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Disorder, Coordination and Regional Differences of Core Elements in China's Urbanization

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Abstract:

China's urbanization is considered significant measures in implementing the modernization and internationalization. The imbalance of three core elements, namely, population urbanization, land urbanization, and public goods supply, in time and space is a main negative aspect associated with urbanization. Therefore, coordinating the relationship among public goods, land, and population is the first priority. An empirical analysis was made to explore the relationship among the three core elements. Urbanization evaluation index systems for three core elements were set up, and the urbanization level and coordination index of 11 cities in Zhejiang Province were accomplished with coordination degree model. After analyzing the coordination degrees of the three core elements in urbanization in 11 cities in Zhejiang Province, we have accomplished two important solutions. First, we can scale up the supply of construction land to promote the coordination degrees of the three core elements in cities with overpopulation, traffic congestion, and overpriced housing and land problems caused by lagging development in land. Second, we can slow down the pace of land development, scale down the public goods supply, loosen the control on population inflow, and try to attract talents in all trades to boost the coordination degree of the three core elements in cities with great land development and timely public goods supply. When population urbanization rate reaches approximately 60%, China's traditional urbanization model should be rethought and changed to improve the quality of urbanization. First, governments should relax the regulation on core elements, such as land bank system and household registration system for population. Local governments in China are controlling land resource allocation and public goods supply, which is a great hinder to rapid urbanization and destroys the development of the three core elements. In a word, if we want to see an ideal urbanization process, then local governments should guarantee a sound environment of land and labor markets and optimize the distribution of public goods supply in time and space.

Keywords: *Urbanization, Core elements, Coordination degree, Regional differences*

I. INTRODUCTION

China's urbanization rate has been on the rise by approximately 1% each year. By the end of 2017, the population urbanization rate has risen from 17.92% in 1978 to 58.52% in 2017. Urbanization rate has three

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stages. In the first stage, the rate slowly increased. From 1978 to 1995, the urbanization rate was between 17.92% and 29.04%, indicating an increase of more than 30%. Since 1992, the government has begun to accelerate the process of urbanization and rural workforce started to swarm into cities from rural areas. In the second stage (1996–2002), the urbanization rate grew steadily from 30.48% to 39.09%. In the third stage, the urbanization process reached the fast track. With land and housing prices tremendously going up, high land value leads to more land leasing revenues, in which local government can obtain huge income [1]. From 2003 to 2017, urbanization rate further increased from 40.53% to 58.52%.

With the rapid urbanization nationwide, the imbalanced development of core elements—population urbanization, land urbanization, and public goods supply—became a serious problem, which has undermined the quality of urbanization [2,3]. The unbalanced development of the core elements has become a huge stumbling block in rapid urbanization, which affects regional economic stability and sustainable development [4]. Furthermore, current economic systems face a potential huge systemic financial risk. The excessive expansion of urban space has caused unreasonable capital investment and housing price bubbles, which has far exceeded the purchasing power of local residents. For example, as the workforce continues to move from villages to cities, agricultural lands are continuously developed to keep pace with the urban growth. Consequently, the urban built-up areas in China were increased by 68.65% from 29636.83 sq. km. in 2004 to 49982.74 sq. km. in 2015 with a 4.86% annual growth rate.

Land development has outpaced urban population growth over the past decade. Moreover, the inconsistency of fast land development and slow population growth leads to a long-term untapped urban spaces and a huge waste of money [5-7]. Overpopulation and insufficient supporting facilities and job opportunities create a desperate, restless, and anxious atmosphere among the workforce and compel people to stay in other cities with better amenities for a potential better lifestyle. As time goes by, cities facing these problems gradually lose their vitality, sustainability, and attentiveness to the workforce. Thus, a balanced development of land, population, and public goods is the final solution for a successful and beneficial urbanization, which can implement a new development concept in depth.

Section 2 is literature review. Section 3 presents a theoretical model and corresponding theoretical explanations. Section 4 shows the data processing and indicator weights. Section 5 discusses the empirical results. Finally, a conclusion is presented.

II. LITERATURE REVIEW

Urbanization is a dynamic interactive process, which goes through equilibrium, non-equilibrium, and re-equilibrium phases and reflects the changes of core elements in scale, structure, and proportion between space supply and demand. In this research, “capital” means public goods and infrastructures, “land” represents urban space development, and “population” refers to the number of local people. According to the developmental sequence of the core elements and the role of governments, urban development can be classified into different types. For example, Cheng and Lin [8] investigated 95 cities in southern Taiwan, and their result shows that population urbanization is coupled with land development. Their research

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reflects that cities with suitable land for development contribute to population growth and cities with little expandable land may cause population drain due to unavailability of land development. Therefore, local governments prefer to implement infrastructure construction and land development in advance during the urbanization process. On the one hand, this strategy can attract people immigrating by providing them with low-rent apartments and abundant job opportunities. On the other hand, it can avoid issues, such as traffic jams, environmental degradation, and rising living costs, caused by rapid population aggregation.

Nevertheless, when the economy starts to progress downwards, population expansion and industry development will not follow as expected. Thus, untapped infrastructure, wasted space, and increased financial risks for the local governments and developers will transpire [9]. Under the passive strategy, population growth and industrial agglomeration are the driving forces of land development and public goods provision. Land and public goods are far from meeting the demands. When the population is growing rapidly and the space supply does not match the needs of people, traffic jams and deterioration of living environment come along [10,11]. In China's urbanization, development strategies vary for each region and city. Even in the same city, different districts may have different development strategies [12,13]. These strategies have urbanization features with spatial agglomeration and industry development of land, population, and public goods, which are essential to land development, population agglomeration, public goods provision, industry incubation, and environmental protection [14-18]. Priorities, scales, and structural proportion of the three core elements decide the development modes and directions of urbanization. Currently, most research do not consider the three core elements as a whole and focus only with one element (land or public goods or population) [19].

Public goods, which require huge investment and long time, have demanding requirements on the government's fiscal and fund-raising capacities. The fund-raising channels and costs of public goods affect the construction decisions of infrastructure projects [20-22]. When the fund-raising threshold is high, public goods provision encounters obstacles and land development activities stagnate. On the contrary, enough funds can stimulate public goods provision and land development activities [23-27].

Public goods interact with land development. On the one hand, public goods provision is a prerequisite for land development. If no planned infrastructure and public services are available in a region, then the expected profit from land development cannot be guaranteed. By contrast, if large facilities (metro, schools, and parks) are already available in a region, then the benefits from land development are secured and the development speed of land are fastened [28]. On the other hand, land development has an impact on public goods. The income from land development and its attachments (land-transferring income, rent, and taxes, among others) is an important warranty for the government to gain funds for infrastructure construction. The rise in land and real estate prices can increase the revenue of local governments. In addition, land and real estate, which can boost government's fund raising and public goods provision abilities, are high-quality mortgage assets and objects of taxation [29-31].

With the current economic growth, the imbalance (disharmonious development) of land urbanization and population urbanization, which leads to the changes in land development strategies or population sizes,

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is becoming more apparent in supply and demand. Whether it is land development that contributes to population agglomeration or population agglomeration that drives land development is still a controversy between developing and developed countries [32]. Developing countries, such as China, are going through fast population migration and land development period with an urbanization speed 2 or 3 times than that of developed countries. Population agglomeration speed is faster than that of land development process. Studies on developing countries have found that population agglomeration drives land development. With a 4% growth in urban population, the growth in land premium will be 59%. Continuous urban population growth will raise the expected revenue in land development, resulting in high real estate prices [33,34]. In developed countries, urbanization and industrialization are basically completed. Population growth and land development are developing in slow speeds, and the causal relationship of both core elements is not clear. Developed countries are more concerned about the availability of adequate and affordable housing, convenient public transport, and equal opportunities to receive quality education [35,36]. In addition, land supply structure (ratio of residential and industrial lands) plays a role in increasing employment, and employment opportunities can significantly promote population agglomeration.

With speedy pace of urbanization, the imbalance of the three core elements has become prominent. By identifying the interconnections and prominence of the three core elements, we can better learn the correlation among public goods supply, land development, and population expansion and coordinate the development pace of each element. After a long-term research on urbanization, we found out that adopting coordination degree and quantified indicators of the three core elements in urbanization can effectively identify the developmental situation of land development, population expansion, and public goods supply.

Based on previous literature, the core elements can be classified into three categories: population urbanization, land urbanization, and public goods supply. This study defines them as three core elements in urbanization. The concept and definition of the three elements should be clarified and defined before measuring the coordination degree of the core elements.

Population urbanization: Population urbanization refers to the population shift from rural to urban residency, the proportion of people living in urban areas, the proportion of population in secondary and service industries, and their living standards.

Land urbanization: Land urbanization is the process of land development, which refers to the conversion of agricultural land to urban land and change of property title. It also refers to investment and profit on unit urban land.

Public goods supply: Public goods refer to goods and services for all population in a specific space, such as a city. Urban public goods mainly include economic and non-economic, including traffic, communication, hospital education, and retirement services. The quality and quantity of urban public goods determine the living standards of urban residents.

The relationship of the three core elements in urbanization is demonstrated in the following statement: “Local governments spare no efforts (borrowing money from banks or using money from taxes) to

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requisite outskirt or rural lands from land owners for city development. The land owners get money or apartments in the new area. Local governments sell lands to developers to build new communities or factories. Then, new amenities will be built to attract population to swamp in for job opportunities and convenience. Thus, more taxes from housing sales, wages, and consumption will flow to the local governments. With more spendable money, governments can provide relaxing parks and clean roads and environment, as well as public goods supply [37-44].

III. COORDINATION DEGREE MODEL AND INDICATORS

Using an index model to appraise some certain social situation is a useful and mature method [36,37]. Liu et al [38] applied coordination degree model to evaluate urbanization rate and eco-environment in 30 provinces. Han et al [39] adopted an index model to examine the relationships between urban population dynamics and PM2.5. Hence, this study uses an index model to evaluate the coordination degree of the three core elements with data from 11 cities in Zhejiang Province from 2002 to 2014. The coordination degree and its trend were fully analyzed. Then, we compared the coordination degree of the three elements in different cities to determine the developmental situation of urbanization in each city and explored the paths of the core elements to develop in an effective and coordinated way.

3.1 Model

Coordination degree is a measurement to evaluate the level of harmonious development of the three core elements. It reflects the process of the three core elements from disharmony state to coordination state. Moreover, it is a quantitative index for measuring developmental trends. Here, we selected the minimal deviation coefficient model, which is a generally acknowledged method, to quantify the coordination degree. The model is listed as follows:

$$C(x,y,z)=\left\{\frac{f(x)*g(y)*h(z)}{\left[\frac{f(x)+g(y)+h(z)}{3}\right]^3}\right\}^k \tag{1}$$

$$f(x)=\sum_{i=1}^{n} a_i \bullet x_i \tag{2}$$

$$g(x)=\sum_{j=1}^{m} b_j \bullet y_j \tag{3}$$

$$h(x)=\sum_{r=1}^{o} d_r \bullet z_r \tag{4}$$

Where C(x,y,z) is the coordination degree; f(x) is the population index; h(z) is the public goods supply

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index; g(y) is the land index; k is the adjustment coefficient (normally, k is equal to the number of indexes); a_i, b_j, and d_r are the normalized weights of population, land, and public goods; xi, yj, and zr are the values of each index in their own evaluation systems; and n, m, and o are the number of population indicators, land indicators, and public goods supply indicators, respectively.

3.2 Coordination Degree

Proving that $0 \leqslant C \leqslant 1$ is not difficult, and the coordination degree C can be 0 or 1. When C =1, the coordination degree is the highest and the system moves to a new ordered one. When C =0, the coordination degree is the lowest and the system develops in a disordered way. The key point is to classify major types and detail status according to the coordination degree's value.

This work can be conducted in two ways. First, some similar studies can provide experience. For example, Cui et al. [3] developed a coordinated development index for urbanization–resources–environment system. They classified the system into five types of coordinated development index: no coordination (0.00–0.20), little coordination (0.21–0.40), basic coordination (0.41–0.60), good coordination (0.61–0.80), and good coordination (0.81–1.00). Yu et al. [37] used an index evaluating urbanization level and eco-environment quality, in which the major types are classified into different types according to the index value.

According to the literature and practices in urbanization, the major types are classified at a different range of degree value. TABLE I shows the correlation between coordination degree and corresponding status. The coordination degree is normally classified into three major types and 10 different statuses according to the existing studies.

TABLE I. Corresponding relationship between coordination degree and its status

MAJOR TYPES	COORDINATION DEGREE	STATUS
DISHARMONY	0.00–0.09	COMPLETE DISHARMONY
	0.10–0.19	GREAT DISHARMONY
	0.20–0.29	MODERATE DISHARMONY
	0.30–0.39	MILD DISHARMONY
TRANSITION	0.40–0.49	SLIGHT DISHARMONY
	0.50–0.59	WEAK COORDINATION
COORDINATION	0.60–0.69	ELEMENTARY COORDINATION
	0.70–0.79	INTERMEDIATE COORDINATION
	0.80–0.89	WELL COORDINATION
	0.90–1.00	PERFECT COORDINATION

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3.3 Indicator Selection

The indicators of the three elements were selected in accordance with the literature review. Population urbanization represents the workforce moving from rural areas to cities. With the inflow of outside population, the increased requirements for public goods and urban spaces will develop. Most studies show that an indicator system can be established based on population composition, industrial structure, and living standard [40,41]. Land urbanization reflects the changes in the scale and structure of space supply. Through careful examination, we set up an evaluation system for land urbanization based on an urban area's scale, inputted capitals, and gained profits. Public goods supply is the investment from the local government.

The amount of local fiscal expenditure, which includes local budgetary expenditures per unit land and local budgetary expenditures per urban resident, is commonly used as a measurement for public goods supply [42,43]. The evaluation indicators for public goods supply can be either economic (roads, electricity, energy, and telecommunications) or non-economic (education, medical services, and social security) [44]. This study builds an indicator system considering population urbanization, land urbanization, and public goods supply. The system has a three-grade evaluation structure (first, second, and third grades) (see TABLE II).

TABLE II. Indicator evaluation system for the three core elements in urbanization

FIRST-GRADE	SECOND-GRADE	THIRD-GRADE	WEIGHT
POPULATION URBANIZATION	POPULATION COMPOSITION	PROPORTION OF NON-AGRICULTURAL POPULATION (X1)	A1
		PROPORTION OF POPULATION IN SECONDARY AND SERVICE INDUSTRIES (X2)	A2
	INDUSTRIAL STRUCTURE	PROPORTION OF OUTPUT VALUE FROM SECONDARY AND SERVICE INDUSTRIES IN GDP (X3)	A3
	LIVING STANDARD	SPENDABLE INCOME PER URBAN RESIDENT (X4)	A4
		NUMBER OF SICKBEDS FOR EVERY 10,000 PEOPLE (X5)	A5
		NUMBER OF CAR OWNERSHIP FOR EVERY 10,000 PEOPLE (X6)	A6
		NUMBER OF PEOPLE TAKING OUT BASIC RETIREMENT	A7

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		INSURANCES IN EVERY 10,000 PEOPLE (X7)	
LAND URBANIZATION	CITY SCALE	BUILD-UP AREA IN URBAN GEOGRAPHICAL BOUNDARY (Y1)	B1
		PARK GREEN LAND SHARE PER PERSON (Y2)	B2
		ROAD SHARE PER PERSON (Y3)	B3
	INVESTED CAPITAL	FIXED-ASSET INVESTMENT PER UNIT LAND (Y4)	B4
		UNBAN MAINTENANCE AND CONSTRUCTION FUND EXPENDITURE PER UNIT LAND (Y5)	B5
	GAINED PROFITS	OUTPUT VALUE OF SECONDARY AND SERVICE INDUSTRIES PER UNIT LAND (Y6)	B6
		LOCAL FISCAL REVENUE PER UNIT LAND (Y7)	B7
PUBLIC GOODS SUPPLY	ECONOMIC	TRANSPORTATION FACILITIES—ROAD SHARE PER PERSON (Z1)	D1
		TELECOMMUNICATION SERVICE—YEAR-END AVERAGE NUMBER OF MOBILE PHONE USERS(Z2)	D2
	NON-ECONOMIC	MEDICAL SERVICE—NUMBER OF SICKBEDS IN HOSPITALS OR CLINICS PER 10,000 PEOPLE (Z3)	D3
		EDUCATIONAL SERVICE—EDUCATIONAL FEE PER PERSON (Z4)	D4
		RETIREMENT SERVICE—NUMBER OF PEOPLE TAKING OUT BASIC RETIREMENT INSURANCES PER 10,000 PEOPLE (Z5)	D5

IV. DATA PROCESSING AND INDICATOR WEIGHTS

4.1 Research Area and Data Source

The research area covers the 11 administrative areas in Zhejiang Province from 2002 to 2014. The 11 cities are Hangzhou, Ningbo, Jiaxing, Huzhou, Shaoxing, Zhoushan, Wenzhou, Jinhua, Zhangzhou,

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Taizhou, and Lishui. The data were obtained from *Zhejiang Statistical Yearbook (2003–2015)* and *China Urban Construction Statistical Yearbook (2003–2015)*. Only one local government controls the land resources and public goods supplies of each area. Furthermore, supporting facilities, such as roads, public schools, hospitals, and retirement services, should be supplied by local governments before developing the land.

4.2 Data Processing

First, we eliminated the impacts of changes in the price index on the empirical results. Then, we set year 2001 as the base year and removed the effects of inflation on each indicator based on the consumer price index. Moreover, formula (5) was adopted to normalize each indicator and avoid bias errors caused by different dimensions.

$$x_{ij}^{new} = \begin{cases} (x_{ij} - m_i)/(M_i - m_i) & positive \\ (M_i - x_{ij})/(M_i - m_i) & negative \end{cases} \quad (5)$$

Where x_{ij} and x_{ij}^{new} are the actual and normalized values of the ith index in the jth year, i indicates the order of an index ranging from 1 to 20, j represents the year with value varying from 2002 to 2014, m_i is the minimum value of the ith index, and M_i is the maximum value of the ith index. All 19 indexes in our empirical study have positive values.

4.3 Indicator Weights

The weights of each indicator were determined by principal component (PC) analysis method, and EViews 8.0 software was used to obtain eigenvalues (E) and contribution degrees (CD) of each index (see TABLE III).

TABLE III. PC eigenvalues and contribution degrees

POPULATION URBANIZATION INDEX			**LAND URBANIZATION INDEX**			**PUBLIC GOODS SUPPLY INDEX**		
PC	**E**	**CD**	**PC**	**E**	**CD**	**PC**	**E**	**CD**
x_1	4.945	0.707	Y_1	3.735	0.534	Z_1	3.577	0.715
x_2	0.938	0.841	Y_2	1.389	0.732	Z_2	0.971	0.910
x_3	0.659	0.935	Y_3	0.758	0.840	Z_3	0.237	0.957
x_4	0.208	0.964	Y_4	0.614	0.928	Z_4	0.154	0.988
x_5	0.154	0.986	Y_5	0.433	0.990	Z_5	0.062	1.000
x_6	0.066	0.996	Y_6	0.049	0.997	—	—	—
x_7	0.028	1.000	Y_7	0.022	1.000	—	—	—

Moreover, the parameters (P) of each weight (see TABLE IV) and the weights and sub-weights of each indicator (see TABLE V) were obtained.

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TABLE IV. Parameters of each weight

POPULATION URBANIZATION INDEX		LAND URBANIZATION INDEX			PUBLIC GOODS SUPPLY INDEX	
WEIGHT	**P_1**	**WEIGHT**	**P_1**	**P_2**	**WEIGHT**	**P_1**
A_1	0.337	B_1	0.282	-0.305	D_1	0.139
A_2	0.383	B_2	0.287	0.535	D_2	0.502
A_3	0.310	B_3	0.038	0.760	D_3	0.478
A_4	0.393	B_4	0.478	0.027	D_4	0.508
A_5	0.400	B_5	0.345	-0.195	D_5	0.492
A_6	0.400	B_6	0.492	-0.017	—	—
A_7	0.412	B_7	0.497	-0.067	—	—

TABLE V. Weights and sub-weights of each index

POPULATION URBANIZATION INDEX		LAND URBANIZATION INDEX			PUBLIC GOODS SUPPLY INDEX	
PC	**A_I**	**PC**	**B_J^1**	**B_J^2**	**PC**	**D_R**
X_1	0.337	Y_1	0.282	-0.305	Z_1	0.139
X_2	0.383	Y_2	0.287	0.535	Z_2	0.502
X_3	0.310	Y_3	0.038	0.760	Z_3	0.478
X_4	0.393	Y_4	0.478	0.027	Z_4	0.508
X_5	0.400	Y_5	0.345	-0.195	Z_5	0.492
X_6	0.400	Y_6	0.492	-0.017	—	—
X_7	0.412	Y_7	0.497	-0.067	—	—

The contribution degree of x_1 in population index is 70.7%, which reveals the urbanization degree of population. The contribution degree of z_1 in public goods index is 71.5%, which sufficiently describes the supply level of public goods. For the land index, y_1 accounts for 53.36% of the total contribution degree and y_2 accounts for 19.85% of the total contribution degree.

Formulas (6) and (7) show how we obtained the normalized weights of indicators for each core element.

$$a_i = |A_i| / \sum_{i=1}^{n} |A_i| \quad (6)$$

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$$d_k = |D_k| / \sum_{k=1}^{r} |D_k| \quad (7)$$

To obtain the normalized weights of land index, the sub-weights (B^1 and B^2) of weight B were used as coefficients to obtain the new weights (B) of land index (formula 8). Then, formula (9) was applied to derive normalized weights (b).

$$B_j = (B_j^1 * p_1 + B_j^2 * p_2) / (p_1 + p_2) \quad (8)$$

$$b_j = |B_j| / \sum_{j=1}^{m} |B_j| \quad (9)$$

Where A_i, B_j, and D_k are the weights of each indicator; B_j^1 and B_j^2 are the sub-weights of the jth indicator of land index; p_1 and p_2 are the parameters of y_1 and y_2, respectively; i is the indicator number of population index varying from 1 to 7; j is the indicator number of land index ranging from 1 to 7; and k is the indicator number of public goods index with a value within [1, 5]. TABLE VI shows the normalized value of each weight.

TABLE VI. Normalized weights of each index

POPULATION URBANIZATION INDEX		**LAND URBANIZATION INDEX**		**PUBLIC GOODS SUPPLY INDEX**	
A_1	0.128	B_1	0.063	D_1	0.066
A_2	0.145	B_2	0.180	D_2	0.237
A_3	0.118	B_3	0.119	D_3	0.226
A_4	0.149	B_4	0.181	D_4	0.240
A_5	0.152	B_5	0.101	D_5	0.232
A_6	0.152	B_6	0.180	—	—
A_7	0.156	B_7	0.175	—	—

V. EMPIRICAL ANALYSES

5.1 Overall Evaluation

We adopted formulas (2), (3), and (4) to obtain the urbanization level of population f(x), land g(y), and public goods index h(z) of Zhejiang Province (see TABLE VII). The average values of f(x), g(y), and h(z) in each year from 2002 to 2004 are presented in Figure 1. The coordination degree C, which has gone

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through three stages (disharmony stage in 2002, transition stage in 2003, and coordination stage from 2004 to 2014), of population, land, and public goods indices in Zhejiang Province from 2002 to 2014 can be achieved with formula (1).

TABLE VII. Coordination degree of the three core elements in zhejiang province

YEAR	F(X)	G(Y)	H(Z)	C	RESULTS
2002	0.198	0.143	0.085	0.352	MILD DISHARMONY
2003	0.232	0.191	0.121	0.527	WEAK COORDINATION
2004	0.271	0.223	0.159	0.658	ELEMENTARY COORDINATION
2005	0.303	0.26	0.194	0.740	INTERMEDIATE COORDINATION
2006	0.341	0.226	0.216	0.674	ELEMENTARY COORDINATION
2007	0.371	0.281	0.275	0.841	WELL COORDINATION
2008	0.396	0.311	0.301	0.871	WELL COORDINATION
2009	0.429	0.352	0.345	0.915	PERFECT COORDINATION
2010	0.467	0.382	0.396	0.932	PERFECT COORDINATION
2011	0.512	0.408	0.455	0.925	PERFECT COORDINATION
2012	0.554	0.437	0.523	0.914	PERFECT COORDINATION
2013	0.595	0.459	0.56	0.898	WELL COORDINATION
2014	0.653	0.493	0.624	0.877	WELL COORDINATION

5.1.1 Disharmony stage

For year 2002, the urbanization level of population, land, and public goods supply were 0.198, 0.143, and 0.085, respectively. These indexes are all lower than 0.2, especially the public goods supply index, which is less than 0.1. Population index has a significant difference with public goods index. The overall coordination degree of the three core elements C is 0.352, which shows a mild disharmonious state as a whole. Figure 1 shows that the population, land, and public goods index are relatively low at this stage.

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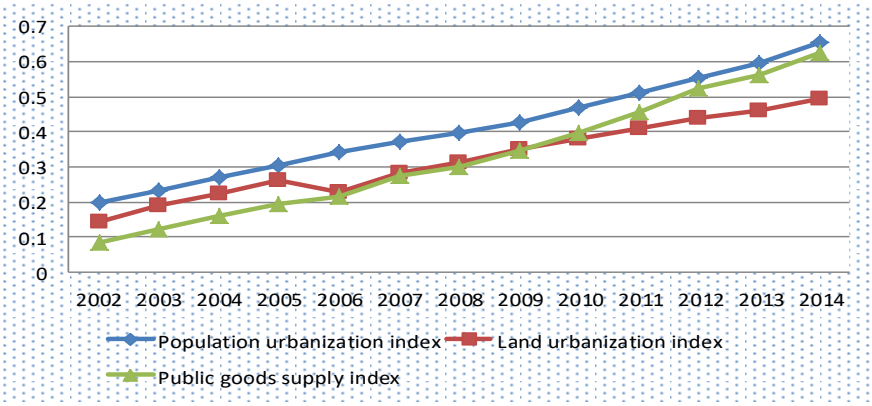

Figure 1: Trends of urbanization level of the three core elements

The main reason for this phenomenon is the delay in the supply of public goods. The population urbanization index is clearly larger than land urbanization and public goods supply index, indicating that the local governments' main focus is to attract more people to settle down in cities at that time. In this stage, the local government's tax and land income are very limited, and the supply capacity of public goods is very poor.

5.1.2 Transition phase

For year 2003, the population, land index, and public goods index were 0.232, 0.191 and 0.121, respectively, which have increased from last year's indices. Moreover, the gaps between each index are slightly narrower compared with the previous year. The overall coordination degree C increased from 0.352 to 0.527. The rising trends of population, land, and public goods indices and the developmental speeds of the three core elements are still the same. The absolute difference between the indices remains unchanged. As the population, land, and public goods indices rise, the difference between the indexes gradually decreases and the coordination degree increases.

Notably, the land and public goods indices are still lower than the population index, thus indicating that the development of land and supply of public goods do not meet the demands of urban residents. Figure 1 shows that from the trend of f(x), g(y), and h(z), the speed of the three indices are equivalent. The major reason in the improvement of the coordination degree is that most local government's finance was eased. As the real estate prices go up, land sale income is the powerful support to supply more public goods.

5.1.3 Coordination stage

From 2004 to 2014, the overall coordination degree C started from 0.658 and maintained a steady year-on-year growth. It reached 0.914 in 2012 and achieved an improvement from a well coordination status to a perfect coordination status. After 2012, the overall coordination degree C began to slightly decline. The overall coordination degree C in 2013 and 2014 was 0.898 and 0.877, respectively, but the development was still in an ideal state. From 2004 to 2014, the population expansion remained a leading

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place and the urban land supply and public goods supply levels were consistently lower than those of the population index. Figure 1 shows that the trend of the urbanization level of population index is higher than that of land index and public goods supply index has changed significantly as time went by.

The land and public goods indices show a completely different development trend, and year 2006 has been a turning point. On the one hand, the land index did not continue to grow but dropped slightly and then remained steady. On the other hand, the public goods index rose at an accelerating rate and gradually exceeded the land index in 2010. The gap between public goods and land indexes continued to widen each year. Public supply index even showed a tendency to reach the population index. After 2010, the lagged development in land led to a slight decrease on the overall coordination degree C.

5.2 City Analyses

Figure 2 shows the trend of changes in coordination degree of the three core elements during urbanization in the 11 cities in Zhejiang Province from 2002 to 2014.

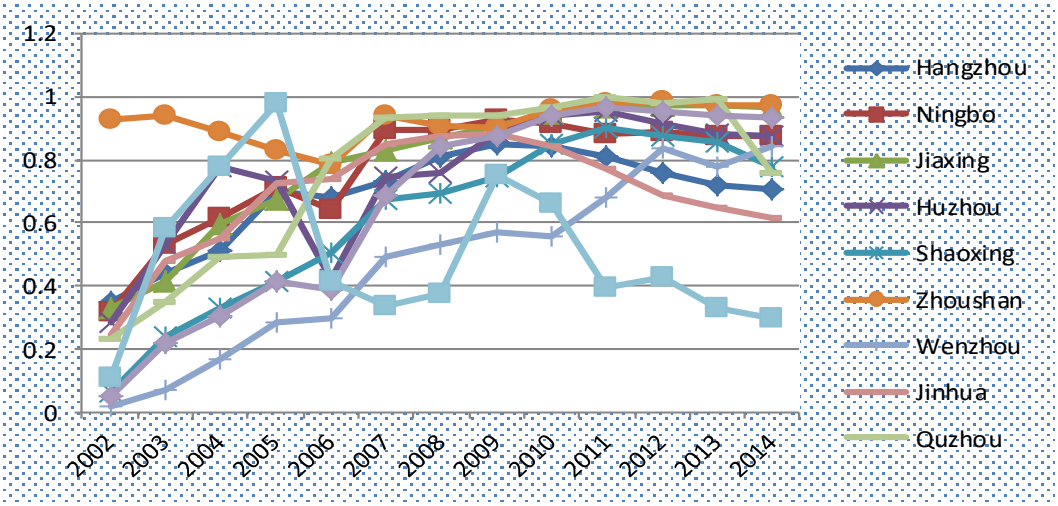

Figure 2: Trends of coordination degrees in 11 cities in Zhejiang Province

TABLE VIII presents the coordination degree of the three core elements during urbanization in the 11 cities.

Among the 11 cities, the coordination degree of Lishui City drastically fluctuated and showed extreme instability, and the developmental result varied between great disharmony status and perfect coordination status. Zhoushan City retained the coordination status from 2002 to 2014, and in most years, it maintained a perfect coordination status. The coordination degrees of other cities kept a rising trend and successively entered and maintained a coordination status. To examine the changes and differences in the coordination degrees in terms of time and space, three time points (2002, 2008, and 2014) were selected as references.

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TABLE VIII. Coordination degrees of 11 cities in zhejiang province

YEAR	HANGZHOU	NINGBO	JIAXING	HUZHOU	SHAOXING	ZHOUSHAN	WENZHOU	JINHUA	QUZHOU	TAIZHOU	LISHUI
2002	0.346	0.318	0.327	0.281	0.066	0.930	0.016	0.245	0.231	0.048	0.109
2003	0.439	0.534	0.414	0.532	0.239	0.944	0.068	0.480	0.350	0.219	0.585
2004	0.512	0.616	0.598	0.777	0.328	0.887	0.164	0.548	0.489	0.303	0.776
2005	0.702	0.715	0.677	0.733	0.417	0.832	0.285	0.724	0.497	0.415	0.982
2006	0.678	0.642	0.792	0.423	0.505	0.788	0.298	0.741	0.805	0.388	0.414
2007	0.734	0.896	0.831	0.746	0.675	0.941	0.491	0.851	0.934	0.690	0.333
2008	0.811	0.898	0.869	0.761	0.696	0.909	0.534	0.876	0.940	0.844	0.377
2009	0.847	0.925	0.906	0.887	0.743	0.904	0.572	0.885	0.938	0.879	0.751
2010	0.846	0.915	0.949	0.941	0.847	0.960	0.555	0.842	0.969	0.944	0.659
2011	0.810	0.882	0.970	0.955	0.901	0.979	0.678	0.772	0.999	0.967	0.397
2012	0.756	0.887	0.976	0.914	0.878	0.989	0.837	0.689	0.981	0.955	0.430
2013	0.722	0.873	0.974	0.883	0.855	0.974	0.778	0.646	0.992	0.942	0.330
2014	0.710	0.876	0.970	0.879	0.776	0.972	0.842	0.614	0.756	0.934	0.300

5.2.1 Analysis on the coordination degrees of 11 cities in 2002

Among the 11 cities in 2002, only Zhoushan City had a perfect coordination status in this year. The population, land, and public goods indices of Zhoushan City were 0.176, 0.165, and 0.142, respectively. The developmental levels of population, land, and public goods supply were all relatively low, leading to a high coordination degree. The other 10 cities were in disharmony status. The coordination degrees of Hangzhou, Ningbo, and Jiaxing were 0.346, 0.318, and 0.327, respectively, showing their mild disharmony status. The coordination degrees of Huzhou, Jinhua, and Quzhou were 0.281, 0.245, and 0.231, respectively, indicating their moderate disharmonious status. Lishui's coordination degree C was 0.109, which signals a great disharmony status. The coordination degrees of Shaoxing, Wenzhou, and Taizhou were 0.066, 0.016, and 0.048, respectively, indicating that the development of the three core elements was extremely out of balance. Overall, the development of the three core elements was not coordinated in the 11 cities in 2002. The local governments did not have a balanced development concept of the three core elements during the urbanization process in Zhejiang Province. Moreover, they did not pay much attention to the development of the three core elements.

In 2002, the coordination degrees of the core elements in various cities were generally very low, as shown in TABLE VIII. In the 11 cities, the three indices were very low and uncoordinated. Overall, the

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development of the three core elements was not coordinated in the 11 cities in 2002. In this year, the key policy is on how to improve the whole urbanization level. In terms of population policy, the regulation of population mobility was relaxed, and rural labor was encouraged to move to cities. However, the backwardness of public goods supply is the main reason for the low coordination degree.

5.2.2 Analysis on the coordination degrees of the 11 cities in 2008

In 2008, Lishui City was still in a disharmonious status with a coordination degree C of 0.377 and a developmental status changing from great disharmony to mild disharmony. The coordination degree C of Wenzhou City was 0.534, reflecting that the city was at a transitional stage with a weak coordination status. Except for Lishui City and Wenzhou City, the other 9 cities have entered the coordination stage. Shaoxing's coordination degree C was 0.696, indicating an elementary coordination status, and Huzhou's coordination degree C was 0.761, showing an intermediate coordination status. The coordination degrees of Hangzhou, Ningbo, Jiaxing, Jinhua, and Taizhou were 0.811, 0.898, 0.86, 0.876, and 0.844, respectively, indicating their well coordination status. The coordination degrees of Zhoushan and Zhangzhou were 0.909 and 0.940, respectively, attaining the perfect coordination status.

From 2002 to 2008, the coordination degrees of the three core elements in local cities significantly improved and most cities entered a coordination stage. Although a few cities were still in a disharmonious or transitional stage, the coordination degrees of these cities were ever-increasing. The land development of Lishui City in the urbanization process remained stagnant, whereas the population expansion, land development, and public goods supply in other cities made great progress. The economic development in northeastern Zhejiang was generally better than that of southwestern Zhejiang in terms of coordination degrees and development of core elements.

5.2.3 Analysis on the coordinated degrees of the 11 cities in 2014

Among the 11 cities in 2014, Lishui City was still in the disharmony stage with a coordination degree C of 0.300, which is even lower than that in 2008. The other 10 cities were already in a coordination stage. The coordination degree C of Jinhua was 0.614, indicating an elementary coordination status. The coordination degrees of Hangzhou, Shaoxing, and Quzhou were 0.710, 0.776, and 0.756, respectively, showing that they were all in the intermediate coordination status. The coordination degrees of Ningbo, Huzhou, and Wenzhou were 0.876, 0.879, and 0.842, respectively, which represent a well coordination status. The coordination degrees of Jiaxing, Zhoushan, and Taizhou were 0.970, 0.972, and 0.934, respectively, which indicate their perfect coordination status. Notably, the coordination degrees of Hangzhou, Jinhua, and Huzhou decreased.

In 2014, the urbanization level of population, land, and public goods significantly increased, and the improvement of the public goods supply level was most apparent. Public goods supply maintained a good coordinated development with population expansion. However, the development of land was lagging behind the population expansion and public goods supply. The coordination degrees of the three core

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elements in the cities from 2008 to 2014 have two trends. First, the coordination degrees of the three core elements in some cities continued to rise. Second, the coordination degrees of the three core elements in other cities had a downward trend. This phenomenon caused the significant developmental differences between the two groups of cities.

VI. CONCLUSIONS

This study used an index model to evaluate the development of land urbanization, population urbanization, and public goods supply in the urbanization process. Instead of adopting single-element or double-element theories, we analyzed and evaluated the three core elements as a whole. After analyzing the coordination degrees of the three core elements in urbanization in 11 cities in Zhejiang Province, we have accomplished two important solutions. First, we can scale up the supply of construction land to promote the coordination degrees of the three core elements in cities with overpopulation, traffic congestion, and overpriced housing and land problems caused by lagging development in land. Second, we can slow down the pace of land development, scale down the public goods supply, loosen the control on population inflow, and try to attract talents in all trades to boost the coordination degree of the three core elements in cities with great land development and timely public goods supply.

When population urbanization rate reaches approximately 60%, China's traditional urbanization model should be rethought and changed to improve the quality of urbanization. First, governments should relax the regulation on core elements, such as land bank system and household registration system for population. Local governments in China are controlling land resource allocation and public goods supply, which is a great hinder to rapid urbanization and destroys the development of the three core elements. In a word, if we want to see an ideal urbanization process, then local governments should guarantee a sound environment of land and labor markets and optimize the distribution of public goods supply in time and space.

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