 10 | 69.62 | 8 | 68.85 | 8 | 72.30 | 4 | 71.21 | 6 |
| Luanchuan | 43.18 | 25 | 43.89 | 24 | 42.78 | 24 | 43.74 | 25 | 57.85 | 15 |
| Songxian | 24.52 | 63 | 24.13 | 66 | 23.04 | 70 | 23.02 | 71 | 32.14 | 62 |
| Ruyang | 25.76 | 60 | 25.18 | 64 | 23.87 | 68 | 24.18 | 69 | 41.17 | 42 |
| Yiyang | 31.40 | 46 | 32.00 | 45 | 31.35 | 45 | 34.26 | 39 | 40.09 | 43 |
| Luoning | 24.56 | 62 | 26.49 | 59 | 27.51 | 54 | 27.86 | 54 | 33.40 | 59 |
| Yichuan | 34.48 | 38 | 37.81 | 33 | 36.77 | 34 | 42.57 | 26 | 52.29 | 23 |
| Yanshi | 64.28 | 8 | 69.74 | 7 | 68.88 | 7 | 70.98 | 6 | 66.70 | 9 |
| Baofeng | 43.64 | 23 | 43.78 | 25 | 42.22 | 25 | 45.68 | 21 | 46.28 | 32 |
| Yexian | 16.01 | 84 | 22.51 | 70 | 24.13 | 67 | 22.86 | 72 | 28.35 | 73 |
| Lushan | 12.10 | 99 | 11.31 | 99 | 10.80 | 100 | 10.88 | 102 | 10.90 | 100 |
| Jiaxian | 26.88 | 54 | 25.68 | 62 | 24.70 | 65 | 24.60 | 65 | 30.50 | 68 |
| Wugang | 34.20 | 39 | 37.85 | 32 | 36.79 | 33 | 35.87 | 36 | 43.66 | 36 |
| Ruzhou | 38.87 | 29 | 38.70 | 30 | 37.91 | 30 | 40.94 | 29 | 49.77 | 27 |
| Anyang | 33.28 | 42 | 32.81 | 43 | 32.23 | 42 | 37.15 | 33 | 35.45 | 55 |
| Tangyin | 41.89 | 26 | 41.76 | 26 | 41.27 | 26 | 42.05 | 27 | 46.37 | 31 |
| Huaxian | 18.41 | 79 | 17.25 | 82 | 16.52 | 86 | 16.43 | 87 | 34.46 | 57 |
| Neihuang | 14.82 | 89 | 15.18 | 89 | 16.66 | 85 | 17.13 | 83 | 21.49 | 88 |
| Linzhou | 55.64 | 14 | 56.63 | 14 | 55.31 | 15 | 56.32 | 15 | 60.77 | 13 |
| Xunxian | 37.28 | 32 | 35.40 | 38 | 33.91 | 38 | 33.88 | 40 | 46.69 | 30 |
| Qixian | 63.53 | 9 | 67.96 | 10 | 67.51 | 9 | 67.03 | 11 | 65.73 | 11 |
| Xinxiang | 54.85 | 15 | 56.02 | 16 | 53.45 | 16 | 44.97 | 23 | 53.32 | 19 |
| Huojia | 29.70 | 50 | 27.81 | 52 | 30.55 | 48 | 30.30 | 48 | 41.77 | 40 |
| Yuanyang | 12.77 | 96 | 9.21 | 103 | 8.82 | 104 | 9.29 | 103 | 10.21 | 103 |
| Yanjin | 12.47 | 97 | 12.35 | 98 | 12.37 | 98 | 12.14 | 100 | 10.49 | 101 |
| Fengqiu | 22.02 | 72 | 20.51 | 77 | 19.76 | 75 | 19.71 | 78 | 30.65 | 66 |
| Changyuan | 36.11 | 35 | 40.32 | 27 | 39.74 | 27 | 39.94 | 30 | 52.96 | 22 |
| Weihui | 19.72 | 78 | 17.24 | 83 | 16.81 | 84 | 16.90 | 85 | 21.75 | 85 |
| Huixian | 34.06 | 40 | 34.15 | 40 | 33.42 | 39 | 33.40 | 41 | 32.50 | 60 |
| Xiuwu | 34.73 | 37 | 36.39 | 36 | 37.01 | 32 | 36.80 | 34 | 37.79 | 49 |
| Boai | 50.75 | 18 | 54.23 | 17 | 52.87 | 17 | 52.40 | 16 | 55.45 | 18 |
| Wuzhi | 28.61 | 51 | 31.72 | 47 | 31.80 | 44 | 31.85 | 44 | 39.13 | 45 |
| Wenxian | 45.76 | 20 | 49.76 | 19 | 52.19 | 18 | 52.05 | 17 | 53.24 | 20 |
| Qinyang | 64.47 | 7 | 69.84 | 6 | 69.70 | 6 | 69.89 | 8 | 65.75 | 10 |
| Mengzhou | 62.58 | 11 | 65.96 | 12 | 65.65 | 12 | 65.47 | 12 | 68.90 | 7 |
| Qingfeng | 12.39 | 98 | 15.22 | 88 | 15.08 | 90 | 13.93 | 94 | 6.50 | 104 |
| Nanle | 20.02 | 75 | 21.21 | 75 | 20.81 | 74 | 20.20 | 76 | 17.53 | 92 |
| Fanxian | 25.39 | 61 | 27.34 | 55 | 26.93 | 58 | 26.66 | 56 | 27.66 | 75 |
| Taiqian | 26.63 | 57 | 26.20 | 60 | 25.13 | 61 | 24.83 | 62 | 29.73 | 70 |
| Puyang | 23.51 | 67 | 24.67 | 65 | 24.82 | 64 | 24.99 | 61 | 23.86 | 81 |
| Yanling | 43.51 | 24 | 44.18 | 23 | 45.29 | 22 | 44.96 | 24 | 57.77 | 16 |
| Xiangcheng | 31.50 | 45 | 33.38 | 41 | 31.87 | 43 | 30.84 | 47 | 38.49 | 46 |
| Yuzhou | 43.87 | 22 | 44.39 | 22 | 43.79 | 23 | 45.05 | 22 | 57.19 | 17 |
| Changge | 61.33 | 12 | 66.17 | 11 | 66.80 | 10 | 67.86 | 9 | 76.49 | 3 |
| Wuyang | 26.74 | 56 | 26.10 | 61 | 25.33 | 60 | 24.79 | 63 | 37.40 | 50 |
| Linying | 30.51 | 47 | 29.95 | 49 | 29.17 | 50 | 31.28 | 45 | 41.41 | 41 |
| Mianchi | 44.24 | 21 | 48.78 | 21 | 47.93 | 21 | 48.37 | 19 | 31.51 | 64 |
| Lushi | 14.18 | 92 | 13.73 | 94 | 12.77 | 97 | 12.76 | 97 | 14.97 | 96 |
| Yima | 100.00 | 1 | 94.10 | 1 | 81.65 | 1 | 80.44 | 2 | 81.56 | 1 |
| Lingbao | 51.71 | 17 | 52.68 | 18 | 51.06 | 19 | 50.04 | 18 | 42.09 | 39 |
| Nanzhao | 15.95 | 85 | 15.46 | 87 | 14.89 | 91 | 14.54 | 92 | 16.52 | 95 |
| Fangcheng | 20.18 | 74 | 19.09 | 79 | 18.35 | 77 | 24.20 | 68 | 45.19 | 33 |
| Xixia | 48.10 | 19 | 49.62 | 20 | 49.44 | 20 | 47.80 | 20 | 53.00 | 21 |
| Zhenping | 33.62 | 41 | 32.21 | 44 | 31.13 | 46 | 31.00 | 46 | 39.23 | 44 |
| Neixiang | 24.31 | 64 | 26.84 | 57 | 28.84 | 51 | 29.66 | 51 | 38.46 | 47 |
| Xichuan | 32.61 | 43 | 31.80 | 46 | 30.77 | 47 | 29.69 | 50 | 38.07 | 48 |
| Sheqi | 35.15 | 36 | 35.76 | 37 | 34.59 | 37 | 34.54 | 38 | 44.67 | 34 |
| Tanghe | 26.86 | 55 | 25.47 | 63 | 24.51 | 66 | 24.34 | 66 | 37.30 | 52 |

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| | 2014 | | 2015 | | 2016 | | 2017 | | 2019 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | score | ranking | score | ranking | score | ranking | score | ranking | score | ranking |
| Xinye | 31.57 | 44 | 32.93 | 42 | 32.28 | 41 | 29.96 | 49 | 32.36 | 61 |
| Tongbai | 37.81 | 31 | 37.67 | 34 | 36.49 | 35 | 36.25 | 35 | 43.46 | 37 |
| Dengzhou | 28.61 | 52 | 30.46 | 48 | 29.22 | 49 | 32.03 | 43 | 42.34 | 38 |
| Minquan | 19.90 | 77 | 20.74 | 76 | 22.81 | 71 | 25.35 | 60 | 34.45 | 58 |
| Suixian | 9.55 | 103 | 9.46 | 102 | 9.16 | 103 | 8.88 | 104 | 10.23 | 102 |
| Ningling | 14.60 | 90 | 13.74 | 93 | 13.22 | 96 | 13.21 | 96 | 17.31 | 93 |
| Zhecheng | 13.61 | 93 | 16.05 | 86 | 17.93 | 78 | 18.03 | 81 | 22.37 | 84 |
| Yucheng | 10.68 | 102 | 9.86 | 101 | 10.29 | 102 | 12.30 | 98 | 14.28 | 97 |
| Xiayi | 15.69 | 87 | 15.12 | 91 | 14.72 | 93 | 16.88 | 86 | 21.62 | 86 |
| Yongcheng | 37.09 | 33 | 36.47 | 35 | 35.31 | 36 | 35.21 | 37 | 48.34 | 28 |
| Luoshan | 26.52 | 58 | 26.57 | 58 | 28.70 | 52 | 28.26 | 52 | 35.37 | 56 |
| Guangshan | 16.38 | 83 | 17.01 | 84 | 16.31 | 87 | 15.00 | 90 | 17.11 | 94 |
| Xinxian | 19.90 | 76 | 23.60 | 68 | 23.73 | 69 | 23.17 | 70 | 23.58 | 83 |
| Shangcheng | 23.26 | 69 | 23.62 | 67 | 25.05 | 62 | 24.31 | 67 | 30.61 | 67 |
| Gushi | 23.26 | 70 | 22.42 | 71 | 21.60 | 72 | 22.79 | 73 | 31.46 | 65 |
| Huangchuan | 27.62 | 53 | 27.67 | 53 | 27.20 | 56 | 26.26 | 57 | 31.92 | 63 |
| Huaibin | 15.16 | 88 | 15.13 | 90 | 14.75 | 92 | 14.67 | 91 | 17.63 | 91 |
| Xixian | 13.15 | 94 | 12.66 | 97 | 12.12 | 99 | 12.18 | 99 | 14.24 | 98 |
| Fugou | 22.85 | 71 | 21.86 | 73 | 21.10 | 73 | 22.25 | 74 | 27.30 | 76 |
| Xihua | 18.37 | 80 | 18.09 | 80 | 17.44 | 81 | 19.67 | 79 | 27.71 | 74 |
| Shangshui | 17.28 | 82 | 16.50 | 85 | 15.85 | 89 | 15.53 | 89 | 26.45 | 78 |
| Shenqiu | 23.92 | 66 | 22.57 | 69 | 17.23 | 82 | 21.60 | 75 | 37.37 | 51 |
| Dancheng | 14.40 | 91 | 13.69 | 95 | 14.43 | 94 | 14.26 | 93 | 17.89 | 90 |
| Taikang | 23.30 | 68 | 21.81 | 74 | 17.18 | 83 | 17.08 | 84 | 29.37 | 71 |
| Luyi | 29.97 | 48 | 29.14 | 50 | 28.38 | 53 | 28.13 | 53 | 36.85 | 53 |
| Xiangcheng | 41.79 | 27 | 39.66 | 29 | 38.49 | 29 | 38.21 | 31 | 51.06 | 26 |
| Xiping | 13.12 | 95 | 14.13 | 92 | 16.05 | 88 | 16.15 | 88 | 23.67 | 82 |
| Shangcai | 6.97 | 104 | 8.30 | 104 | 17.58 | 80 | 17.55 | 82 | 21.50 | 87 |
| Pingyu | 29.73 | 49 | 28.30 | 51 | 27.35 | 55 | 27.31 | 55 | 35.65 | 54 |
| Zhengyang | 10.96 | 101 | 11.09 | 100 | 10.68 | 101 | 11.89 | 101 | 18.28 | 89 |
| Queshan | 41.31 | 28 | 40.13 | 28 | 39.11 | 28 | 41.83 | 28 | 52.02 | 24 |
| Qinyang | 18.05 | 81 | 18.09 | 81 | 17.66 | 79 | 19.73 | 77 | 27.19 | 77 |
| Runan | 36.20 | 34 | 34.40 | 39 | 33.38 | 40 | 33.20 | 42 | 44.45 | 35 |
| Suiping | 37.88 | 30 | 38.26 | 31 | 37.29 | 31 | 37.50 | 32 | 47.96 | 29 |
| Xincai | 21.10 | 73 | 19.72 | 78 | 18.90 | 76 | 18.79 | 80 | 24.79 | 80 |

## 4. Conclusions and suggestions

This paper mainly evaluated the urbanization development level of each county in Henan Province, and found that in the process of urbanization in Henan province, there are large differences in urbanization level between different cities and unbalanced urbanization level between different counties in the same city. In view of these problems of urbanization development, we offer the following suggestions.

(1) Development plans should be implemented in light of local conditions

In view of the imbalance of urbanization development among counties, strategies should be adopted according to the specific characteristics of each county to promote its urbanization development process and improve the quality of development. Local governments should start from their own reality, fully consider the advantages of local characteristics, adhere to the "one county, one product" and "one region, one industry", to achieve industrial differentiation between districts and counties. Particularly, the economically developed counties with a certain industrial and service basis don’t not play a good driving role to the surrounding areas and counties Nevertheless, these counties as they mainly distributed in the northwestern edge of the province. such counties should broaden investment channels and learn from the successful experience of neighboring provinces to promote the transformation and upgrading of traditional manufacturing industry on the basis of their geographical characteristics and resource advantages. In addition, economically less developed counties account for a higher proportion in the south and are generally less exposed to the radiation from central cities. For these regions, efforts should be made in various ways to promote economic development. On the one hand, infrastructure

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construction needs to be accelerated, and on the other hand, the potential market of traditional industries should be further explored.

(2) Strengthen the radiation intensity of developing high-quality cities

Zhengzhou, as the capital city of Henan Province, has achieved good results in the high-quality development of urbanization, but it has not played a strong radiating force to the urbanization development of the surrounding less-developed areas, and failed to effectively play the economic driving role of the capital city. In view of this phenomenon, we should make full use of the developed transportation system of Zhengzhou, take the modern logistics industry as the focus, and create a perfect logistics transportation system according to the law of commodity distribution. On the other hand, perfect one-hour economic circle, strengthen economic and cultural exchanges between Zhengzhou and surrounding areas.

Sanmenxia, with a small population, has convenient transportation and abundant resources. The county-level urbanization of Sanmenxia can drive the flow of talents in surrounding areas, and the flow of human capital will in turn accelerate the development of economically underdeveloped areas. Therefore, by absorbing the technology, products and development experience of economically developed cities to accelerate their own urbanization, Sanmenxia can solve the unbalanced development of county urbanization and the approach also works in other cities.

(3) Give full play to the government's macro-allocation function

Due to the small size, unbalanced development opportunities and insufficient development motivation, the quality level of urbanization in less developed areas is significantly different from that of other counties, which is caused by insufficient capital and limited investment and financing opportunities. To solve the problems, government departments can tilt the fiscal towards areas severely short of capital and formulate specific support policies to encourage and support their development. For example, the government can improve the investment and development environment of these areas through micro-credit and inclusive finance, encourage enterprises to innovate and develop characteristic industries, so that they can get support from the root. In addition, for the regions lacking development opportunities, the government can help enterprises to carry out trans-regional cooperation and exchange, so as to help the regions with relatively backward economic development to improve their strength; For areas lacking development motivation, we should realize that innovation is the driving force of development, vigorously introduce and constantly innovate new information technology, persist in developing innovative thinking, and focus on exploring effective ways to improve the development of innovation capacity. And once the development opportunity and development momentum are sufficient, it can be left to its own development.

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