

## Research Article

# Analysis of the Spatial Characteristics and Influencing Factors of e-Commerce Industrial Chains from the Perspective of Embeddedness: Taking Xiong'an New Area in China as an Example

Yifan Gu  and Jianghui Ding 

*School of Geographic Sciences, Hebei Normal University, Shijiazhuang 050024, China*

Correspondence should be addressed to Jianghui Ding; [widjh@163.com](mailto:widjh@163.com)

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e-commerce has promoted the application of the Internet by traditional enterprises. While this phenomenon has deepened industrial embeddedness, it has also profoundly affected the development of traditional manufacturing and retail industries. Based on the embeddedness theory, this paper takes the e-commerce industrial chain in Xiong'an New Area of China as an example, uses location entropy method and local spatial autocorrelation to analyze its spatial characteristics and influencing factors, and also discusses the features of embeddedness from each dimension of industrial chains. The results show the following: ① The supply chain of industry-dependent e-commerce is dominated by production wholesalers, and suppliers with cost advantages and commercial traditions are embedded in local characteristic industries; the e-commerce value chain is dominated by production and processing activities, and the spatial orientation of the business model is affected by regional industrial functions; the e-commerce enterprise chain is dominated by B2B enterprises, the high-level agglomeration of which reflects the absolute scale advantage provided by the e-commercialization of traditional industry. ② The distribution of the e-commerce industrial chains of Xiong'an New Area is characterized by spatial heterogeneity and has obvious spatial agglomeration. The industrial chains are concentrated in Xiong County, followed by Rongcheng County, and Anxin County has the weakest agglomeration. ③ The main factors that cause the uneven distribution of the e-commerce industrial chains in Xiong'an New Area include three aspects: transportation location advantages, traditional industrial foundation, and government policy regulation. Research can provide a scientific reference for accurately identifying the spatial development characteristics of the industrial chains from various perspectives and promoting the sustainable development and e-commercialization of traditional industries.

## 1. Introduction

With the transformation and upgrading of information and communication technologies (ICTs), e-commerce has not only changed consumers' shopping concepts and shopping behaviors but also greatly changed the traditional commodity-circulating mode [1–3]. The attempts of traditional enterprises to e-commerce have appeared in large numbers in developed and developing countries successively and have brought huge economic benefits [4–6]. The global retail e-commerce sales reached 4,135 billion US dollars in 2020, with an annual growth rate of about 15% [7]. The e-commerce entity is a key node in

geographic space and cyberspace, which possesses the dual attributes of reality and virtuality, material flow, and information flow [8]. The rapid expansion of e-commerce scale has enabled various industrial departments to objectively form an e-commerce industrial chain based on technical and economic connections in accordance with a certain logical relationship and spatial organization [9]. Nowadays, the scope of the e-commerce industrial chain has become wider, and its competitive advantages are increasing day by day [10], which has gradually infiltrated into all areas of global business, playing a significant role in optimizing and reconstructing the regional industrial system.

Previous research on e-commerce is mainly based on the perspectives of economics and sociology, and there are relatively few geographical studies. Research of economics mainly starts from the theories of industrial economics, evolutionary economics, and trade economics, focusing on the industrial evolution [11], industrial clusters [12], industrial integration [13], and value chain models [14] of e-commerce. Sociological research is based on the theory of space production and sustainable livelihoods and so on, focusing on social restructuring [15], social transformation [16, 17], and social governance [18, 19] in urban and rural areas driven by e-commerce. Geography researchers mainly start from the perspective of space, analyzing the spatial development law, formation mechanism, regional influence, and spatial effect of e-commerce. The main contents include the spatial organization characteristics of e-commerce entities from different scales [20–22], the formation mechanism and influencing factors of e-commerce industrial clusters [23–25], the relationship between e-commerce enterprises and brick-and-mortar enterprises [26, 27], and the influence of e-commerce development on traditional industries and urban commercial spatial organization [28–30]. There are a few research about the e-commerce industrial chain from geographical perspectives, which have only studied the formation and development of the industrial chain of Taobao villages at the mesomicroscale and the reorganization of the urban supply chain [31–33]. The research reflects the spatial impact of e-commerce industry agglomeration and the importance of cross-border e-commerce in the global value chain [34, 35]. Overall, the study found that, as a kind of knowledge economy, e-commerce has crossed time and space and become the new driving force of national and regional economic development [36]. With the advancement of information technology, the fragmented physical space and industrial elements in various regions are connected to each other, which increases the complexity of the spatial structure of e-commerce entities, reflecting the obvious characteristics of spatial heterogeneity. The main factors that drive and affect the e-commerce industry cluster include regional industrial foundation, economic level, transportation environment, degree of informatization, and social attributes of employees [37]. The expansion of e-commerce information flow, material flow, and capital flow has reconstructed the spatial organization of the supply and demand market and the shopping process, forming the effects of competition, substitution, and complementation with brick-and-mortar retail. Furthermore, it affects the location decision of entity enterprise and drives their agglomeration development. The supporting effect of traditional industrial clusters and the pulling effect of market demand make e-commerce products more embedded in the place, indicating that the importance of traditional geographic factors has not disappeared in cyberspace, which has further promoted the spatial infiltration and integration of virtual and real economy. Due to the differences in online shopping patterns, commodity types, trading platforms, and transaction entities, there will be apparent discrepancies in the

functioning manners and intensity of geographical factors in online shopping, which makes e-commerce show different geographical embeddedness.

Our research focuses on the spatial characteristics of the e-commerce industrial chain and the characteristics of its industrial embeddedness. Embeddedness, which is also called “endogeneity,” is an important concept in economic geography [38]. It refers to the natural and inherent connection between the development of social and economic activities and their location [39]. It is profoundly affected by a long-term, basic, and intrinsic relationship brought about by the industrial chain or industrial network composed of local resource and affiliated enterprises [40]. Previous studies have integrated the conceptions of embeddedness into the theories of global space economy [41, 42]. Some scholars believe that embeddedness is a dynamic, longitudinal, and adaptive process that evolves with the reshaping of the supply chain, the expansion of industry scale, and the innovation of technology [43]. The embeddedness of the company in the region reflects the sticky relationship and the degree of integration between the two. There are the results of both the company’s choice to be embedded in a certain industry or region and a certain industry or region’s choice to develop and retain the company. The company’s space selection depends on its location decision, and the regional viscosity depends on the influence of the regional economy, society, culture, and so on [44]. The involvement of the Internet increased the product sales channels, which made brick-and-mortar companies accelerate the speed of transferring the knowledge and technology to e-commerce enterprises. Then, the transfer and adaptation of consumer preferences make the e-commerce industry more embedded in the entity industry and the life of consumer groups, which leads to (re)creating new spatial characteristics [45]. Combining the spatial organization of the e-commerce industrial chain, the study of the industrial embeddedness is helpful to judge whether the local traditional industry will be eliminated or not under the boom of e-commercialization and fierce market competition.

All in all, despite the work of spatial development and its influencing factors of e-commerce in different scales and different models, there is a lack of research on the e-commerce industrial chain’s spatial distribution characteristics. In addition, the study of e-commerce embeddedness in traditional industries is relatively limited. China’s state-level new area, Xiong’an New Area, covers Xiong County, Anxin County, Rongcheng County, and some surrounding areas. After decades of development and accumulation, the counties have formed some traditional industries with a considerable industrial scale, most of which are labor-intensive manufacturing industries, and the overall added product value is low. Compared with the high-end positioning requirements of the development plan of Xiong’an New Area, the nonadaptability characteristics are obvious. With the help of the Internet platform and under the leadership of the new economic model of e-commerce, the way for traditional industries to adapt to the future economic functions and industrial division is a question worth considering. Taking Xiong’an New Area as an example,

using spatial autocorrelation and location entropy methods, the authors analyzed the spatial distribution characteristics and influencing factors of different types of e-commerce industry chains at the township scale. The spatial heterogeneity of e-commerce embeddedness was clarified. This work is expected to supplement and improve the research on the spatial organization of regional industrial chain, reveal the survival and development ability of traditional industries embedded by e-commerce, and provide a scientific reference for promoting the integrated development of the digital economy and the substantial economy.

## 2. Understanding e-Commerce Industrial Chain and Its Embeddedness

*2.1. Dimensions of e-Commerce Industrial Chains.* In 1958, Hirschman put forward and explained the concept of industrial chain from the perspective of industry's backward-forward linkages in the book "The Strategy of Economic Development" [46]. The industrial chain describes the complex and dynamic relationships at different levels among enterprises, industries, and regions. Western literature seldom uses the traditional concept of "industrial chain" alone and rarely sees the industrial chain as one unit for systematic research. Instead, value chain, supply chain, logistics chain, and commodity chain are more discussed [47–50]. Domestic and foreign perspectives on the industrial chain are different as a result of economic and institutional backgrounds' discrepancies. Wang [51] and Liu [52] all believe that the industrial chain is a network chain with value-added functions that integrates backward-forward linked industries through the flow of commodities based on industrial input and output. Referring to the "point" and "line" structure of the industrial chain, Wu [53] analyzed the industrial chain from the four dimensions of supply and demand chain, value chain, enterprise chain, and space chain. Subsequently, many researchers carried out an in-depth study of the connotation of the industrial chain based on the views of Wu [54–56]. This paper draws on and extends Wu's summary of industrial chain because it covers the supply-demand relationship of the upstream and downstream links in the commodity circulation process, reflects the direction of value flow and the nature of value added, and also considers the spatial connection relationships among enterprises, the main body of production and management.

The e-commerce industrial chain is the result of the integration of the information technology industry and traditional industries relying on the e-commerce platforms, and it is also the innovation of the e-commerce model compared with the original industry [57]. Based on the dimensions of the industrial chain (see Figure 1), this paper explored the e-commerce industrial chain of Xiong'an New Area from the perspective of spatial analysis.

The supply and demand chain represents the connection between "nodes." Given that the data of e-commerce enterprises in this paper are mainly production factors, the products' technology and market demand factors are not considered. The supply chain structure is mainly analyzed.

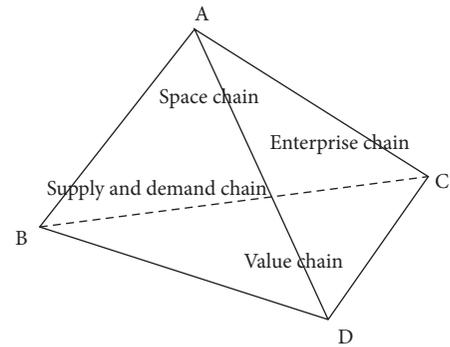


FIGURE 1: Four dimensions of industrial chain.

The e-commerce supply chain relies on the connection of production factors, logistics, and e-commerce platforms. It is the process of commodities from raw materials' production and processing to wholesale and retail and finally selling to consumers.

The e-commerce enterprise chain represents the connection between "points" and "lines." It is the carrier and the actual manifestation of the industrial chain. It is also the linear connection of all enterprises in different production and sales sections in the same industrial chain. The categories of e-commerce enterprises reflect the complex environment of e-commerce industry clusters. The economic size of enterprises reflects their ability to adapt to market changes and their development status in the e-commerce environment [58].

The e-commerce space chain expresses the connection between "line" and "line," which refers to the distribution of the same type of industrial chain in different regions. If it tends to be spatially concentrated, it will form a spatial agglomeration of the industrial chain, which can be divided into three levels: regional chain, national chain, and global chain.

The e-commerce value chain represents the connection between the "chain" and "chain." Porter was the first to create the value chain theory based on the competitive advantages of enterprises who believed that value chain is the embodiment of enterprise to create and deliver value [59]. Value chain plays an important role in causing the formation and change of the industrial chain. Its changes will first be characterized in the supply chain and further lead to changes in the enterprise chain and space chain. Finally, the various dimensions of the e-commerce industrial chain are intertwined and interact with each other, forming a stable and complex chain of spatiotemporal relationships under multiple factors.

*2.2. The Embeddedness of e-Commerce Industrial Chains.* e-commerce is inseparable not only from the production, processing, and logistic transport of commodities but also from the transmission of transaction information, capital, and technology. Therefore, the spatial organization of the e-commerce industrial chain has both cyberspace and geographic space forms. When consumers purchase products online, they are generally more inclined to choose

products with strong competitive edges; that is to say, the products are unique or at good prices in that place, which leads to the spatial directivity of consumers' online shopping. As far as online sellers are concerned, in order to produce and sell products with competitive edges, they must reduce production costs. Meanwhile, the products sold in related industrial clusters are often more low cost. Information technology embeds local products in cyberspace. As a result, the distribution and agglomeration characteristics of the e-commerce industry will be different, which reflects obvious embeddedness characteristics [60].

In the e-commerce industrial chain, the online e-commerce platform is the central part. In the dimension of the e-commerce supply chain, the starting point of commodity circulation is brick-and-mortar manufacturers and wholesale retailers. Logistics provides a guarantee for the connection of the e-commerce industrial chain and the spatial flow of elements. In the meantime, e-commerce products are mainly embedded in locations, resources, industry, and economy. Location provides development space for the e-commerce industry, and element endowments such as resources provide material conditions for the e-commerce industry to put down roots. The value chain dimension is the chain that realizes the empowerment of e-commerce. Each e-commerce value link carries out similar and interrelated production and operation activities with offline industries from brand R&D and technological upgrading upstream to imports and exports downstream, realizing the continuous value added of the entire e-commerce industrial chain. At the dimension of the enterprise chain, embeddedness means the integration of online and offline departments in one enterprise. The online part is responsible for information transmission and commodity payment, and the offline part is responsible for commodity production and processing, in which social capital (such as labor resources and government orientation) is an important factor to support the sustainable development of e-commerce enterprises in the local area, and the economic output of enterprises is also a manifestation of the differences in industrial embeddedness [40]. At the dimension of the space chain, the externalities of industrial clusters promote the agglomeration of the e-commerce industry. There is also a certain coupling between the e-commerce chain and the traditional industrial chain that it depends on.

### 3. Materials and Methods

**3.1. Study Area.** Xiong'an New Area is a state-level new area under the jurisdiction of Hebei Province in China. It is located on the eastern edge of Baoding City, at the junction of Langfang City and Cangzhou City, close to Beijing and Tianjin. Xiong'an New Area consists of Xiong County, Rongcheng County, Anxin County, and some surrounding areas (including the Baiyang Lake). The area has a total of 33 towns (see Figure 2). At the end of 2019, the GDP of Xiong'an New Area reached 21.5 billion RMB yuan. Its industry is dominated by light industry, which is all labor-intensive companies. Leading industries include the paper-plastic packaging industry and latex product industry in

Xiong County, clothing industry, toy industry, and luggage manufacturing industry in Rongcheng County, and shoe-making industry and feather product industry in Anxin County. For instance, the paper-plastic packaging and printing industry in Xiong County is a traditional industry that started in the early 1960s. After more than 60 years of original capital accumulation, it has developed three major packaging products (plastic package, paper package, and artificial leather package), four printing technology (intaglio printing, relief printing, screen printing, and planographic printing), and five major production areas (central towns as the comprehensive core area, the production area of paper-plastic package and balloon latex products centered on the Dabu Village Industrial Zone in Longwan Town, the printing area of plastic pipes and silk-screen color balloons with Zangang Town as the center, the artificial leather calendered film production and processing area with the Xiliu Village Industrial Zone in Zhugezhuang Town as the core, and the Dongzhao Village of Daying Town as the core circuit board printing and processing area) [61].

Before 2013, residents in Xiong'an New Area mostly produced and sold products all by themselves or resorted to OEM to operate physical stores or factories as their main source of income. Most kinds of traditional industries had similar development models. The majority of the enterprises were small dispersed individuals, mainly engaged in family workshop's production and sold with large group scale. The enterprises were facing pressure brought by low technological level, high product similarity, and fierce market competition, which caused a negative impact on the development of traditional industries. However, subsequently, under the trend of national e-commerce development, Xiong'an New Area gradually explored methods for the transformation of traditional industries to e-commerce by relying on the advantages of local special industries and leading enterprises. At present, the e-commerce market scale has expanded widely. In order to realize the industrial transformation, all counties in Xiong'an New Area have established e-commerce industrial parks and e-commerce public service centers, upgrading from scattered individuals to intensive groups. As of 2021, there are 25 Taobao villages and 8 Taobao towns in Xiong'an New Area, and the development trend of agglomeration is obvious. The integrated development of e-commerce and physical industries has gradually become an important way for the transformation and upgrading of traditional industries in Xiong'an New Area. Therefore, analyzing the spatial characteristics of the e-commerce industry and its industrial embeddedness is of great significance to the factors optimization of industry-dependent e-commerce and the sustainable development of traditional industries in the future.

**3.2. Data Source.** Company data from e-commerce platforms: data acquisition software was used to collect information on the homepages and archives of e-commerce enterprises in various industries on "1688.com" (<https://www.1688.com/>) and "Taobao.com" (<https://www.taobao.com/>). The "business model" of "1688.com" is the way used

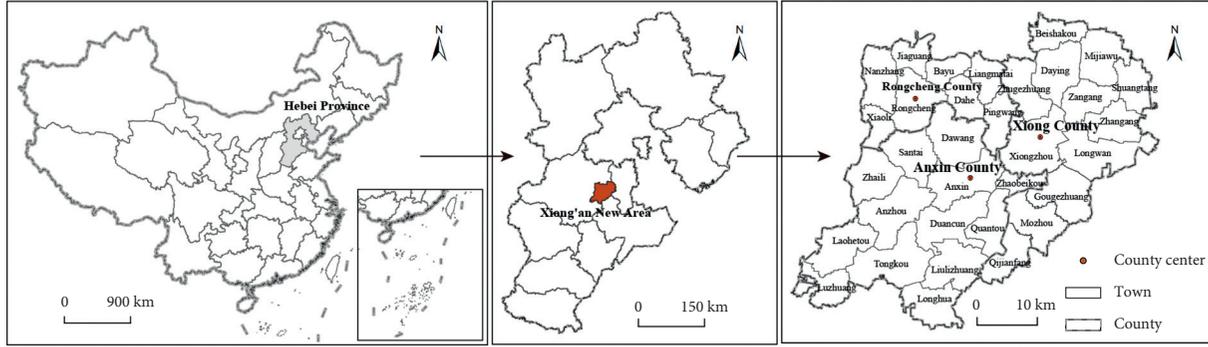


FIGURE 2: Profile of Xiong'an New Area.

by e-commerce enterprises to make profits during the operation, which is divided into four categories: production and processing, distribution and wholesale, investment agency, and business services. “Production and processing” refers to enterprises engaged in production, processing, and OEM work and then wholesale trade; “distribution and wholesale” refers to enterprises that buy and sell large quantities of commodities in the form of intermediaries for profit; the data the authors collected do not include investment agency and business services enterprises. According to the “1688.com” industry market classification, the products can be divided into 19 types, including packaging, rubber plastic chemical, craft decoration, and toys. A total of 1213 valid data were collected from “1688.com.” “Commodity retail” refers to the trade activity of selling commodities or services to consumers. This type of data originates from “Taobao.com.” A total of 195 valid data are collected. After data sorting, it was found that the first e-commerce company was established in 1998, and the data collection time is from December 15, 2020, to December 31, 2020, with a total of 1408 valid data. The data mainly includes the e-commerce enterprises’ name, establishment time, product details, registered address, business model, type of company, annual turnover, and number of employees.

Data from Taobao Village in Xiong’an New Area: the number and location information of Taobao villages in Xiong’an New Area is collected, which is obtained from the list of China Taobao villages released by the Ali Research Institute during the years 2015–2020.

The dimensions of the industrial chain are classified based on the data of e-commerce enterprises. As for the supply chain, according to commodity circulation links, suppliers can be divided into wholesalers (production wholesalers and distribution wholesalers), retailers, and integrated suppliers, among which production wholesalers are enterprises involved in the production and manufacturing sections among wholesalers, distribution wholesalers are enterprises engaged in pure wholesale trade, and integrated suppliers are suppliers that include both wholesale and retail businesses. Value chain dimension can be divided into three categories, production and processing, distribution and wholesale, and commodity retail, according to the value-added ways of commodity circulation of

e-commerce enterprises. Enterprise chain dimension can be divided into business to business (B2B), business to consumer (B2C), and business to government (B2G) according to transaction subjects. Because the enterprises are online, almost all the corresponding production and sales sections from the original industrial space can be found on the Internet [62]. Therefore, combined with the connotation of the industrial chain, the embeddedness connections between different e-commerce industrial chain links and industrial space are shown in Figure 3. Due to the lack of horizontal connection of data, this paper does not analyze the characteristics of the e-commerce space chain.

### 3.3. Methods

3.3.1. *Location Entropy*. Location entropy refers to the specialization and concentration level of an industry in a region [63]. In this paper, location entropy is used to calculate the regional orientation and dominance of e-commerce enterprises of different product categories in Xiong’an New Area. The formula used is as follows:

$$Q_j^i = \frac{N_j^i/N^i}{N_j/N}. \quad (1)$$

Here,  $Q_j^i$  is the location entropy of product  $j$  in county  $i$ ,  $N_j^i$  is the number of that kind of e-commerce enterprises,  $N^i$  is the total number of the e-commerce enterprises in county  $i$ , and  $N_j$  is the total number of the e-commerce enterprises that produce product  $j$ . When  $Q_j^i < 1$ , e-commerce enterprises of this kind product in this region do not have obvious professional advantages compared with Xiong’an New Area as a whole. When  $Q_j^i > 1$ , the comparative advantages do exist, and the larger the value, the higher the degree of advantage. Combined with the result of location entropy, the local embeddedness of e-commerce enterprises can be further judged by comparing the dominant e-commerce products with the local leading industries.

3.3.2. *Spatial Visualization and Spatial Analysis*. Local spatial autocorrelation method is used to visualize the spatial organization of the e-commerce industrial chains in Xiong’an New Area by ArcGIS. Specifically, Getis-Ord  $G_i^*$  is

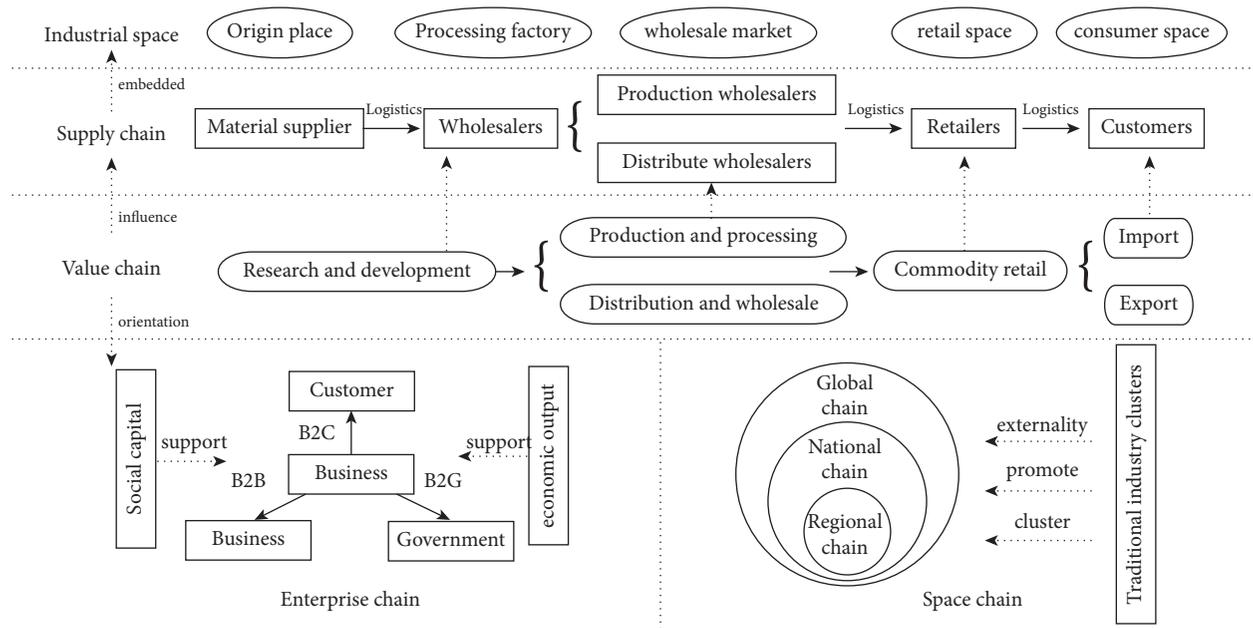


FIGURE 3: The embeddedness relationship between e-commerce industrial chains and industry space.

used to calculate and estimate the cold and hot spots of different types of enterprises in the e-commerce industries chain in Xiong'an New Area so as to explore its spatial organization mode. The formula is omitted. Finally, based on the spatial characteristics and combined with the actual situation of product types and sales types of e-commerce enterprises, the authors analyzed the embeddedness characteristics of e-commerce industry chains.

**3.3.3. Transport Superiority.** With reference to the research by Jin and others [64, 65], the degree of transport superiority is mainly composed of traffic network density, traffic line influence, and location superiority. It embodies the scale and the agglomeration capacity of transportation facilities and the accessibility status of key nodes in the region and is used to describe the advantages and disadvantages of regional traffic as an integrated indicator. The transport superiority reflects the advantages of quantity, quality, and superiority of regional traffic. Previous studies generally believe that these three aspects are of the same importance to the degree of transport superiority. In order to understand the relationship between e-commerce development and transportation location in Xiong'an New Area and further clarify the influence of transportation endowment on e-commerce, this paper revised the existing evaluation system of transport superiority, combined with the actual situation of e-commerce enterprises, and identified five secondary indexes, including the density of traffic lines in each township, the number of traffic nodes, the number of traffic lines, the shortest distance from e-commerce enterprises to the traffic line, and the distance between township administrative centers and county-level administrative centers (see Table 1). To calculate the transport superiority of Xiong'an New Area, the data in the density of traffic lines, traffic line influence on

the region, and location superiority were standardized, and all dimensions were weighted uniformly. The weight is set to 1/3, and then the processed elements are integrated. Finally, the transport superiority of each township was obtained.

## 4. The Spatial Characteristics of e-Commerce Industrial Chain and the Influencing Factors

### 4.1. Spatial Distribution Characteristics of e-Commerce Industrial Chain in Different Dimensions

**4.1.1. Analysis of e-Commerce Supply Chain.** e-commerce products circulate through the supply chain to connect upstream and downstream related enterprises and customers. The core feature is transaction orientation and linear connection. In terms of quantity, the types of products sold by suppliers are quite different. Production wholesalers (63.92%) mostly sell packaging and rubber plastic chemical products. Most of them are raw materials or semifinished products such as plastic pellets, plastic bags, and chemical supplies. Most processing enterprises need a large amount of raw material for further working in local factories, such as pipe manufacturing, bag making, printing, brand customization, and other primary processing or deep processing activities. Comprehensive suppliers (16.55%) mainly produce clothing textiles and toys. It covers a wide range, and the companies play the role of multiple suppliers. Retailers' (13.85%) product types are mainly shoe bag accessories and craft decoration products, all of which are finished products. Distribution wholesalers' (5.68%) product types are mainly composed of rubber plastic chemicals, toys, and craft decoration products. Among them, craft decorations mainly include balloons and wreaths, and rubber plastic chemical products are mainly semifinished or finished products of plastic pipes. The processing level is relatively high, and it is

TABLE 1: Evaluation index system of transport superiority of Xiong'an New Area.

Indices	Indicator	Statistical method
Density of traffic lines	Traffic nodes' number	Calculation of traffic nodes' number.
Traffic line influence on the region	Traffic lines' density	The ratio of the traffic line length of each township to the administrative area of the township.
Location superiority	Traffic lines' number	Number of traffic routes covered by each town.
	Shortest distance from e-commerce enterprises to the traffic line	The natural breakpoint method by ArcGIS is used to divide the shortest distance between e-commerce enterprises and transportation lines into 5 categories. The closer the distance, the easier the transportation. Therefore, the weights of 5, 4, 3, 2, and 1 are set in order from the nearest to the farthest distance. The number of each distance level is counted, and each town's weighted value is summed.
	Distance between township administrative centers and county-level administrative centers	Calculation of Euclidean distance between the town government and the county government.

only used for transit and wholesale sales. There are not many such enterprises. From this point of view, the supply and marketing mode of the same type of commodities determines the degree of processing.

In order to explore the spatial distribution law of e-commerce enterprises' supply chain, local spatial autocorrelation analysis was used to identify the clustering characteristics of the number of suppliers. The results show that hot spots with a  $Z$ -score greater than 1.65 and a 90% confidence level ( $P < 0.1$  for probability likelihood) are mainly distributed in Xiong County and Rongcheng County. Anxin County is in a large area with nonsignificant agglomeration areas; meanwhile, the overall hot spot coverage rate is low.

The hot spots for production wholesalers (in Figure 4(a)) and distribution wholesalers (in Figure 4(c)) are mainly distributed in towns of Xiong County. The product types in the hot spots are mainly rubber plastic chemical and packaging, respectively. Self-produced products and dealers' products are mostly from the local village or nearby rural enterprises. These two types of wholesalers are usually close to the industrial clusters in order to minimize the cost between production and sales. In the meantime, their hot spots just cover the five major production areas of Xiong County's paper-plastic packaging and printing industry. The hot spots for retailers (in Figure 4(b)) are in Xiongzhou Town and Zhaobeikou Town, with the smallest middle-level clusters, in which the products are mainly packaging. The physical size of retailers is relatively small. In order to obtain price advantages, they retail through specialized markets nearby or out of town. As for comprehensive suppliers (in Figure 4(d)), zones with  $Z > 2.98$  are mostly concentrated in the east of Rongcheng and mainly based on the toy products of the local characteristic industry. The cluttering zone not only includes specialized retail markets but also has a large-scale and highly specialized toy industry cluster.

Rongcheng County's e-commerce supply chain is relatively comprehensive. Xiong County's wholesalers and retailers are more concentrated. Anxin County's supply chain is not yet mature, and characteristic industries still have great development potential. The supply chain mainly connects various suppliers with the flow of commodities.

Most of the traditional industrial clusters in Xiong'an New Area have a history of decades of development. The most obvious competitive advantage stems from the low cost of commodity manufacturing, and the tradition, culture, and invisible knowledge and experience of local business have also become the foundation of e-commerce. Therefore, in general, the product types in the hot spots are based on local traditional industrial clusters, and e-commerce is embedded on the basis of geographical proximity, sharing economic resources such as production materials and labor with traditional industries [66].

*4.1.2. Analysis of e-Commerce Value Chain.* The value-added process of e-commerce products in circulation is shown in Figure 3. The value-added activities of the e-commerce value chain in Xiong'an New Area are mainly production and processing. This type of enterprise accounts for 80.04% of the total, which has a great advantage in terms of quantity, followed by commodity retail enterprises, accounting for 13.85%. The number of distribution and wholesale enterprises is very small, only accounting for 6.11%.

The value chain distribution and spatial orientation of different product types are shown in Table 2. To avoid the lack of statistical significance, Table 2 only counted the top 10 product types with the largest number of e-commerce enterprises included. The components of the value chain of all types of products are roughly the same, with production and processing as the main focus and distribution and wholesale as the least. Except for toys and rubber plastic chemical products, which have more distribution and wholesale enterprises than retailers, the rest of the enterprises are mainly concentrated in the production and processing and retail links, that is, the upstream and downstream of the e-commerce industrial chain, leading to the "polarization" characteristic of the chain. Now that mixed operations have become the mainstream, high-intensity links in the value chain, such as production and processing (production and wholesale) and retail (export and import), can bring more enterprise profits [3], which causes less pure wholesale trade.

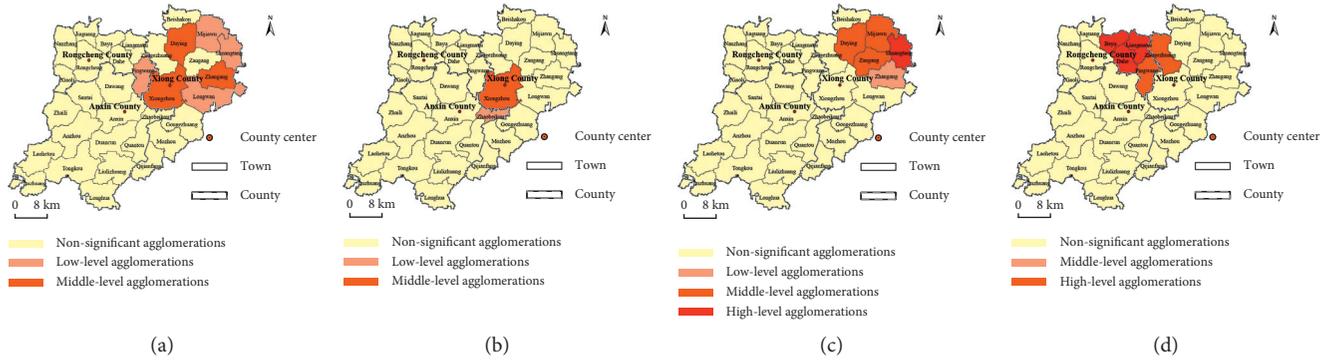


FIGURE 4: Hot spot distribution of supply chain e-commerce enterprises in Xiong'an New Area. (a) Production wholesalers. (b) Retailers. (c) Distribution wholesalers. (d) Comprehensive suppliers.

TABLE 2: Value chain composition and main distribution areas of major e-commerce product types in Xiong'an New Area.

Type of product	Number of enterprises and spatial orientation	Production and processing	Commodity retail	Distribution and wholesale
Packaging	Number Orientation	221 Xiongzhou Town	41 Xiongzhou Town	2 Xiongzhou Town
Rubber plastic chemicals	Number Orientation	228 Zangang Town	14 Xiongzhou Town	20 Zangang Town
Craft decorations	Number Orientation	175 Longwan Town	51 Longwan Town	14 Mijiawu Town
Toys	Number Orientation	124 Liangmatai Town	5 Rongcheng Town	13 Liangmatai Town
Shoe bag accessories	Number Orientation	108 Zhugezhuang Town	24 Daying Town	10 Santai Town
Clothing textiles	Number Orientation	116 Rongcheng Town and Anxin Town	9 Rongcheng Town	7 Liangmatai Town and Longhua Town
Household supplies	Number Orientation	61 Luzhuang Town	7 Xiongzhou Town	7 Anxin Town
Machinery and equipment	Number Orientation	20 Xiongzhou Town	9 Rongcheng Town	2 Zhugezhuang Town and Liulizhuang Town
Hardware tools	Number Orientation	18 Pingwang Town	6 Xiongzhou Town and Jiaguang Town	4 Rongcheng Town
Automotive supplies	Number Orientation	14 Pingwang Town	11 Xiongzhou Town and Rongcheng Town	2 Rongcheng Town and Daying Town

In terms of spatial distribution, the overall value chain tends to be centered on Xiongzhou Town, Zangang Town, Longwan Town in Xiong County and Liangmatai Town and Rongcheng Town in Rongcheng County. The development of an industry not only is based on resource endowments but also depends on the regional preference of its industrial functions. The value-added business model will be more inclined to areas with strong industrial functions and then realize the specialization and scale operation of this type of e-commerce product. For example, although the traditional industries of shoe bag accessories and clothing textiles are leading industries in Anxin County, the production processing and retail links are concentrated in Zhugezhuang Town, Daying Town, and Rongcheng Town in Rongcheng

County. Locally, labor-intensive manufacturing activities are highly specialized; the production and processing and distribution and wholesale links of household supplies enterprises are concentrated in Luzhuang Town and Anxin Town, Anxin County. Originally, this type of product had the greatest advantage in the traditional industries of Anxin County. However, its e-commerce retail links point to Xiongzhou Town, Xiong County, which has a higher economic level and richer market resources. The distribution of the value chain of the above categories of products has shifted from its advantageous regions, which not only reflects the social division of labor of the same type of products in different regions but also proves the impact of the specialization of regional industrial functions on the value chain [67].

*4.1.3. Analysis of e-Commerce Enterprise Chain.* Divided by transaction entities, B2B enterprises are the main component of the Xiong'an New Area enterprise chain (74.29%), followed by B2C (13.85%), and B2G enterprises (11.86%) are the least, which is in line with the scale of national e-commerce [68]. B2B enterprises are mainly production wholesalers (72.37%), which is consistent with the characteristic that the traditional industries in Xiong'an New Area are basically labor-intensive manufacturing. They produce and sell finished products and semifinished products, such as plastic bags, paper packaging bags, balloons, and funeral supplies. Comprehensive suppliers (21.13%) are the second, which mainly produce toys and clothing. Distribution and wholesalers (6.50%) are the least, mainly to wholesale downstream enterprises toys, clothing, plastic pipes and balloons, and other completed products. B2C enterprises are retailers, mainly selling plastic bags, cartons, balloons, funeral supplies, and other finished products to customers. B2G enterprises are also mainly production wholesalers (85.62%), aiming to serve the government's municipal works, water conservancy, and building works by manufacturing and selling plastic pipes. Distribution and wholesalers (7.19%) and integrated suppliers (7.19%) are equal, mainly supplying plastic pipes and shoe bags.

During the rapid expansion of e-commerce in space, the scale of enterprises is dominated by small, medium, and microenterprises, among which all B2C enterprises are this kind of enterprise. e-commerce enterprises with 11–50 employees have become the largest type (41.55%) in the enterprise chain of Xiong'an New Area. A large number of small-scale e-commerce enterprises means that the e-commerce market is sinking and refined, and at the same time, it also reflects the strong driving force of e-commerce to transform traditional small and microenterprises. e-commerce enterprises with an annual turnover of 7–10 million yuan accounted for the highest proportion (14.91%), mostly pointing to areas with industrial foundations such as Xiongzhou Town, Longwan Town, and Zangang Town in Xiong County. e-commerce enterprises with an annual turnover exceeding 100 million yuan are also concentrated in Zangang Town, Xiong County, which shows that the externalities of the traditional industrial economy have in turn enhanced the vitality of e-commerce development.

Using the hot spot analysis method to explore the spatial correlation patterns of various e-commerce companies, this paper observed the spatial clustering diagram of the enterprise chains in Xiong'an New Area. On the whole, hot spots with a Z-score greater than 1.96 and a 95% confidence level ( $P < 0.05$  for probability likelihood) of B2B, B2C, and B2G are basically concentrated in Xiong County and have strong continuity, while nonaggregating areas and cold spot areas are concentrated in Anxin County and Rongcheng County. The hot spots for B2B enterprises (in Figure 5(a)) are gathered in Pingwang Township, Rongcheng County, Xiongzhou Town, and Longwan Town, Xiong County, showing a linear distribution. The cold spot area is located in Mozhou Town of Anxin County. B2C enterprises hot spots (in Figure 5(b)) are located in Xiongzhou Town, Xiong County, and Zhaobeikou Town,

Anxin County, with a small distribution area, and the rest are nonsignificant areas. As for B2G enterprises, areas with  $Z > 3$  (in Figure 5(c)) are concentrated in Zhanggang Town, Shuangtang Town, Zangang Town, Mijiawu Town, and Daying Town, Xiong County, covering the Xiongdong area, presenting a block distribution. Affected by the construction of the new area, e-commerce enterprises' aggregation provides a large amount of materials needed for urban infrastructure.

The number of hot spots of B2G companies is significantly higher than that of B2B and B2C enterprises, indicating that B2G companies have a higher degree of agglomeration. It can be seen that B2B, B2C, and B2G enterprises have significant spatial agglomeration characteristics. Xiong County has always been a high-level cluster of various enterprises, followed by Rongcheng County, and Anxin County has not seen an obvious spatial agglomeration. This high-level agglomeration is embedded in the strong industrial foundation of Xiong County, and the base of e-commerce scale is relatively large, so it has an absolute scale advantage provided by the e-commercialization of traditional industry [69]. e-commerce enterprises in low-level agglomeration areas are sparse, and the development of traditional industries is relatively weak. The main products of local industries are not prominent. It is necessary to promote the transformation of traditional industries by improving the level of e-commerce development or developing "blue ocean" products.

#### *4.2. Influencing Factors of the Spatial Distribution of e-Commerce Industrial Chain*

*4.2.1. Transport Superiority Promotes the Agglomeration of e-Commerce Industry.* Although e-commerce can cross the constraints of spatial distance, its development is still based on regional embeddedness in reality, and the transportation and logistics foundation has profoundly affected the agglomeration level of the regional e-commerce industry [22]. Visualizing and spatially superimposing the e-commerce enterprises in the Xiong'an New Area with highways and railway traffic lines shows that there is a very high correlation between the two layouts. On the whole, the northern part of Xiong'an New Area, namely, Xiong and Rongcheng County, has more and dense traffic routes and hubs than Anxin County and has a higher traffic location advantage. There are obvious clusters and strips of e-commerce enterprises around the traffic lines. This feature is extremely prominent in Xiongzhou Town and Rongcheng Town. Figure 6 shows that the distribution of e-commerce enterprises and transport superiority in Xiong'an New Area is basically the same. Pearson correlation analysis and verification are carried out on the number of e-commerce enterprises and the degree of transport superiority. The correlation coefficient is 0.804, which means that it has a strong correlation. The significance level is 0.00 ( $p < 0.01$ ). It has an extremely significant statistical effect; that is, the greater the degree of transport superiority, the greater the number of e-commerce enterprises in the town.

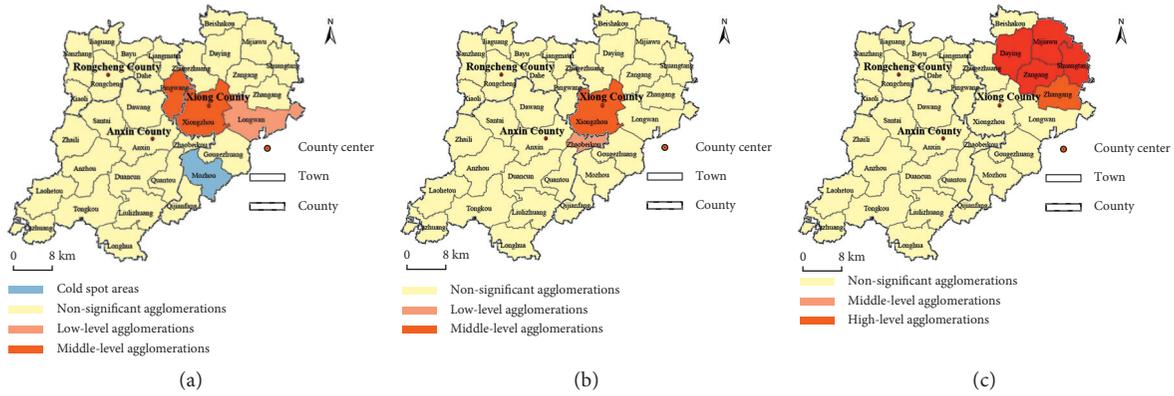


FIGURE 5: Hot spot distribution of enterprises chain e-commerce enterprises in Xiong'an New Area. (a) B2B enterprises hot spots. (b) B2C enterprises hot spots. (c) B2G enterprises hot spots.

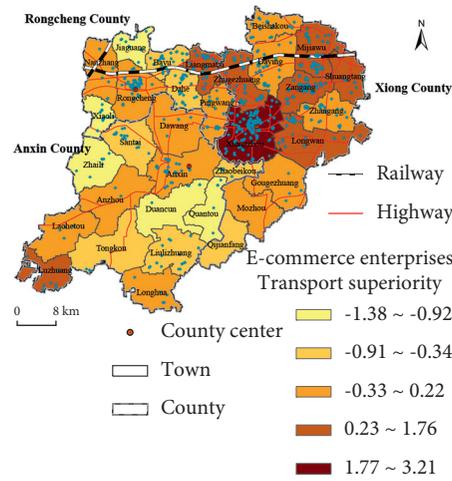


FIGURE 6: Distribution of transport superiority in Xiong'an New Area.

4.2.2. *Traditional Industries Support the Diffusion of the e-Commerce Industrial Chains.* With the popularization of e-commerce, a large number of traditional industries in Xiong'an New Area have formed the sales network. Relying on the guarantee of the government and major e-commerce platforms, the originally relatively scattered but highly local advantage industries and products have begun to connect to the Internet, and they gradually turned into an online e-commerce industry cluster [58]. Use the location entropy method to explore the correlation between the location orientation of e-commerce companies and local industrial clusters (see Table 3).

It can be seen that the distribution of location entropy of the e-commerce products in Xiong'an New Area has a strong correlation with its leading industries. The industrial chain of packaging, rubber plastic chemical, craft decoration, electrical electronics, and medical supplies has significant advantages in Xiong County. Toys, machinery and equipment, hardware tools, automotive supplies, office supplies, and pets supplies tend to be distributed in Rongcheng County. Shoe bag accessories, clothing and textiles, household supplies, food and beverages, home

building materials, gardening supplies, sports and fitness, and metal processing products are more specialized in Anxin County. The paper-plastic packaging industry is one of the leading industries in Xiong County. The location entropy of corresponding e-commerce enterprises such as packaging (plastic bags, paper bags, etc.), rubber plastic chemicals (pipes, pipe fittings, and other plastic material products), and craft decorations (latex balloons and accessories) is relatively large, and the e-commerce industrial chain is concentrated. One of the leading industries in Rongcheng County is the toy industry. The location entropy of the corresponding e-commerce products is as high as 4.35. There are 137 enterprises, accounting for 43.91% of the total number of e-commerce enterprises in Rongcheng, which indicates that the e-commerce industrial chain involves many links. The leading industries in Anxin County include the shoemaking industry and feather product industry, the corresponding e-commerce products are shoe bag accessories (shoes, soles, and other products) and clothing textiles (down products), and this category of e-commerce enterprises has the largest location entropy.

TABLE 3: Location entropy distribution of different types of e-commerce products in Xiong'an New Area.

Type of commodity	Xiong County	Rongcheng County	Anxin County
Packaging	<b>1.33</b>	0.39	0.32
Rubber plastic chemicals	<b>1.51</b>	0.02	0
Craft decorations	<b>1.47</b>	0.06	0.14
Toys	0.03	<b>4.35</b>	0.12
Shoe bag accessories	0.99	0.48	<b>2.02</b>
Clothing textiles	0.21	2.50	<b>2.62</b>
Household supplies	0.48	0.42	<b>4.95</b>
Machinery and equipment	0.68	<b>1.75</b>	1.36
Hardware tools	0.70	<b>1.93</b>	0.90
Automotive supplies	0.62	<b>2.67</b>	0
Food and beverages	0.45	1.06	<b>4.96</b>
Home building materials	0.80	0.95	<b>1.33</b>
Gardening supplies	0.51	0.38	<b>4.92</b>
Electrical electronics	<b>1.52</b>	0	0
Sports and fitness	0.38	1.13	<b>4.22</b>
Office supplies	0.51	<b>3.01</b>	0
Metal processing	0	0	<b>8.43</b>
Medical supplies	<b>1.52</b>	0	0
Pets supplies	0	<b>4.51</b>	0

The bold values are the highest location entropy value of each type of product, which means the highest regional specialization degree.

*4.2.3. Government Policy Guides the Development of e-Commerce Industrial Chains.* The agglomeration and development of the e-commerce industrial chains in Xiong'an New Area cannot be separated from the adjustment and policy guidance of governments. In recent years, Hebei Province has successively issued "Implementation Opinions on Promoting Full Coverage of Rural e-commerce," "Three-Year Promotion Plan for e-commerce Development in Hebei Province (2014–2016)," "Action Plan for Accelerating e-Commerce Development in Hebei Province (2018–2020)," and other policy documents. In 2020, the State Council approved the establishment of a national cross-border e-commerce comprehensive pilot zone in Xiong'an New Area. In 2017, the Xiong'an New Area Management Committee began to study the ideas for the construction of "digital Xiong'an" based on big data, which will promote the innovative development of e-commerce transformation and new retail. In 2018, the Xiong County Bureau of Commerce signed an e-commerce talent training strategy with Taobao University to promote the transformation and upgrading of Xiong County's traditional industries to apply "Internet +." In 2019, Rongcheng County plush toys association achieved strategic cooperation with Quyang County to jointly build an e-commerce training base. In 2020, the country suffered the impact of the COVID-19 epidemic, and countless offline physical industries turned to online. Especially with the help of the government, Rongcheng County formulated the "Nine Measures to Support the Transformation and Upgrading of Traditional Industries in Rongcheng County (Temporary)" to strongly support the local enterprises such as Jihongxing Apparel and Aosen Apparel. These companies transition to the production of anti-epidemic materials and live-streaming e-commerce to fill the gaps in the New Area. In general, the Xiong'an New Area will focus on key urban areas and town centers, and policies will internally support the development of e-commerce enterprises, accelerate the

cultivation of specialized villages, and plan and deploy e-commerce from point to point. e-commerce industry collaboration relationships across administrative regions should be established while strengthening front-to-back industry linkages through Internet technology and platforms. Finally, the e-commerce industry will realize the upgrade of the industrial chain.

*4.2.4. Influence Mechanism.* The influence mechanism of the e-commerce industry chain development in Xiong'an New Area is shown in Figure 7. First of all, the vast majority of e-commerce enterprises in Xiong'an New Area sell tangible products, so the products' flow path cannot be separated from the production processing and logistics transportation. In order to produce and sell goods with cost advantages, the location of e-commerce enterprises must be close to factories and markets to reduce transportation costs, which will promote the integrity and efficiency of the e-commerce supply chain. Therefore, the advantage of transportation and location is the primary condition and the basis for the formation and agglomeration of the e-commerce industry. Further, in order to reduce production costs to a greater extent and increase the competitive advantage of commodities, online and offline industries will replicate and migrate the value chain, and the layout of e-commerce enterprises will point to areas with relevant industrial clusters. Then, the advantages of traditional industries promote the diffusion of the e-commerce industry, making the e-commerce in Xiong'an New Area form an industry-dependent development path. Finally, the guidance and support capabilities of government policies support the coordinated development of multiple places and institutions from a macroperspective and ensure the development of e-commerce and infrastructure construction within the county on a microlevel. The government measures provide

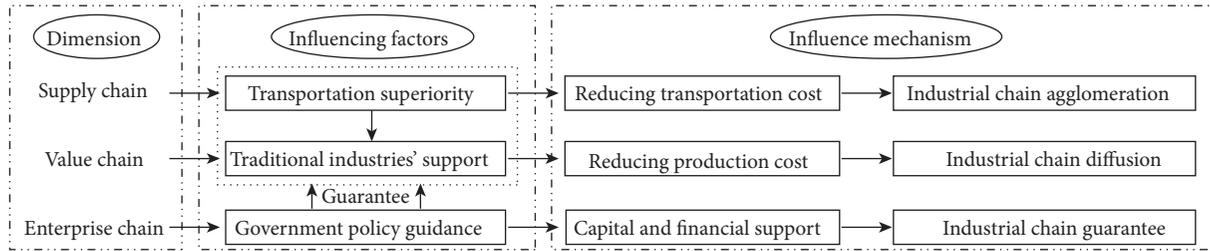


FIGURE 7: Influence mechanism.

social capital and economic support for the e-commerce enterprise chain and also provide a suitable institutional environment for the industrial chain.

## 5. Conclusion and Discussion

Based on 1408 e-commerce enterprises' data in Xiong'an New Area, this paper revealed the spatial characteristics and influencing factors of e-commerce industrial chains and discussed the characteristics of industrial embeddedness based on various aspects of the e-commerce industrial chain.

The e-commerce supply chain in Xiong'an New Area is dominated by production wholesalers, followed by integrated suppliers, retailers, and distribution wholesalers. Rongcheng County's e-commerce supply chain is more comprehensive, Xiong County's wholesalers and retailers are more concentrated, and Anxin County's supply agglomeration is the weakest. Commodities can characterize the industrial embeddedness of the supply chain, and supply links' differences can cause discrepancies in the degree of product completion. The cost advantage of product manufacturing makes traditional industries the basis for the development of e-commerce.

The value chain dimension is dominated by production and processing activities, followed by commodity retailing and distribution and wholesale. Value links spatially inclined to Xiongzhou Town, Zangang Town, and Longwan Town in Xiong County and Liangmatai Town and Rongcheng Town in Rongcheng County. The intensity of value information promotes the agglomeration of the value chain sections, while the production and sales links deviate from the industrial advantage regions. This cross-township and even cross-regional geographical division of labor structure reflect the impact of the specialization of regional industrial functions on the value chain.

At the enterprise chain, B2B enterprises are the majority, followed by B2C enterprises and B2G enterprises. The scale of employees and the annual turnover of all kinds of enterprises have an obvious trend of miniaturization. Local industrial clusters bring economic vitality to e-commerce enterprises. Spatially, the high-level clusters of the three types of e-commerce companies are all located in Xiong County. The agglomeration of Rongcheng County is the second, and Anxin County has no obvious agglomeration. The high-level agglomeration stems from the strong traditional industrial foundation, which brings scale advantages for the transformation of e-commerce.

Exploring the factors influencing the spatial distribution of the e-commerce industrial chains in Xiong'an New Area, it is found that transportation location advantages are the basis for e-commerce enterprises and their chains to agglomerate and also provide conditions for e-commerce supply chains to be rooted in traditional industries. Relying on traditional industries, different types of e-commerce commodities have achieved large-scale operations in their industrial advantage regions. Government policy regulation provides a guarantee for the agglomeration and expansion of the e-commerce industrial chains.

The study found that the supply chain of industry-dependent e-commerce still relies on the commodity circulation path of traditional industries, especially the e-commerce derived from the strong industrial foundation of Xiong'an New Area, whose products have more local embeddedness. This phenomenon indicates that traditional geographical factors are still very important in cyberspace [60, 70, 71]. Under the embeddedness effect of e-commerce, traditional industries will not be completely eliminated. Enterprises that already have the scale of the supply chain, are rich in value links, and have vigorous enterprises are more likely to survive in the future development of Xiong'an New Area. Based on the above conclusions, with the help of a multidimensional industrial chain formed by the connection of e-commerce enterprises in Xiong'an New Area, the local government should pay special attention to the improvement of disadvantaged areas and use e-commerce advantages and positive externality of traditional industries to radiate to underdeveloped areas in order to drive the application of e-commerce by business entities in Anxin County. On the other hand, focusing on improving the quality and efficiency of e-commerce in areas where the e-commerce industrial chain is concentrated and under the premise of green development, Xiong'an New Area should promote the digitalization and intelligentization of industries to tackle the "low-locked" and element loss problem of traditional industries with low added value, weak R&D capabilities. Then thereby, the elimination rate of enterprises in the industrial clusters of Xiong County and Rongcheng County could be reduced. Finally, the embeddedness characteristics of the e-commerce industrial chain studied in this paper can be used as proof to analyze the interaction between e-commerce and traditional industries, focusing on the adjustment of the traditional industrial structure under the influence of e-commerce, provide a theoretical reference for the entry and exit of enterprises, and point out the direction of the sustainable development of traditional industries.

Previous research always makes further discussion about the transformation and reconstruction of physical space caused by the embedding of e-commerce into local economic space after analyzing the e-commerce characteristics and influencing factors. This paper mainly revealed how e-commerce was embedded in the local industry and area from a different perspective of industrial chains and discussed the survival and development of traditional industries. Limited by data, the research in this paper is limited to the qualitative discussion of the embeddedness characteristics of the e-commerce industrial chain. In fact, based on the embeddedness connotation, it should also cover social, cultural, political, and other aspects. It needs to be further investigated through field research and data collection. In short, the research on the spatiality and embeddedness of the e-commerce industrial chain plays an important role in the transformation and upgrading of traditional industries, as well as the integration and development of the digital economy and the real economy, and more empirical cases are urgently needed for systematic research on it.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare no conflicts of interest.

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## References

- [1] T. Garín-Muñoz, R. López, T. Pérez-Amaral, I. Herguera, and A. Valarezo, "Models for individual adoption of eCommerce, eBanking and eGovernment in Spain," *Telecommunications Policy*, vol. 43, no. 1, pp. 100–111, 2019.
- [2] Á. Valarezo, T. Pérez-Amaral, T. Garín-Muñoz, I. Herguera García, and R. López, "Drivers and barriers to cross-border e-commerce: evidence from Spanish individual behavior," *Telecommunications Policy*, vol. 42, no. 6, pp. 464–473, 2018.
- [3] G. Saridakis, Y. Lai, A.-M. Mohammed, and J. M. Hansen, "Industry characteristics, stages of E-commerce communications, and entrepreneurs and SMEs revenue growth," *Technological Forecasting and Social Change*, vol. 128, pp. 56–66, 2018.
- [4] N. Wrigley and A. Currah, "Globalizing retail and the 'new e-economy': the organizational challenge of e-commerce for the retail TNCs," *Geoforum*, vol. 37, no. 3, pp. 340–351, 2006.
- [5] D. Zhang, P. Zhu, and Y. Ye, "The effects of E-commerce on the demand for commercial real estate," *Cities*, vol. 51, pp. 106–120, 2016.
- [6] G. Clarke, C. Thompson, and M. Birkin, "The emerging geography of e-commerce in British retailing," *Regional Studies, Regional Science*, vol. 2, no. 1, pp. 371–391, 2015.
- [7] A. H. Mohamad, G. F. Hassan, and A. S. A. Elrahman, "Impacts of e-commerce on planning and designing commercial activities centers: a developed approach," *Ain Shams Engineering Journal*, vol. 13, no. 4, Article ID 101634, 2022.
- [8] B. Parker and R. Weber, "Second-hand spaces: restructuring retail geographies in an era of e-commerce," *Urban Geography*, vol. 34, no. 8, pp. 1096–1118, 2013.
- [9] J. H. Ding, Z. Y. Song, and W. D. Liu, "An empirical study on the spatial organization variation with the application of Information and Communication Technologies (ICTs): a case study of textile and apparel enterprises in China," *Geographical Research*, vol. 28, no. 4, pp. 883–892, 2009.
- [10] J. Zhao and C. Wang, "Size distribution of credit rating of C2C clothing stores and its influencing factors: a case study of Jiangsu, Zhejiang, and Shanghai," *Tropical Geography*, vol. 39, no. 5, pp. 790–798, 2019.
- [11] Y. J. Liu and X. M. Chu, "The industrial evolution of TAOBAO villages," *China Soft Science*, vol. 2, pp. 29–36, 2017.
- [12] Z. Xue and X. H. Geng, "E-commerce platform, acquaintance society and rural distinctive industrial clusters--case study of 'Taobao Village' in Shaji Town," *Journal of Northwest A&F University (Social Science Edition)*, vol. 18, no. 5, pp. 46–54, 2018.
- [13] X. Z. Li and R. Huang, "Research on the competitiveness of China's textile industry in the context of industry 4.0 based on the integration of textile industry and electronic information industry," *China Soft Science*, vol. 2, pp. 21–31, 2018.
- [14] Z. R. Zhang and J. D. Yang, "How to optimize the path of industrial goods downlink by rural e-commerce from the perspective of rural revitalization: based on grounded theory research of value chains coupling mechanism," *Issues in Agricultural Economy*, vol. 4, pp. 118–129, 2019.
- [15] Y. N. Zhang, H. L. Long, S. S. Tu, Y. R. Li, L. Ma, and D. Z. Ge, "A multidimensional analysis of rural restructuring driven by e-commerce: a case of Xiaying village in central China," *Scientia Geographica Sinica*, vol. 39, no. 6, pp. 947–956, 2019.
- [16] J. Q. Zhang and Q. L. Qian, "Research of the spatial transformation of 'taobao village' in information age," *Urban Development Studies*, vol. 22, no. 10, pp. 81–101, 2015.
- [17] J. Zhou, L. Yu, and C. L. Choguill, "Co-evolution of technology and rural society: the blossoming of Taobao villages in the information era, China," *Journal of Rural Studies*, vol. 83, pp. 81–87, 2021.
- [18] C. C. Wang, J. T. Miao, N. A. Phelps, and J. Zhang, "E-commerce and the transformation of the rural: the Taobao village phenomenon in Zhejiang Province, China," *Journal of Rural Studies*, vol. 81, pp. 159–169, 2020.
- [19] F. F. Chen, Z. D. Luo, and H. M. He, "Study on the pluralistic reconstitution of rural governance driven by e-commerce: a case study of Daji town of Cao County, Shandong Province," *Modern Urban Research*, vol. 10, pp. 22–29, 2016.
- [20] Z. W. Ding, M. L. Han, G. S. Zhang, and Z. H. Jian, "Spatial differentiation and influencing factors of the service quality of Taobao online C2C stores in central plains urban agglomeration at county level," *Economic Geography*, vol. 39, no. 5, pp. 143–154, 2019.
- [21] J. G. Yu, L. H. Wang, and N. Li, "E-shops spatial distribution rule: a case study of Taobao net," *Economic Geography*, vol. 30, no. 8, pp. 1248–1253, 2010.
- [22] M. F. Wang and S. Lu, "Exploring the spatial organization of online retailing: a case study of Dangdang.com," *Geographical Research*, vol. 30, no. 6, pp. 965–976, 2011.
- [23] Z. Lu, X. N. Li, L. H. Yang, D. Yang, and L. L. Deng, "Location orientation of E-shops in China's major cities based on neighborhood facilities: case studies of Shanghai, Shenzhen,

- Tianjin and Beijing,” *Acta Geographica Sinica*, vol. 66, no. 6, pp. 813–820, 2011.
- [24] G. F. Gu and Y. H. Xu, “Influencing factors and spatial pattern of electronic commerce development level in China at the prefecture-level city,” *Economic Geography*, vol. 39, no. 10, pp. 123–129, 2019.
- [25] Y. W. Zeng, D. M. Qiu, Y. T. Shen, and H. D. Guo, “Study on the formation of taobao village: taking dongfeng village and junpu village as examples,” *Economic Geography*, vol. 35, no. 12, pp. 90–97, 2015.
- [26] K. B. Shi, Y. C. Yang, S. Bai, E. L. Li, and D. Chen, “Innovation diffusion hypothesis or efficiency hypothesis: spatial penetration of online-to-offline e-commerce in China based on Meituan.com,” *Geographical Research*, vol. 37, no. 4, pp. 783–796, 2018.
- [27] G. Yeung and K. L. Ang, “Online fashion retailing and retail geography: the blogshop phenomenon in Singapore,” *Tijdschrift voor Economische en Sociale Geografie*, vol. 107, no. 1, pp. 81–99, 2016.
- [28] M. F. Wang, S. Lu, and J. Qiu, “Exploring the spatial organization of online retailing: a case study of Dangdang.com,” *Geographical Research*, vol. 30, no. 11, pp. 1835–1840, 2010.
- [29] X. Liu, F. Zhen, M. Zhang, and G. L. Xi, “Research review of online shopping impact on personal travel and urban retail space and implications,” *Progress in Geography*, vol. 34, no. 1, pp. 48–54, 2015.
- [30] W. Tang and J. Zhu, “Informality and rural industry: rethinking the impacts of E-Commerce on rural development in China,” *Journal of Rural Studies*, vol. 75, pp. 20–29, 2020.
- [31] J. Qian and Z. F. Zheng, “E-commerce clusters based on taobao industrial chain: a case study on Qingyanliu Village in Yiwu City,” *City Planning Review*, vol. 11, pp. 79–83, 2013.
- [32] C. S. Zhu, X. Wang, D. Wang, T. Zhang, and W. J. Zhong, “Spatial connection of Taobao Village in Haining based on the operation process,” *Shanghai Urban Planning Review*, vol. 2, pp. 36–41, 2021.
- [33] Z. P. Xiao, Q. Yuan, Y. H. Sun, and X. X. Sun, “New paradigm of logistics space reorganization: E-commerce, land use, and supply chain management,” *Transportation Research Interdisciplinary Perspectives*, vol. 9, Article ID 100300, 2021.
- [34] G. H. Gessner and C. R. Snodgrass, “Designing e-commerce cross-border distribution networks for small and medium-size enterprises incorporating Canadian and U.S. trade incentive programs,” *Research in Transportation Business & Management*, vol. 16, no. 16, pp. 84–94, 2015.
- [35] Y. Xu, H. Gui, J. Zhang, and Y. Wei, “Supply chain analysis of cross border importing e-commerce considering with bonded warehouse and direct mailing,” *Sustainability*, vol. 11, no. 7, pp. 1909–1921, 2019.
- [36] B. Moriset, “e-Business and e-Commerce,” *International Encyclopedia of Human Geography*, Elsevier, Amsterdam, Netherlands, Second edition, 2020.
- [37] M. Liu, Q. Zhang, S. Gao, and J. Huang, “The spatial aggregation of rural e-commerce in China: an empirical investigation into Taobao Villages,” *Journal of Rural Studies*, vol. 80, pp. 403–417, 2020.
- [38] M. Hess, “‘Spatial’ relationships? Towards a reconceptualization of embedded ness,” *Progress in Human Geography*, vol. 28, no. 2, pp. 165–186, 2004.
- [39] A. Jones, “Beyond embeddedness: economic practices and the invisible dimensions of transnational business activity,” *Progress in Human Geography*, vol. 32, no. 1, pp. 71–88, 2008.
- [40] X. D. Fu and J. S. Fu, “The theory origin and enlightenment of leading industrial embeddedness,” *Regional Economic Review*, vol. 1, pp. 26–32, 2017.
- [41] S. Burt, U. Johansson, and J. Dawson, “International retailing as embedded business models,” *Journal of Economic Geography*, vol. 16, no. 3, pp. 715–747, 2016.
- [42] S. Wood, N. M. Coe, and N. Wrigley, “Multi-scalar localization and capability transference: exploring embeddedness in the Asian retail expansion of Tesco,” *Regional Studies*, vol. 50, no. 3, pp. 475–495, 2016.
- [43] N. M. Coe and Y.-S. Lee, “‘We’ve learnt how to be local’: the deepening territorial embeddedness of Samsung-Tesco in South Korea,” *Journal of Economic Geography*, vol. 13, no. 2, pp. 327–356, 2013.
- [44] H. Y. Zhu, Z. X. Zhu, and L. Zhang, “Theoretical framework of the primary features of industrial agglomeration and regional development,” *Economic Geography*, vol. 38, no. 10, pp. 111–117, 2018.
- [45] A. Appel, “Embeddedness and the (Re)making of retail space in the realm of multichannel retailing: the case of migros sanal market in Turkey,” *Geografiska Annaler Series B Human Geography*, vol. 98, no. 1, pp. 55–69, 2016.
- [46] A. O. Hirschman, *The Strategy of Economic Development*, Yale University Press, New Haven, CT, USA, 1958.
- [47] A. Flynn, K. W. Chan, Z. H. Zhu, and L. Yu, “Sustainability, space and supply chains: the role of bamboo in Anji County, China,” *Journal of Rural Studies*, vol. 49, pp. 128–139, 2017.
- [48] R. S. Piao, L. Fonseca, E. D. C. Januário, M. S. Macchione Saes, and L. Florencio de Almeida, “The adoption of voluntary sustainability standards (VSS) and value chain upgrading in the Brazilian coffee production context,” *Journal of Rural Studies*, vol. 71, pp. 13–22, 2019.
- [49] T. Styliadis and C. Chlomoudis, “Analyzing the evolution of concentration within containerized transport chains through a circuitist approach: the role of innovations in accelerating the circuits of liner and container terminal operators,” *The Asian Journal of Shipping and Logistics*, vol. 37, no. 4, pp. 321–328, 2021.
- [50] J. B. Huang, Q. Ding, Y. Wang, H. J. Hong, and H. W. Zhang, “The evolution and influencing factors of international tungsten competition from the industrial chain perspective,” *Resources Policy*, vol. 73, Article ID 102185, 2021.
- [51] J. C. Wang, “Some related concepts in China’s research of industry cluster,” *Acta Geographica Sinica*, vol. 59, no. S1, pp. 47–52, 2004.
- [52] G. F. Liu and Y. C. Zhao, “Content characteristics and formats of industrial chains,” *The Theory and Practice of Finance and Economics*, vol. 27, no. 141, pp. 114–117, 2006.
- [53] J. M. Wu and C. Shao, “Research on formation mechanism of industrial chain: ‘4+4+4’ model,” *China Industrial Economy*, vol. 4, pp. 36–43, 2006.
- [54] Z. L. Fei, L. Zhu, and S. L. Zhao, “The governance of regional industry chain: connotation and measures,” *Economic Geography*, vol. 30, no. 10, pp. 1688–1692, 2010.
- [55] W. Wang, “The evolution, government and upgrading of the resource-based industrial Chain: taking the copper industry chain of Tongling City as a case,” *Economic Geography*, vol. 37, no. 3, pp. 113–120, 2017.
- [56] H. Z. Zhang, L. Lu, and Y. N. He, “Industry chain tourism: concept and cases,” *World Regional Studies*, vol. 29, no. 5, pp. 1006–1016, 2020.
- [57] S. J. Li and Q. Li, “Research on the growth mechanism of e-commerce platform enterprises from the perspective of

- industry chain integration,” *China Business And Market*, vol. 33, no. 9, pp. 83–92, 2019.
- [58] Q. L. Qian, Y. B. Chen, S. X. Liu, J. X. Zhang, and Z. X. Chen, “Development characteristics and formation mechanism of taobao town: taking xintang town in guangzhou as an example,” *Scientia Geographica Sinica*, vol. 37, no. 7, pp. 1040–1048, 2017.
- [59] M. Porter, *Competitive Advantage*, Free Press, New York, NY, USA, 1985.
- [60] D. D. Bai and Z. W. Sun, “The spatial organization and geographic embeddedness of Taobao Village in China,” *World Regional Studies*, vol. 28, no. 1, pp. 121–129, 2019.
- [61] Y. Qin, “Function orientation and transformation and upgrading of the traditional industries in the xiong’an new area,” *Reforma*, vol. 1, pp. 77–86, 2019.
- [62] Z. P. Xiao, J. X. Wang, and Y. H. Sun, “The geographical impact of e-retailing and supply chain reconfiguration,” *Economic Geography*, vol. 35, no. 12, pp. 98–104, 2015.
- [63] X. F. Fan and X. Q. Kang, “Agglomeration level measurement of manufacturing in Shaanxi Province and its influencing factors empirical analysis,” *Economic Geography*, vol. 33, no. 9, pp. 115–119, 2013.
- [64] F. J. Jin, C. J. Wang, and X. W. Li, “Discrimination method and its application analysis of regional transport Superiority,” *Acta Geographica Sinica*, vol. 63, no. 8, pp. 787–798, 2008.
- [65] X. G. Cui, C. L. Fang, and Q. Zhang, “Spatial relationship between high-speed transport superiority degree and land-use efficiency in Shandong Peninsula urban agglomeration,” *Acta Geographica Sinica*, vol. 76, no. 6, pp. 1149–1161, 2018.
- [66] G. Y. Chang, “Social and geographical embeddedness of SMEs in Lanzhou,” *Urban Development Studies*, vol. 18, no. 1, pp. 114–119, 2011.
- [67] K. R. Sheng, L. P. Wang, and W. Sun, “Patterns and determinants of functional division of cities across product value chain in China,” *Geographical Research*, vol. 39, no. 12, pp. 2763–2778, 2020.
- [68] Z. Yang, X. Wang, and Z. D. Luo, “The spatial pattern of the Yangtze River Delta Region based on the B2B e-commerce enterprise network,” *Urban Planning Forum*, vol. 4, pp. 37–42, 2020.
- [69] Y. L. Rao and Z. D. Luo, “Digital transformation and deep diffusion: the evolution of industrial space in the Yangtze River Delta Region based on B2B E-commerce enterprises,” *Urban Planning Forum*, vol. 3, pp. 82–89, 2021.
- [70] Z. Y. Song and T. Xiao, “Dose spatial distance factor still matter in online shopping behavior: a study of undergraduates’online shopping in Guangzhou,” *Economic Geography*, vol. 40, no. 8, pp. 18–26, 2020.
- [71] J. Peng and J. He, “Spatial differentiation and influencing factors of fan economy in China: taking TikTok livestreaming commerce host as an example,” *Progress in Geography*, vol. 40, no. 7, pp. 1098–1112, 2021.