The Coordinated Development of "Transport-Industry" in Lanzhou-Xining Urban Agglomeration from the Perspective of flow space

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Abstract: Under the perspective of "flow space", the text of this paper constructs an interactive spatial connection network within 30 county towns units of the Lanzhou-Xining urban agglomeration. Further, with the help of social network and ArcGIS (which is the spatial analysis method), the quantitative analysis is used to analyze the structural characteristics of multi-dimensional spatial network of the Lan-Xi urban agglomeration and their mutual relations. Moreover, the synergetic degree model is used to measure the synergetic development level of the "traffic-industry" compound system in urban agglomeration at present. The results indicate that the Lanzhou-Xining urban agglomeration forms a double-core structure that Lanzhou and Xining as the center, and the space of county towns presents the correlated characteristic of "dumbbell-like" expansion. Furthermore, the central power of county towns which are restricted by the traffic condition and industrial structure indicates some outstanding differences. Further, it shows that the center develops to the periphery in a low-level but balanced way. In addition, the random disequilibrium of order degree of traffic and industry in urban agglomeration restricts the synergetic development of county towns, and the compound system of urban agglomeration is in the low-medium stage of synergetic development. The results of this study can provide some references for improving the traffic infrastructure construction and industrial functional structure of Lan-Xi urban agglomeration. This study also can shed some lights on the construction of the Silk Road Economic Belt.

1. Introduction
The construction of regional transportation network and the optimization of industrial layout are the key factors for promoting the synergetic development of urban agglomerations. On the one hand, transportation speeds up the flow of production factors, and further promotes the reasonable layout of industrial structure in space[1-2]; and on the other hand, the demand for the circulation of regional resource factors forces the rapid construction of transportation network among county nodes[3-4]. The synergetic development of urban agglomeration factors can give full play to the comparative advantages of different cities, avoid the diseconomy caused by excessive concentration of core urban factors, and drive the industrial upgrading of surrounding cities, thus balancing the internal contradictions of each city, and promoting regional cooperation and connectivity[5]. However, limited
by geographical location and natural environment conditions, Lanzhou-Xining urban agglomeration, during its cultivation, still has problems of small integrated transportation scale and unbalanced development, and low density of road network in some areas[^6]; obvious isomorphic trend of industrial structure, and unclear division of specialization among county nodes[^7-8]; difficulty in the coordination of regional interests, and the low level of development and competitiveness, which hold back the health and sustainable development of urban agglomerations.

In recent years, relevant scholars have studied spatial development of Lanzhou-Xining urban agglomeration from multiple dimensions: firstly, they explored the spatial connection characteristics of the urban agglomeration through traffic accessibility. For example, Yue Yang, Guo Qianqian et al. explored the structure of accessibility network of cities in northeast of China through the connection of railway transport of passenger, and found the existing of an obvious hierarchical relationship between the accessibility and urban economic volume[^9-10]; Cao Xiaoshu, Wei Lili et al. conducted an analysis to the spatial connection of the urban nodes in the Silk Road Economic Belt through land transportation, and found the existing of an obvious “corridor” spatial characteristics within the Lanzhou-Xining urban agglomeration[^11-12]; secondly, they evaluated the development of urban agglomerations through the interaction of factors. For example, Yu Jianfeng et al. evaluated the development quality of urban agglomerations through the influence of railway and expressway on spatial distribution, and found the necessity to promote the economic development through the construction of traffic network for the unbalanced economic development in Lanzhou-Xining urban agglomeration[^13]; Wu Le, Liang Feng, Shao Chuanlin et al. explored the layer structure of the urban agglomeration network through the connection between economy and industry, and put forward the industrial development strategy of regional division of labor and cooperation[^14-16]. In addition, some scholars explored the optimization of economy and industry in urban agglomerations through the characteristic of factor flow. For example, Zhang Chunmin found that the high-speed rail could enhance the strength of associations between cities along the line and promote industrial integration through the analysis on the economic relation strength of Lanzhou-Xinjiang high-speed rail to cities[^17]; Huang Ke proposed the suggestions of optimizing the industrial structure and promoting the synergetic development of regional functions through the influence of transportation infrastructure construction on the strength of industry circulation[^18].

To sum up, scholars have gradually deepened their studies on the spatial development of Lanzhou-Xining urban agglomeration, from the single influence of transportation on spatial pattern to the spatial interrelation with industry and economy. However, there is still scarce research on the spatial structure of transportation and industry and their mutual coordinated development at multi-factor dynamic spatial level, and the interactive relationship between them is the key to promote the sustainable development of urban agglomerations. In view of this, from the perspective of spatial connection of two interrelated compound systems of the transportation flow and industry flow, their degree of order at the county level and the synergetic development level of the compound systems at the current stage are measured in this paper based on the analysis of the spatial network structure of counties and towns in the Lanzhou-Xining urban agglomeration, then countermeasures and suggestions for the synergetic development of the urban agglomeration are proposed from four aspects, namely, the cultivation of emerging cities, the improvement of infrastructure, the optimization of industrial structure and the innovation of governance mechanism.

2. Study Area, Data and Method

2.1. Regional Overview

This paper takes 6 prefecture-level urban centers and 24 counties and towns determined in the Development Planning of Lanzhou-Xining urban agglomeration as the research object, with a total area of 97,500 square kilometers and total permanent resident population of 119.3 million (Figure 1).
2.2. Data Sources and Processing
The transportation flow is represented by the highway, railway, and air passenger transportation frequency data. The data of highway passenger transportation frequency was collected from the BUS365 (https://www.bus365.com) and Checi (https://www.checi.cn); the data of railway passenger transportation frequency was collected from the ticketing system of 12306 official website (http://www.12306.cn); the data of air passenger transportation was collected from the flight inquiry system (https://flight.supfree.net). The industry flow is represented by the relationship between parent companies and subsidiaries, and the data was sourced from the Tanyancha Professional Edition (https://std.tianyancha.com) and merged and processed with county as the basic unit. The industry is classified according to the standard in the National Industries Classification (GB/T4754-2017), and if the enterprise is a cross-industry business, it shall be classified based on the industry classification of the subsidiary enterprise.

Based on the data of highway, railway, air transportation frequency and the primary, secondary and tertiary industry, six kinds of 30×30 connection matrices were constructed in order to make different relational data comparable, and the normalization processing was conducted to the matrix data to represent the strength of interaction between spatial connection networks [19].

2.3. Research Method

2.3.1. Network Scale Expansion Analysis
Based on the network research method of Space of Flow proposed by Taylor et al. [20], the spatial connection matrices were transformed into a one-dimensional O-D relationship, and the ArcGIS software was used to spatially express the connection patch of these different attributes in order to explore the spatial network characteristics of transportation and industry in urban agglomerations.

2.3.2. Social Network Analysis
SNA (Social Network Analysis) is an analysis method for describing the overall network morphology, characteristics and structure [21]. On the basis of the spatial connection network, the overall network development level and structural complexity of Lanzhou-Xining urban agglomeration were analyzed in this paper by using the indicator of network relationship strength, central power, resource utilization and information transmission are listed in table 1.
| No.   | Spatial network index and their topological meanings                                                                 |
|-------|---------------------------------------------------------------------------------------------------------------------|
|       | First-class indicator                                                                                                    |
| 1     | Network relationship strength                                                                                           |
| 2     | Network density                                                                                                          |
| 3     | Degree centrality                                                                                                        |
| 4     | Network central power                                                                                                   |
| 5     | Efficient scale                                                                                                         |
| 6     | Network resource utilization                                                                                             |
| 7     | Degree of constraint                                                                                                    |
| 8     | Network information transmission Mean distance                                                                            |
|       | Second-class indicator                                                                                                   |
|       | Computational formula                                                                                                    |
|       | Explanation of formula                                                                                                   |
|       | Meaning                                                                                                                |
| 1     | $N D = N / K ( K - 1 )$                                                                                                  |
|       | $N$ is the number of nodes; $K$ is the number of network edges, $K' = \sum \{ R \}$, and $\bar{R}$ is the edge set.    |
| 2     | $D_c(\bar{R}) = \sum \{ \bar{R} \}$                                                                                   |
|       | $\bar{R}$ is the amount of connections between the county node $i$ and $j$.                                             |
| 3     | $c_{ji} = \sum_{k=1}^{n} \frac{g_{ji}}{g_{kk}}$                                                                           |
|       | The ability of the city itself to communicate                                                                        |
| 4     | $E S = \sum_{j} \left( 1 - \sum_{i} P_{ij} M_{ij} \right)$                                                               |
|       | The ability to interact with other nodes in the control network                                                         |
| 5     | $C H_{ij} = \left( p_{ij} + \sum_{q \neq i,j} P_{ij} M_{ij} \right)$                                                     |
|       | The network repetition degree to which the action representative of a city in the network starts from a node             |
| 6     | $M D = \frac{\sum \{ Di j(s \rightarrow t) \}}{\sum \{ R \}}$                                                            |
|       | The degree to which a node is constrained when it acts in an overall network                                           |
| 7     | $D I S T (s \rightarrow t)$                                                                                              |
|       | The degree to which the dissemination of information among nodes in the overall network is restricted by the path length|

2.3.3. Synergy Degree Analysis

2.3.3.1 Synergetic evaluation indicator system

In this paper, with the spatial network development level of transportation and industrial system as the degree of order, the improved synergy degree model of compound system was used with six types of spatial network connection indicator values covered by the subsystems as the vertical sequence to construct the “transportation - industry” compound system of Lanzhou-Xining urban agglomeration. The synergistic evaluation indicator system is shown in Figure 2.
2.3.3.2. Synergy Degree Calculation Method of Compound System

① Determine the subsystem and order parameter of the compound system, \( T = \{T_1, T_2\} \), wherein \( T_1 \) and \( T_2 \) represent the transportation subsystem and industry subsystem respectively; \( T_j = \{T_{j1}, T_{j2}, T_{j3}, T_{j4}, T_{j5}\} \), wherein \( T_{j1}, T_{j2}, T_{j3}, T_{j4}, T_{j5} \) stand for five sequences of network scale expansion system, network relationship strength system, network central power system, network resource utilization system and network information transmission system, with the number of nodes, network density, centrality, structural hole indicator and mean distance as the network characteristic evaluation indicator of the subsystem.

② Calculate the degree of order \( U_j(T_{ij}) \) of the order parameter \( T_{ij} \) of each subsystem, the formula is as follows:

\[
U_j(T_{ij}) = \begin{cases} 
\frac{T_{ij,j} - T_{ij,min}}{T_{ij,max} - T_{ij,min}} & j \in [1, m] \\
\frac{T_{ij,k} - T_{ij,min}}{T_{ij,max} - T_{ij,min}} & k \in [m + 1, n] 
\end{cases}
\]  

Wherein, \( T_{ij}^{min} \) and \( T_{ij}^{max} \) stand for the minimum value and maximum value of the order parameter of the subsystem \( T_i \) composed by longitudinal sequences. Moreover, \( U_j(T_{ij}) \in [0, 1] \), the higher the value, the larger degree of order of \( T_{ij} \) for its subsystems.

③ Calculate the degree of synergetic development in the system

\[
S_j(T_j) = \sqrt[n]{\prod_{i=1}^{n} U_j(T_{ij})}
\]

Wherein, \( S_j(T_j) \) stands for the synergy degree of the system, \( S_j(T_j) \in [0, 1] \), the greater the value, the higher the synergy degree.
3. Characteristics of Spatial Network Structure of the Urban Agglomeration

3.1. Dual-core Dumbbell-shaped Network Expansion of Urban Agglomeration

To obtain the spatial network structure map of the city area, the data of six connection matrixes was divided into two system categories, namely, transportation and industry, and by using ArcGIS software for O-D visualization, and dividing the connection strength of network nodes in counties and towns with the method of breakpoint, a topological graph of spatial network connection was obtained, as shown in Figure 3.

Fig.3 Urban agglomeration network connection topology diagram from the perspective of multi-flow

As can be seen from Figure 3, both the spatial connection of transportation and industry formed a radiation trend of outward expansion with the urban area of Lanzhou and Xining as the core; as the only two provincial capitals in the city area, they play an important role as a financial, cultural and transportation hub; they are also located at the center of the city area, and the close and efficient connection modes promote the two core cities to form a main connecting corridor, undertaking the transfer of most functional elements between the two provinces like the holding rods of a dumbbell. To further analyze the spatial network characteristics and interrelationships of subsystems, as can be seen from the transportation flow connection network, the transportation network connection of Lanzhou-Xining urban agglomeration shows a pattern of mutual complementarity of various means of transportation such as highway, railway and air, but there is still non-balanced development of some counties and towns. In the eastern urban nodes, the railway transportation is closed connected, while the highway transportation has a relatively low density of connection, but in Gonghe County, Guinan County, Tongren County, Jishishan County and Linxia city in the western and southern region, the construction of railway and air transportation infrastructure lags behind due to the restriction by their geographical location and economic conditions. The single mode of transportation restricts the flow speed of industry factors in this region, which is characterized by single structure and low strength of spatial connection in industrial relations; by comparing with the spatial connection of industry in Figure 3b, it shows the spatial characteristics coupled with the transportation network, and the industrial relations is spatially expressed as dense in the east and sparse in the west, while the eastern cities and towns with diversified means of transportation are closely connected with the central cities, and the neighboring county nodes also form the exchange of some factors, which plays a positive role in the formation of regional industry chain; and the western peripheral cities and towns are lack of orderly factors and economic interaction. From the fitting effect of the spatial connection of the transportation and industry system, it can be inferred that the transportation infrastructure of counties and towns influences the layout of industrial structure to a certain extent, and the diversification and convenience of travel modes are the key factors to promote the regional industry to develop towards network.

3.2. Low-level Balance of Spatial Connections of Counties and Towns

It can be found from the comparison of the network density calculated by the formula (1) that the overall network density of the two system are 0.23 and 0.32 respectively. In the case of the same low-level balance, the network density of industry is higher than that of transportation, which indicates
that the investment in the transportation infrastructure among the 30 country nodes in the city area is insufficient, and the traffic integration construction of urban agglomeration is being reversed by the investment trend of industrial economy. From the point of view of subsystem elements, the network density of highway, railway and air transportation factors in the transportation network system are 0.582, 0.101 and 0.009 respectively, and the network density of railway and air transportation network is obviously lower than that of railway. The weak connection of railway and air transportation system that undertake the main external links reflects the inadequate capability of the urban agglomeration and the surrounding urban agglomerations in terms of the transmission and interaction of economic and industrial factors, and it is urgent to improve the transportation infrastructure. The network density of industrial factors is manifested as the low-level balanced development with the tertiary industry as the center, with the network density of 0.324, 0.218 and 0.418 respectively. As the pillar of urban agglomeration, the secondary industry accounts for the largest proportion in the economy but has the lowest network density, indicating that the extensive development model of industry in Lanzhou-xinning city area lacks the industry chain with upstream and downstream linkage and the cooperation of light and weight industry. The old industry bases such as Lanzhou, Baiyin and Xining need to build the core competitiveness of the circular economy industrial chain by introducing equipment and talents.

3.3. Significant Difference in the Central Power of Urban Agglomeration Nodes

The UCINET software was used to calculate multiple centralities, the spatial distribution of degree centrality and between centrality with multiple space of flow were drawn by inverse distance spatial interpolation in ArcGIS, as shown in Figure 4.
### 3.3.1. Difference in aggregation and diffusion effect of urban circles

Lanzhou, Xining, Haidong and Baiyin are the top four cities in terms of degree centrality, which are spatially separated into two distinct urban functional circles by the interval zone with provincial administrative boundaries as the barrier. The centrality of county-level cities and towns surrounding the city circles is higher than that of the peripheral cities and towns, which indicates that the city circles are located in the network core areas of the urban agglomeration, and the flow of labor and production factor within the city circles are obviously superior than that in peripheral cities and towns. The “Lanzhou-baiyin city circle”, relying on the transportation advantage of Lanzhou-baiyin Express, Baotou-Lanzhou Railway and Zhongchuan Airport, links the urban areas of Lanzhou, Yongdeng County, Gaolan County and the urban areas of Baiyin to realize a one-hour commuting circle, and the main industrial production enterprises are also distributed in this city circle and become the eastern network cores of Lanzhou-Xining city area; the “Xining- Haidong city circle”, mainly based on the two node cities of Xining and Haidong, has greater degree of agglomeration than the degree of diffusion with non-obvious radiation driving effect on the surrounding counties and towns, and needs to transfer the construction of transportation infrastructure and layout of emerging industry to the surrounding Minhe County, Huangzhong County and Hualong in priority. The agglomeration and diffusion effect of the two city circles of the Lanzhou-Xining city area on regional differences between the surrounding counties and towns provides a basis for the synergetic function development of urban agglomeration.

### 3.3.2. Polarization effect of core city nodes

The between centrality of Xining urban area is 4.8 times that of Haidong urban area, and the between centrality of two core cities, Lanzhou and Xining, in the city area, accounts for 40% of the total value of all county nodes. Core cities have absolute control over the surrounding counties and towns, and has gathered and occupied a large number of superior resources and production factors. The polarization phenomenon of core cities promotes the surrounding towns to be “marginalized”. For example, Rugao County, Yuzhong County and Huangzhong County show the obvious phenomenon of “dark under light” due to the resource monopoly of core cities.

### 3.3.3. Dispersion and deviation of peripheral counties and towns

Both the agglomeration and diffusion effect of city circles and the polarization effect of core cities are limited by their own development degree at present, and have not reached the degree of radiating the peripheral counties and towns. In addition, peripheral towns have a tendency of dispersion and deviation due to lack of their own development motivation. Therefore, it is necessary to give full play to the advantages of transportation in resource allocation and factor transfer, accelerate the construction of the transportation network connecting the center and the periphery, strengthen the multi-center network structure of Dingxi, Linxia and Tongren, and promote the balanced development of counties and towns in the city area.

### 3.4. “Pyramid” Hierarchical Propagation of Network Resources of Urban Agglomeration

The scale value and control value of Burt structure hole were used to reflect the ability of nodes in the network to control the resource flow [22]. As can be seen from Table 2, the network scale of urban agglomeration is in descending order of provincial cities > prefecture-level cities > county-level towns, which indicates that the cities with higher administrative levels have more transportation hubs and industrial factors, and attract their surrounding towns to move closer to the center, thus achieving the rapid development of economy and information of the central cities in the urban agglomerations and the “pyramid” structure that the peripheral towns gather towards the center.

| County/City | Composite system | County/City | Composite system |
|-------------|------------------|-------------|------------------|
|             | Effective Size   |             | Effective Size   |
| Lanzhou     | 11.754           | Xining      | 11.329           |
|             | 0.227            |             | 0.223            |

Tab.2  index of Structural Hole
According to formula (7), the mean distance of information transmission of the compound network is 1.494, with the density of 0.753. In the urban agglomeration, Haiyan County, Huangyuan County and Yongdeng County in the urban agglomeration have the degree of limitation of greater than 30%. The passers of these cities through whom the information transmission shall pass in the network are mostly restricted by the passing cities. It indicates that the interconnection of transportation networks can promote the allocation of industrial factors in urban agglomeration, and the synergetic development of multiple modes of transport can radiate and diffuse the advanced resources, information and management of industrial factors at different levels to peripheral counties and towns. It can be thus seen that it is the only way for the synergetic development of the Lanzhou-Xining city area by constructing the integrated transportation network and allocating the malposition and complementation of industrial factors, combining the county and town economy and environmental advantages to optimize industrial structure, and creating the interconnected and multi-center growth pole.

### 4. Synergy Analysis of Compound System of the Urban Agglomeration

#### 4.1. Random Non-balanced Development of Degree of Order of Urban Agglomeration Subsystem

| City       | Degree | Density |
|------------|--------|---------|
| Yongdeng   | 4.578  | 0.319   |
| Gaolan     | 2.198  | 0.274   |
| Yuzhong    | 4.253  | 0.243   |
| Baiyin     | 5.761  | 0.193   |
| Jingyuan   | 3.149  | 0.232   |
| Jingtai    | 1.429  | 0.283   |
| Dingxi     | 3.925  | 0.208   |
| Longxi     | 2.000  | 0.274   |
| Weiyuan    | 1.093  | 0.290   |
| Lintao     | 3.115  | 0.157   |
| Linxia     | 5.161  | 0.128   |
| Dongxiang  | 1.524  | 0.211   |
| Jingyuan   | 2.568  | 0.148   |
| Jishishan  | 1.120  | 0.203   |
| Datong     | 1.492  | 0.260   |
| Huzhu      | 1.500  | 0.198   |
| Huangzhong | 1.413  | 0.363   |
| Haidong    | 7.347  | 0.256   |
| Minhe      | 2.335  | 0.159   |
| Huzhu      | 1.715  | 0.178   |
| Hualong    | 1.320  | 0.190   |
| Xunhua     | 3.115  | 0.143   |
| Haiyan     | 2.076  | 0.428   |
| Gonghe     | 2.585  | 0.188   |
| Guide      | 2.745  | 0.151   |
| Guinan     | 1.947  | 0.179   |
| Tongren    | 3.018  | 0.142   |
| Jainca     | 2.367  | 0.157   |

Fig. 5 Synergies of the transportation-industry composite system
Through the linear regression analysis on the degree of order of the transportation and industry system, it is found that Pearson's r is 0.26, a low degree of correlation, which indicates that the construction of transportation infrastructure in Lanzhou-Xining urban Agglomeration is not perfect, and the industrial structure and factor transfer demand are not enough to reverse the optimization of transport infrastructure; the random non-balanced spatial distribution also reflects the lack of endogenous power during the synergetic development of the city area from another point of view, and the convergence of the lack of core competitiveness in counties and towns also, to a certain extent, restricts the sustainable development of urban agglomerations.

4.2. The synergy degree level of peripheral counties and towns needs to be improved
The synergy degree of “transportation – industry” compound system is obtained by superimposing the transportation and industry subsystems at the level of counties and towns, as shown in Figure 5. The synergetic development level of the compose system of eight counties and cities in the Lanzhou-Xining city area, namely, Longxi, Jingyuan, Gaolan, Minhe and Lanzhou, Baiyin, Xining and Haidong, is at the first level; the development degree of these cities are basically consistent with the scope of city circles, which shows that transportation infrastructure and industrial structure of Lanzhou-Xining city area have achieved certain development results in the exploration of the mode with city circle as the growth pole; affected by the siphonic effect of the central cities and the imperfect infrastructure, six counties including Gonghe, Huangzhong, Guide, Guinan, Tongren and Jishishan have single industrial structure, slow flow of production factors, and are relative lag in the synergetic development of urban agglomerations.

4.3. Low-level synergetic development in the compound system of urban agglomerations
The synergy degree value of the transportation – industry compound system of the city area at the current stage is 0.339. Based on the rule theory of the synergetic development of urban agglomerations and combined with the development characteristics of western cities [23-25], it is judged that the compound system of the Lanzhou-Xining city area is at the middle and low level of synergetic development, see details in Table 3.

| Synergy degree | 0–0.1 | 0.1–0.2 | 0.2–0.3 | 0.3–0.4 | 0.4–0.5 | 0.5–0.7 | 0.7–0.85 | 0.85–1 |
|----------------|------|--------|--------|--------|--------|--------|--------|-------|
| Synergy level  | Original synergy | Initial synergy | Low-level synergy | Medium and low-level synergy | Medium-level synergy | Medium and high-level synergy | High-level synergy | Top-level synergy |

At this stage, the demand for transportation infrastructure and allocation of industrial factors among counties and towns is gradually increasing; the industrial structure function develops towards the high technology content and high-quality service, the problems and conflicts among regional cities are increasingly rapidly, and it's difficult for a single city to solve the common problems facing the region by itself; only by carrying out inter-regional cooperation and giving full play to the advantages of the group in infrastructure investment, the construction of industrial chain and talent strategy, and creating a regional multi-center growth pole, can the development contradictions be dissolved and coordinated to promote the sustainable development.

5. Conclusion and Recommendation

5.1. Conclusion
(1) The spatial network of urban agglomerations expands in the shape of a "dumbbell". The city area shows a spatial network structure that expands from the two cores of Lanzhou and Xining to the peripheral counties and towns from the two dimensions of transportation and industry, with an overall fitting relationship spatially represented as a "dumbbell"; the differences in the factor flow of the subsystem between counties and towns reflect the restrictive relation of mutual influence between transportation and industry; the homogeneity of industrial development of each county and town arises from the constraint of transportation infrastructure to a certain extent.
(2) The hierarchical power difference of counties and towns restricts the synergetic development, and with the low-level balance of the overall network density of urban agglomerations, the overall network value fluctuates between 0.2 and 0.3. The transportation infrastructure and industrial functions of the counties and towns need to be further improved. With the centralized power in core cities, the dominating power of the peripheral towns over the resource factors is affected by the polarization effect and becomes a typical city “dark under light”.

(3) The compound system of urban agglomerations is at the stage of medium and low-level synergetic development, and the random non-balance of the order degree of the “transportation – industry” compound system reflects the lack of driving force for the development of counties and towns in the urban agglomeration, so that county nodes need to achieve the purpose of upgrading industrial functions by further enhancing their own industrial competitive advantages, accelerating the improvement of transportation infrastructure and promoting the reasonable allocation of resource factors.

5.2. Countermeasures

(1) Strengthen the cultivation of new centers, and create diversified growth poles for urban agglomerations

To promote the functional dispersal of urban agglomerations including Dingxi, Linxia, Lintao, Gonghe and Tongren while strengthening the radiation driving capabilities of the two provincial core cities, Lanzhou and Xining, to introduce emerging small and medium-sized cities to undertake the transfer; to promote the construction of regional industrial chains by building the advantages of industrial clusters of small cities; to drive the industrial agglomeration of surrounding towns by relying on the local characteristics, creating new urban growth poles in the west and south of the urban Agglomeration.

(2) Improve transportation infrastructure and build the regional integrated transportation network

To reasonably set up stations in Gaolan County, Jingyuan County, Yongjing County and Linxia City to promote the westward and southward expansion of the urban agglomeration railway station by relying on the location advantages of the transportation hubs on the nodes of “Silk Road Economic Belt” and combining with the construction of Lanzhou – Zhongwei, Xining – Chengdu, Lanzhou – Hezuo railway network facilities; to actively guide the site selection of the branch airports in Linxia and Xining city to form a spatial network of urban agglomerations that link various modes of transportation including highway, railway and air.

(3) Optimize the industrial function structure, and boost the supporting of infrastructure based on demand

To accelerate the construction of industrial chains, talent introduction and entrepreneurial support policy through the radiation-driven advantages of the two city circles of “Lanzhou – Baiyin” and “Xining – Haidong”; to accurately position and promote the transfer of industrial structure based on the natural endowment of the county, and to promote the industrial structure longitudinally to a multi-industrial chain of agricultural and livestock product finishing, equipment manufacturing, trade logistics and cultural tourism; to guide the industrial division of labor relying on the construction of innovation and reform pilot zone of the city circles, promote the transformation and upgrading of the misplaced industrial labor division of the traditional industry towns to the new materials, biochemical and modern service industry, and promote the multi-industry integrated development in the region through the construction of industrial parks.

(4) Jointly build a resource information platform, and innovate the regional collaborative governance system

To build a resource-sharing information platform for the city area through regional linkage to resolve the supply and demand contradiction in the industrial chains of urban agglomeration; to integrate new media technologies to build a linked big data platform for the urban agglomerations, and break the information barrier by supporting efficient and timely release of dynamic data such as people flow, logistics and information flow; to establish a regional communication and negotiation
mechanism to solve the conflict problems in cooperation, resolve the interest disputes and improve the status of division of labor of the regional value chain; to promote the flow of regional factors, resource allocation and technological upgrading through efficient synergy mechanism to achieve the efficient and synergetic development of the Lanzhou-Xining urban Agglomeration.

Foundation item.
National Social Science Foundation of China (15BJY037) Research on the Optimization of multi-dimensional rail transit in the Silk Road Economic Belt on the Evolution of space-time Morphology of New Urbanization;
National Social Science Foundation youth Program(14CJY052) Study on dynamic Characteristics of the Influence of Traffic Integration on new-type urbanization in Western China;
Natural Science Foundation of Gansu Province (1606RJZA017) Research on collaborative Optimization Decision System of emergency logistics comprehensive Transportation based on cloud Computing architecture;
Natural Science Foundation of Gansu Province(18JR3RA119) Research on complex characteristics of critical evolution of traffic Flow based on dynamic information feedback;

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