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Accessibility and Economic Connections between Cities of the New Western Land–Sea Corridor in China—Enlightenments to the Passageway Strategy of Gansu Province

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Abstract: In 2019, China proposed the New Western Land–Sea Corridor (NWLSC) to strengthen economic and trade cooperation between China and Southeast Asia. As an important province in western China, Gansu plays a crucial role in transportation and cultural exchange in the Silk Road Economic Belt (SREB). Thus, how to develop the strategic passageway of Gansu Province becomes the research focus. In order to enhance the radiation effect of the NWLSC on the northern region and help Gansu Province expand its pattern of expanding, this paper firstly selects 16 core cities in this Corridor by using an accessibility method and an urban flow intensity method; then, analyzing the status of accessibility and the economic connection patterns between those cities; and lastly, obtaining conclusions that the accessibility of space layout is “corridor style”, the spatial distribution of urban flow intensity is balanced, and Gansu should actively participate in southbound gateway and gain the full advantages of the “golden passageway”. To sum up, this paper is innovative in terms of regional selection, research methods, and theoretical significance.

Keywords: New Western Land–Sea Corridor; strategic passageway; accessibility; urban flow intensity

1. Introduction

At present, the world is in a period of rapid economic globalization. According to the requirements of high-quality joint construction of “the Belt and Road” (“B&R”), economic and trade cooperation between China and Southeast Asia is increasingly close. The implementation of the “the Belt and Road” initiative is conducive to the fast development of the provinces along the western route, and it creates rare opportunities for tourism development, cultural dissemination, and infrastructure construction in the central and western provinces [1]. Therefore, on 31 August 2017, the four provincial governments of Chongqing, Guangxi, Guizhou, and Gansu signed the “Framework Agreement on the Cooperative Construction of the Southbound Passageway of the China–Singapore Interconnection Project”. The China–Singapore Interconnection Southbound Passageway is one of the important cooperation projects between the governments of China and Singapore, which takes Chongqing as its operating center, and Guangxi, Guizhou, Gansu, Qinghai, Xinjiang and other western provinces as its key nodes. Compared to the sea route through the eastern region, it saves about 15 days by using railway, sea, road and other transportation methods to reach ASEAN countries such as Singapore through the Guangxi Beibu Gulf. In order to fully enable the link between the “One Belt” and “One Road”, promoting development of the western and forming a new open pattern, on 2 August 2019, the China National Development and Reform Commission issued the “The Overall Plan of the New Western Land–Sea Corridor (NWLSC)” (hereinafter referred to as the “Plan”). The NWLSC is an important part of the China–Singapore Interconnection Southbound Passageway,
which is located in the hinterland of western China, connected to the Silk Road Economic Belt to the north and linked the Maritime Silk Road to the south, and it has an important strategic position in the regional coordinated development pattern. Consequently, studying the urban spatial connection of nodes in the NWLSC is the basis for building a new pattern, which is conducive to improving the level of expanding in western China.

Gansu Province of China is the gateway from the inland to almost all the important provinces in the west and neighboring countries. It is the most important transportation hub and cultural exchange hub in the west, the throat of the ancient Silk Road, and one of the most important passages of the Asia–Europe Land Bridge. It has been an important area for communication between China and foreign countries since ancient times, whose capital is Lanzhou, the geometric center of China’s terrestrial territory. Therefore, researching the spatial connection of the NWLSC core cities and the expansion strategy of Gansu Province is the foundation which can mobilize multidirectional resources, gather various elements, break the development bottleneck, and build a new pattern of expansion.

Accessibility was proposed by scholar Hansen [2] in 1959, and it refers to the size of the interaction opportunity of each node in the transportation network. Scholars often use accessibility to measure the convenience of the factor flow between cities. The study’s content mainly focused on the impact of the opening of high-speed railways on regional accessibility [3–8]. The general conclusion reached is that the operation of high-speed rail directly shortened travel time, improved the accessibility of nodes along the line, and promoted economic ties between regions. Complementarily, accessibility can also be used to analyze spatial connections and hierarchical structures between cities [9,10]. The research methods mainly include weighted average travel length [11] and grid accessibility [12]. Grid accessibility is one of the index methods used in this research.

The theory of flow space [13] provides a methodological basis for research on Urban Spatial Connection. Castells believes that society is a “flow space” including capital flow, technology flow, and information flow, where cities act as nodes to connect the overall network to form a hierarchical and regular city network. Existing studies usually studied the network system of a region or urban agglomeration through quantitative analysis and empirical research, such as the “chain network model” [14–16], network positioning strategy [17], social network analysis method [18] and so on. Besides research on urban networks with business linkages, urban flow intensity [19] and the gravity model [20] are also often used as important indicators to measure the spatial structure of an urban economy. This paper draws on the urban flow intensity index for research.

Regarding the impact of corridor construction on the city and economy, in terms of “the Belt and Road”, with the implementation of China’s Belt and Road Initiative (BRI), research results on cross-border transportation and regional cooperation among countries along the “B&R” are gradually increasing [11,21,22]. Scholars have concluded through empirical analysis that the BRI can greatly reduce delivery time and trade costs [23] and has significant impacts on the economic growth of Asian economies [24–26]. Bulis et al. [27] discussed the importance of freight potential in the economic cooperation between Latvia and China, and its reliance on statistical analysis and expert forecasting methods; the BRI has proven to be a key economic initiative, having ignited a new economic momentum for undeveloped regions [28]. As can be seen, current studies on cities along the “B&R” mainly focuses on economic factors, and we are lacking studies on urban connections and accessibility. On the other hand, in terms of the New Western Land–Sea Corridor, the research directions mostly start from marine transportation, focusing on logistics competition between China and Southeast Asian countries [29], freight structure [30], export potential [31], and economic development [32–35]. In addition, Zong [21] analyzed the accessibility and urban spatial connections of 41 transportation node cities in Southwest China and Southeast Asian countries by the accessibility method and gravity models; Chen [36] examined the spatial differences and influencing effects of urban innovation at the nodes of the NWLSC through the Markov chain and spatial panel measurement analysis methods. In summary, the existing researches have contributed to the importance
of BRI and the NWLSC to economic growth, but few studies on the spatial connection characteristics between cities have been focus.

The main contribution of this paper is that the measurement method of quantitative research is used in combination with the specific data of the node cities to analyze the current status of regional connection. Secondly, by scientifically analyzing the spatial differences between the core cities of the NWLSC, this paper improves the radiation and linkage effect of the NWLSC and promotes the integration of economy and transportation in the western region. Thirdly, it reveals the strategic passageway that Gansu Province should construct, which can help Gansu gather element resources, increase the pattern of expansion and promote economic development.

2. Materials and Methods

2.1. Research Area

According to the spatial layout mentioned in the “Plan”, the research area includes Chongqing, Chengdu, Beibu Gulf Port, and Yangpu Port (Danzhou) as important hubs. As Beibu Gulf Port actually includes Fangchenggang City, Qinzhou City, and Beihai City, there are 6 cities in total as the important hubs; 5 cities in the core coverage area of Guiyang, Nanning, Kunming, Zunyi, and Liuzhou; 5 cities in the radial extension zone of Lanzhou, Xining, Urumqi, Xi’an, and Yinchuan; and there are 16 cities in total, covering 11 provinces (autonomous region, municipalities directly under the central government) in the west except Tibet, with a total area of 6,531,800 km² and a total population of nearly 362 million (Figure 1).

![Study area](image-url)
2.2. Research Methods

2.2.1. Grid Accessibility

In order to reflect the convenience of inter-city activities, the accessibility method is adopted to measure the potential of inter-regional personnel, capital, and information flow. Due to the large scale and long timespan of the research, the cost–distance algorithm is used to measure the level of urban accessibility [12]. Under this algorithm, spatial accessibility represents the shortest time it takes for any grid to reach the corresponding node, as well as taking the time and costs to determine the condition that the grid belongs to a node [37]. As shown in Figure 2, the specific calculation steps as follows:

![Figure 2: Cost distance algorithm.](image)

The first step is to create a geodatabase by taking ArcGIS 10.3 software as the operating platform, using the “Merge” tool in “Geoprocessing”, merging railway transportation network and the highway transportation network element data set, and storing it in a geodatabase.

Then, generate the cost raster. Use the “To Raster” tool in the “Conversion Tools” to divide the road network into a grid of 1 km × 1 km. Referring to the results of existing studies [12,37], assign values to the travel time cost of roads at all levels (Table 1). After assigning cost attributes to the raster via the “Reclass” tool in “Spatial Analyst Tools”, obtain the cost grid data.

| Road Grade | Railway (km/h) | Highway | National Highway | Provincial Road | County Road | Country Road |
|------------|----------------|---------|-----------------|---------------|-------------|--------------|
| Speed      | 90             | 100     | 80              | 60            | 40          | 20           |
| Time Costs (sec) | 40 | 36      | 45              | 60            | 90          | 180          |

Next, calculate the cost distance. Run the “Cost Distance” command, obtain the minimum cumulative cost from any grid in the area to the nearest city, that is, the shortest travel time [38], thereby achieving the measurement of the accessibility of the node cities in the study area.

Finally, divide the hinterland. Run the “Cost allocation” command and, according to each point, select the nearest source on the basis of the minimum cumulative cost, thereby assigning the range of the point set of each source and further obtaining the hinterland range and accessibility ranking of each node city.

2.2.2. Urban Flow Intensity

Because accessibility can only unilaterally measure the level of urban transportation infrastructure, in order to reflect the city’s economic influence and external radiation capabilities, the location entropy and urban flow index is adopted, which collects the spatial flows such as people flow, information flow, technology flow, service flow and capital flow between cities, which are used to measure the urban agglomeration, diffusion ability and
spatial connection pattern. The industries with strong export functions selected in this paper include manufacturing, construction, wholesale and retail, transportation, catering and postal, accommodation and catering, information transmission, computer services and software, finance, real estate, leasing and business services, scientific research and technical services industry, resident service, repair and other service industry, education, health and social work, culture, sports and entertainment industry, public administration, social security and social organization.

The formula is as follows [19]:

Measuring the number of outward departments in a city to calculate the location entropy of department \( j \) in city \( i \):

\[
L_{qij} = \frac{G_{ij}}{G_i} \frac{G_j}{G}
\]  

In the formula, \( G_{ij} \) is the number of employees in department \( j \) of city \( i \), \( G_i \) is the total number of employees in city \( i \), and \( G \) is the total number of employees in the region. When \( L_{qij} < 1 \), department \( j \) in city \( i \) has no outward function; when \( L_{qij} > 1 \), department \( j \) in city \( i \) has an outward function.

The measurement formula of outward function is as follows:

\[
E_{ij} = G_{ij} - G_i \times \frac{G_j}{G} = G_{ij} / L_{qij}
\]

\[
E_i = \sum_{j=1}^{m} E_{ij}
\]

In the formula, \( E_{ij} \) is the outward function quantity of department \( j \) in city \( i \), \( E_i \) is the total outward function capacity of \( m \) departments in city \( i \).

Functional efficiency. The functional efficiency of city \( i \), \( N_i \), is expressed by the ratio of the per capita GDP of employees to the number of employees:

\[
N_i = \frac{GDP_i}{G_i}
\]

Urban flow intensity \( F_i \) is calculated as follows:

\[
F_i = E_i \times N_i = E_i \times \frac{GDP_i}{G_i} = GDP_i \times \frac{E_i}{G_i} = GDP_i \times K_i
\]

In the formula, \( K_i \) is the city flow tendency degree, which reflects the outward degree of the total functional capacity of city \( i \). The greater the intensity of urban flow and the higher the tendency of urban flow, the stronger the outward function, the stronger the ability of external radiation and the ability to gather elements, and vice versa.

2.3. Data Sources

This study constructed the indicator system for 2015, 2017, and 2019. This is because of the operation of the Lanzhou–Xinjiang high-speed rail on 26 December 2014, the opening of the Baoji–Lanzhou high-speed rail on 9 July 2017, and the opening to traffic of the Lanzhou–Chongqing railway on 30 September 2017. The National Development and Reform Commission issued the “Plan” in 2019. The number of employees in each city and the number of employees in industries with strong export-oriented functions are from the “China Urban Statistical Yearbook” (2016, 2018, 2020) published on the official website of the National Bureau of Statistics (www.stats.gov.cn, accessed on 27 May 2021) [39]. Additionally, traffic network data are obtained from the OSM (www.openstreetmap.org, accessed on 5 July 2021) website.
3. Results of Accessibility

3.1. The Spatial Layout of the Urban Accessibility of the NWLSC

1. There is a clear trend of strong south and weak north. As shown in Figure 3, accessibility presents significant spatial heterogeneity. The accessibility level in the south is significantly higher than that in the north, and the degree of accessibility is gradually decreasing from south to north, and from east to west. The four coastal ports, which are Beihai, Qinzhou, Fangchenggang and Yangpu Port, are in a core, and there is strong interoperability. On the other hand, the urban agglomerations of Chengdu-Chongqing, Lanzhou-Xining, Central-Guizhou, Guanzhong-Plain and other urban agglomerations are also relatively accessible. However, most areas in Qinghai and Xinjiang have weak accessibility and poor resource circulation. In addition, the longest time distance from the grid to the node cities was reduced from 9.388 h in 2015 to 8.413 in 2017 and then increased to 8.919 in 2019. This was affected by the diminishing marginal effect of infrastructure construction; regional accessibility cannot increase indefinitely with the construction of the road network [38].

![Accessibility of core cities of the NWLSC](image-url)  
(a) Accessibility in 2015; (b) Accessibility in 2017; (c) Accessibility in 2019.

2. The accessibility space layout is “corridor style”. Due to the level of infrastructure construction is the decisive factor for accessibility. It can be found that the nodes with high accessibility are in a corridor layout and basically coincide with various railway lines or high-speed routes. For example, the Lanzhou–Hexi Corridor–Urumqi route is highly accessible, which coincides with the Lanxin railway; the Lanzhou-Chongqing–Zunyi–Guiyang–Nanning–Fangchenggang–Qinzhou–Beihai corridor is basically consistent with the Lanhai highway.

3. Accessibility is positively correlated with economic level and the city’s scale, but negatively correlated with the distance between cities. It can be observed in Figure 4 that the accessibility rankings of the 16 node cities have not changed in the past five years; they have maintained the status quo, which is Chengdu-Chongqing Urban Agglomeration leading, Beibu Gulf in the middle, and northwestern lagging behind. Accessibility is positively correlated with urban economic level and urban population; in a sense, the agglomeration force and radiation ability of a city are affected by the level of accessibility. Therefore, cities with strong accessibility are also high-level development cities such as Chongqing and Chengdu. Nevertheless, affected by distance decay effects, the distance between cities in the northwest region is relatively long; meanwhile, the cities in the southwest region have strong agglomeration, especially Fangchenggang, Qinzhou, Beihai, and Yangpu, whose accessibility rankings all surpass the five northwestern capital cities. In addition, because Lanzhou is in the middle of the northwest region, its accessibility ranking is the highest in the northwest.
4. The agglomeration features are significant. It can be observed in Figure 5 that, as with the ranking, which is affected by the diminishing marginal effect of infrastructure construction [38], the layout of the studied regional accessibility has hardly changed in five years. Chongqing, Sichuan, Guizhou, Yunnan and the other regions form high-access areas; Gansu, Shaanxi, open-door Guangxi, and Hainan form medium-access areas; Ningxia, Qinghai on the Qinghai–Tibet Plateau, and sparsely populated Xinjiang are low-access areas. The high-reaching zones gather in an “R” shape in southwestern China. It is worth mentioning that as the infrastructure becomes more and more perfect, its grids become increasingly dense, and the high-reach area also shows stronger agglomeration characteristics.

Figure 4. Hinterland scope and accessibility ranking of core cities of the NWLSC. (a) Hinterland scope and accessibility ranking in 2015; (b) Hinterland scope and accessibility ranking in 2017; (c) Hinterland scope and accessibility ranking in 2019.

3.2. How to Develop the Strategic Passageway of Gansu Province—Southbound Passageway

With the formation of “one ring and eight shots” high-speed road network in Chengdu, the radiation range of Chengdu is increasing year by year. As shown in Figure 4, in 2015, the scope of radiation was basically only Sichuan Province, but in 2019, it has radiated to neighboring provinces such as Qinghai, Gansu, and Yunnan. Affected by the expansion of Chengdu’s radiation range, the hinterland of Lanzhou is decreasing northward year by year. This shows that expanding to the south is the way out and also the future development trend. It can be seen from Figure 5 that the western and northern parts of Lanzhou are low-accessibility areas, the eastern part is the medium-accessibility area, and the south consists of seven cities in the high-accessibility area. Therefore, expanding to the south is the only way for Gansu to integrate into the NWLSC and achieve high-quality development.

Figure 5. Accessibility spatial layout of core cities of the NWLSC. (a) Accessibility spatial layout in 2015; (b) Accessibility spatial layout in 2017; (c) Accessibility spatial layout in 2019.
4. Results of Location Entropy and Urban Flow Intensity

4.1. Location Entropy

According to Formula (1), the status and role of the main export industries of the core cities along the NWLSC in the region have been obtained, as shown in Table 2. Since the study area is located in the west and its development capacity is relatively weak, there were no cities with location entropy greater than 1 in 2015, 2017 or 2019. In 2015, the cities with more export-oriented industries with a location entropy greater than 1 were Xi’an (11), Kunming (10), and Chengdu (9). Lanzhou is the same as other capital cities such as Guiyang, Nanning, Xining, and Urumqi; in terms of location entropy, there are eight outbound service departments with a value greater than 1, which are at the middle level of the region. In 2017, the cities with the most outward sectors with a location entropy greater than 1 were Lanzhou (9) and Chengdu (9). Lanzhou became the city with the most outward sectors with a location entropy greater than 1. In 2019, the cities with the most outward sectors with a location entropy greater than 1 were Lanzhou (8), Xi’an (8) and Chengdu (8). From the perspective of the characteristics of temporal and spatial changes, the polarization phenomenon in the region is gradually weakening, and sectors with a high level of outward function are increasingly evenly distributed in each city.

It can be found, with the exception of Danzhou (Yangpu), that there was no industry with outward functions in 2015. The number of industries with external functions in each city in the region showed a balanced distribution, even if the agglomeration and radiation capabilities of non-provincial cities were not weak. The location entropy exceeds 3 in the following: the public management, social security and social organization industry, and the education industry in Zunyi in 2015; the education industry in Qinzhou in 2015; the public management, social security and social organization industry in Fangchenggang in 2019; and the public management, social security and social organization industry in Danzhou (Yangpu) in 2019.

4.2. Urban Flow Intensity

The urban flow intensity of the core cities in the NWLSC (Table 3) is calculated by Formulas (2)–(4). After dividing the node cities into five levels (Figure 6) by the “Natural Breaks” tool of ArcGIS10.3 software, we can investigate.

![Figure 6. Classification of urban flow intensity at core cities of the NWLSC. (a) Classification of urban flow intensity in 2015; (b) Classification of urban flow intensity in 2017; (c) Classification of urban flow intensity in 2019.](image-url)
Table 2. Location Entropy of Main Outward Service Industries of Core Cities of the NWLSC.

| City Order Number | Nanning | Liuzhou | Beihai | Fangchenggang | Qinzhou | Danzhou (Yangpu) | Chongqing | Chengdu | Guiyang | Zunyi | Kunming | Xi'an | Lanzhou | Xining | Yinchuan | Urumqi |
|-------------------|---------|---------|--------|---------------|---------|------------------|-----------|--------|---------|-------|---------|-------|---------|--------|----------|--------|
| 1 2015            | 0.694   | 1.366   | 1.404  | 0.312         | 0.811   | 0.281            | 1.109     | 1.048  | 0.808   | 0.939 | 0.756   | 1.187 | 0.854   | 0.995  | 0.559    | 0.588  |
| 2 2017            | 1.227   | 1.591   | 0.561  | 1.189         | 1.431   | 0.292            | 1.066     | 0.824  | 1.582   | 0.475 | 1.335   | 0.788 | 1.298   | 0.931  | 0.347    | 0.832  |
| 3 2015            | 0.42    | 0.26    | 0.193  | 0.148         | 0.237   | 0.808            | 1.045     | 1.552  | 0.437   | 0.421 | 0.711   | 0.534 | 0.369   | 0.445  | 2.58     | 0.387  |
| 4 2017            | 0.892   | 0.537   | 0.548  | 1.807         | 0.516   | 0.736            | 0.842     | 0.885  | 1.393   | 0.47   | 1.552   | 1.49  | 0.627   | 1.984  | 0.445    | 2.703  |
| 5 2015            | 0.371   | 0.133   | 0.381  | 0.196         | 0.128   | 0.911            | 1.267     | 1.427  | 0.268   | 0.15   | 0.578   | 0.58  | 0.385   | 0.216  | 1.374    | 0.314  |
| 6 2017            | 0.811   | 0.251   | 0.548  | 0.568         | 0.305   | 0.265            | 0.788     | 1.536  | 0.718   | 0.366 | 0.837   | 1.865 | 0.643   | 1.105  | 0.923    | 0.642  |
| 7 2015            | 1.936   | 0.76    | 2.614  | 0.821         | 0.878   | 0.054            | 0.707     | 0.762  | 1.155   | 1.146 | 1.214   | 1.813 | 1.618   | 1.963  | 1.611    | 1.367  |
| 8 2017            | 0.934   | 0.851   | 0.759  | 0.803         | 0.458   | 0.215            | 0.922     | 1.08   | 1.662   | 0.709 | 1.172   | 1.126 | 1.226   | 0.708  | 0.763    | 0.825  |
| 9 2015            | 1.308   | 1.106   | 0.373  | 0.492         | 0.3     | 0.278            | 0.73      | 1.46   | 0.693   | 0.454 | 1.03    | 1.282 | 0.934   | 0.507  | 1.66     | 1.095  |
| 10 2017           | 1.518   | 0.956   | 0.83   | 0.479         | 0.527   | 0.24             | 0.435     | 1.062  | 1.164   | 0.951 | 1.534   | 2.625 | 2.122   | 1.823  | 0.773    | 1.444  |
| 11 2015           | 0.039   | 0.037   | 0.034  | 0.01          | 0.037   | 0.222            | 1.793     | 1.074  | 0.16    | 0.032 | 0.107   | 0.115 | 0.027   | 0.034  | 0.946    | 0.036  |
| 12 2017           | 1.797   | 1.536   | 2.32   | 2.099         | 3.126   | 0.397            | 0.704     | 0.717  | 1.099   | 3.317 | 1.492   | 1.368 | 1.585   | 1.337  | 0.65     | 1.18   |
| 13 2015           | 1.744   | 1.654   | 2.011  | 1.941         | 2.68    | 0.322            | 0.667     | 0.883  | 1.122   | 2.589 | 1.458   | 1.131 | 1.328   | 1.802  | 0.953    | 1.478  |
| 14 2017           | 1.511   | 0.436   | 0.889  | 0.586         | 0.387   | 0.3              | 0.691     | 1.253  | 0.94    | 0.61  | 1.06    | 1.233 | 1.528   | 1.646  | 1.63     | 1.899  |
| 15 2015           | 1.57    | 1.369   | 2.376  | 2.927         | 2.241   | 0.286            | 0.608     | 0.663  | 1.541   | 3.425 | 1.354   | 1.117 | 1.85    | 1.687  | 1.09     | 2.895  |
### Table 2. Cont.

| City          | Order Number | Nanning | Liuzhou | Beihai | Fangchenggang | Qinzhou | Danzhou (Yangpu) | Chongqing | Chengdu | Guiyang | Zunyi | Kunming | Xi’an | Lanzhou | Xining | Yinchuan | Urumqi |
|---------------|--------------|---------|---------|--------|----------------|---------|------------------|-----------|----------|---------|-------|---------|-------|---------|--------|----------|--------|
| 2019          |              |         |         |        |                |         |                  |           |          |         |       |         |       |         |        |          |        |         |
| 1             | 1            | 0.575   | 1.31    | 1.212  | 0.359          | 0.667   | 0.323            | 1.145     | 1.063    | 0.608   | 0.932 | 0.776   | 1.344 | 0.825   | 0.918  | 0.872    | 0.515  |
|               | 2            | 1.428   | 2.219   | 0.515  | 0.621          | 1.355   | 0.068            | 1.239     | 0.78     | 1.825   | 0.422 | 0.922   | 0.656 | 1.27    | 0.62   | 0.306    | 0.712  |
|               | 3            | 0.548   | 0.281   | 0.3    | 0.174          | 0.292   | 0.311            | 0.66      | 1.872    | 0.482   | 0.416 | 0.643   | 0.577 | 0.541   | 0.569  | 0.525    | 0.607  |
|               | 4            | 0.707   | 0.358   | 0.407  | 1.397          | 0.467   | 0.303            | 0.917     | 0.935    | 1.33    | 0.369 | 0.975   | 1.268 | 0.699   | 1.821  | 0.558    | 2.466  |
|               | 5            | 0.5     | 0.178   | 0.4    | 0.245          | 0.123   | 0.196            | 0.3       | 2.227    | 0.227   | 0.263 | 0.639   | 0.608 | 0.404   | 0.223  | 0.222    | 0.346  |
|               | 6            | 0.595   | 0.155   | 0.57   | 0.457          | 0.265   | 0.266            | 0.451     | 1.436    | 0.771   | 0.262 | 0.845   | 1.811 | 1.079   | 0.853  | 0.443    | 0.679  |
|               | 7            | 1.769   | 0.733   | 1.011  | 1.052          | 0.728   | 0.342            | 1.307     | 0.444    | 0.768   | 1.583 | 0.931   | 1.731 | 0.854   | 1.369  | 1.778    | 1.072  |
|               | 8            | 0.829   | 0.597   | 0.895  | 0.859          | 0.499   | 1.012            | 0.98      | 1.046    | 1.29    | 0.771 | 0.96    | 1.155 | 1.145   | 0.847  | 0.897    | 0.805  |
|               | 9            | 0.741   | 0.7     | 0.666  | 0.443          | 0.537   | 0.705            | 0.864     | 1.412    | 0.687   | 0.754 | 1.016   | 0.707 | 0.693   | 0.731  | 1.078    | 0.787  |
|               | 10           | 1.086   | 0.396   | 0.626  | 0.373          | 0.344   | 0.17             | 0.645     | 0.95     | 0.905   | 0.296 | 1.219   | 1.822 | 1.739   | 1.017  | 0.868    | 1.225  |
|               | 11           | 0.145   | 0.061   | 0.192  | 0.105          | 0.074   | 0.048            | 0.151     | 2.612    | 0.493   | 0.128 | 0.372   | 0.229 | 0.063   | 0.108  | 0.04     | 0.109  |
|               | 12           | 1.344   | 0.915   | 1.904  | 1.826          | 2.379   | 2.87             | 1.315     | 0.536    | 0.85    | 2.194 | 1.236   | 1.092 | 1.109   | 1.004  | 1.046    | 0.979  |
|               | 13           | 1.218   | 1.165   | 1.64   | 1.752          | 2.172   | 2.644            | 1.104     | 0.638    | 1.006   | 1.964 | 1.192   | 0.949 | 1.087   | 1.733  | 1.317    | 1.172  |
|               | 14           | 1.103   | 0.477   | 0.621  | 0.427          | 0.178   | 0.288            | 0.646     | 1.247    | 0.829   | 0.643 | 1.092   | 1.012 | 1.342   | 1.076  | 1.214    | 1.141  |
|               | 15           | 1.229   | 1.096   | 1.85   | 3.165          | 1.748   | 3.446            | 1.205     | 0.423    | 1.024   | 2.556 | 1.377   | 0.738 | 1.304   | 1.724  | 1.603    | 2.002  |

Annotation 1: Manufacturing; 2: Construction; 3: Wholesale and retail; 4: Transportation, catering and postal services; 5: Accommodation and catering; 6: Information transmission, computer service and software; 7: Finance; 8: Real estate; 9: Leasing and business services; 10: Scientific research and technical services; 11: Resident services, repair and other services; 12: Education; 13: Health and social work; 14: Culture, sports and entertainment; 15: Public administration, social security and social organizations.
Table 3. Urban Flow Intensity of Core Cities of the NWLSC.

| City              | 2015      | Rank | City              | 2017      | Rank | City              | 2019      | Rank |
|-------------------|-----------|------|-------------------|-----------|------|-------------------|-----------|------|
| Urumqi            | 69,192.722| 1    | Beihai            | 125,148.012| 1    | Chengdu           | 98,409.059| 1    |
| Chengdu           | 69,097.913| 2    | Chengdu           | 97,235.517| 2    | Urumqi            | 92,047.264| 2    |
| Yinchuan          | 64,773.66 | 3    | Fangchenggang    | 94,163.835| 3    | Kunming           | 89,341.127| 3    |
| Fangchenggang    | 63,289.085| 4    | Liuzhou           | 93,438.638| 4    | Xi’an             | 87,808.585| 4    |
| Xi’an             | 62,283.64 | 5    | Kunming           | 84,412.944| 5    | Yinchuan          | 79,433.843| 5    |
| Guiyang           | 58,629.876| 6    | Xi’an             | 78,904.045| 6    | Guiyang           | 78,050.19 | 6    |
| Kunming           | 55,510.312| 7    | Urumqi            | 74,873.486| 7    | Liuzhou           | 73,337.323| 7    |
| Liuzhou           | 54,774.599| 8    | Nanning           | 74,311.793| 8    | Beihai            | 73,259.535| 8    |
| Lanzhou           | 52,957.287| 9    | Guiyang           | 74,295.226| 9    | Chongqing         | 72,174.389| 9    |
| Beihai            | 51,363.536| 10   | Lanzhou           | 73,472.67 | 10   | Lanzhou           | 71,592.151| 10   |
| Chongqing         | 48,684.016| 11   | Yinchuan          | 73,030.5  | 11   | Fangchenggang    | 69,626.977| 11   |
| Xining            | 45,759.795| 12   | Xining            | 72,761.472| 12   | Nanning           | 58,765.703| 12   |
| Nanning           | 45,635.957| 13   | Chongqing         | 59,681.658| 13   | Xining            | 53,118.927| 13   |
| Zunyi             | 32,691.623| 14   | Zunyi             | 49,619.375| 14   | Zunyi             | 52,748.577| 14   |
| Qinzhou           | 27,493.671| 15   | Qinzhou           | 43,377.29 | 15   | Qinzhou           | 38,936.429| 15   |
| Danzhou (Yangpu)  | 24,011.466| 16   | Danzhou (Yangpu)  | 29,892.628| 16   | Danzhou (Yangpu)  | 37,170.407| 16   |

In 2015, the first-level cities were Urumqi and Chengdu. In 2017, the first-level city was Beihai. In 2019, the first-level cities were Chengdu, Urumqi, Kunming, and Xi’an. Lanzhou, on the other hand, has always been in the third tier, and its ranking dropped from ninth in 2015 to tenth in 2017 and 2019, with a small fluctuation. In addition, although Chongqing is the city with the highest GDP and the largest population in the study area, due to its large population, Chongqing’s functional efficiency is low. As a large city, its proportion of non-basic industries used for production and living in the city is high, resulting in a low level of external energy and urban flow intensity. Conversely, there is only one big city west of Xining, Urumqi, and as an important node city on the Silk Road Economic Belt, Urumqi has strong outward functions and functional efficiency, and its urban flow intensity is also high.

In the past three years, Chengdu has remained in the top two, indicating that it is located in the “Land of Abundance” with rich natural resources, good industrial foundation and tourism resources, high resource integration capabilities and regional radiation. Capital, technology, information and service flow have all achieved high level in the region. As an influential open port on the southwest coast of China, the Beibu Gulf region has unique tourism resources, a large amount of import and export trade, strong regional radiation capabilities, and high regional radiation capabilities. Among those, Beihai was the only city in the first tier in 2015. It can be seen that along the NWLSC, Urumqi is playing its outward role in the north, Chengdu is the core in the middle, and the Beibu Gulfport radiates to Southeast Asia in the south. The urban flow intensity space of the Corridor is roughly balanced.

4.3. How to Develop the Strategic Passageway of Gansu Province—“Golden Passageway”

As shown in Table 2, Lanzhou city was the city with the most outward sectors with a location entropy greater than 1 in Northwest China in 2017 and was the city with the most outward sectors with a regional location entropy greater than 1 in 2019. As the provincial
capital of the Gansu Province, Lanzhou should upgrade its industrial structure, gather resource elements and efficiently connect the “B&R” economic belt and the Yangtze River Economic Belt in order to help Gansu develop a greater expansion pattern. It can be seen from Table 3 and Figure 6 that Urumqi, Beihai, and Chengdu each have the highest urban flow intensity in different years. Therefore, Gansu should serve as a bridge which can connect northwestern cities such as Urumqi and southwestern cities such as Chengdu and Beihai. It assumes the role of the golden passageway to connect the NWLSC and the “B&R”.

5. Discussion

By using accessibility, the study has shown that the situation of core cities of the NWLSC is significantly strong in the south but weak in the north; the space layout is “corridor style”; the status of accessibility is positively correlated with economic level and city scale, but negatively correlated with city distance; and the high-reaching area gathers in the southwestern part of China in an “R” shape. In terms of Urban Flow Intensity, it is found that the distribution of location entropy is relatively balanced, and Lanzhou is one of the cities with the most export-oriented industries, except for Chengdu and the Beibu Gulf, and has the strongest external radiation capacity and factor agglomeration capacity. The spatial intensity of urban flow in the Corridor is roughly balanced.

Thus, Gansu must depend on the opportunities of the policy, and rely on the infrastructure construction of the NWLSC, to build a logistics hub system, upgrade the industrial structure, enhance the advantages of the “golden passageway”, and integrate into the south-facing expansion pattern.

The specific recommendations are as follows:

First, improve transportation and logistics infrastructure. The efficiency of infrastructure determines the regional accessibility; in order to promote the south-bound rail–sea combined transportation channel, it is necessary to improve the transportation and logistics infrastructure. Construct and improve the Lanzhou–Chongqing, Lanzhou–Chengdu, Yan’an–Ping (liaog) Qing (Yang)–Tianshui–Longnan–Jiuzhaigou and Eurasian Continental Bridge corridors, build a “one center, four hubs and five nodes” modern logistics industry strategic layout, and accelerate construction in Lanzhou, Wuwei, Tianshui International Land Port and Lanzhou, Dunhuang, Jiayuguan International Airport.

Second, upgrade the industrial structure and improve the technological level. As one of the cities with the most outward sectors with a location entropy greater than 1, Lanzhou should improve its technological level, upgrade its industrial structure, rely on its own resource advantages, vigorously develop characteristic industries, increase export-oriented functions and the intensity of urban flow, enhance the city’s overall strength and radiation function, and become a pillar of economic growth in Northwestern China, thereby enhancing the radiation linkage effect of the NWLSC in the northwestern region.

Third, climb high by ladder and go to sea by ship. The “ladder” is the strategy of the New Western Land–Sea Corridor, and the “ship” is the freight train on the southbound gateway. It is urgent to actively integrate this into the Corridor, specifically relying on areas with high accessibility such as Chengdu, Chongqing, Fangchenggang, Qinzhou, Beihai, etc. The Lanzhou–Qinzhou Port direct train and the Lanzhou–Chongqing transit train should be opened. In addition, the Lanzhou dry port should be built in cooperation with Guangxi, to promote the normal operation of freight trains in the southbound gateway.

Finally, actively integrate into a southward expansion pattern in order to bring into full play the roles of the link and bridge. Gansu should actively participate in the southbound gateway to gain the full advantages of the “golden passageway”. In doing so, Gansu can serve as a bridge connecting northwestern cities such as Urumqi and southwestern cities such as Chengdu and Beihai, efficiently connecting the “B&R” economic belt and the Yangtze River Economic Belt to promote the interconnection and coordination of the NWLSC core cities in order to achieve high-quality development.
6. Conclusions

The goal of this research is to measure the accessibility and economic connections of the New Western Land–Sea Corridor core cities, from the two aspects of the convenience of the transportation network and the economic space connection, and thereby to find some inspiration for the strategic passageway of Gansu Province. Thus, this paper uses the grid accessibility method and the urban flow intensity method, and uses ArcGIS software to visualize the research results. The following research results are obtained. Firstly, this study finds the time–cost distance, urban hinterland range and accessibility spatial layout of the core cities of the NWLSC. Secondly, it obtains the location entropy and urban flow intensity of each city. Thirdly, according to the overall spatial structure and connection characteristics between cities of the NWLSC, it provides suggestions for the future expansion pattern of Gansu Province.

Therefore, this paper has theoretical significance for increasing the empirical research of accessibility and urban flow intensity. It confirms the positive effects of the BRI and the NWLSC and enriches the research on spatial connections of urban agglomerations in western China. Moreover, it has a practical impact on promoting high-quality economic development in western China and builds a new pattern of development and expansion in Gansu Province.

Nevertheless, this study only takes the core cities of the Chinese section of the NWLSC as the main research object, and may lack in terms of research on the entire line of the NWLSC. In the future, research on economic and trade cooperation between China, Southeast Asia and South Asia is worthy of further discussion.

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