WORKING PAPER SERIES

Ruixue Li

# The Mechanism of Formation of Logistics Clusters

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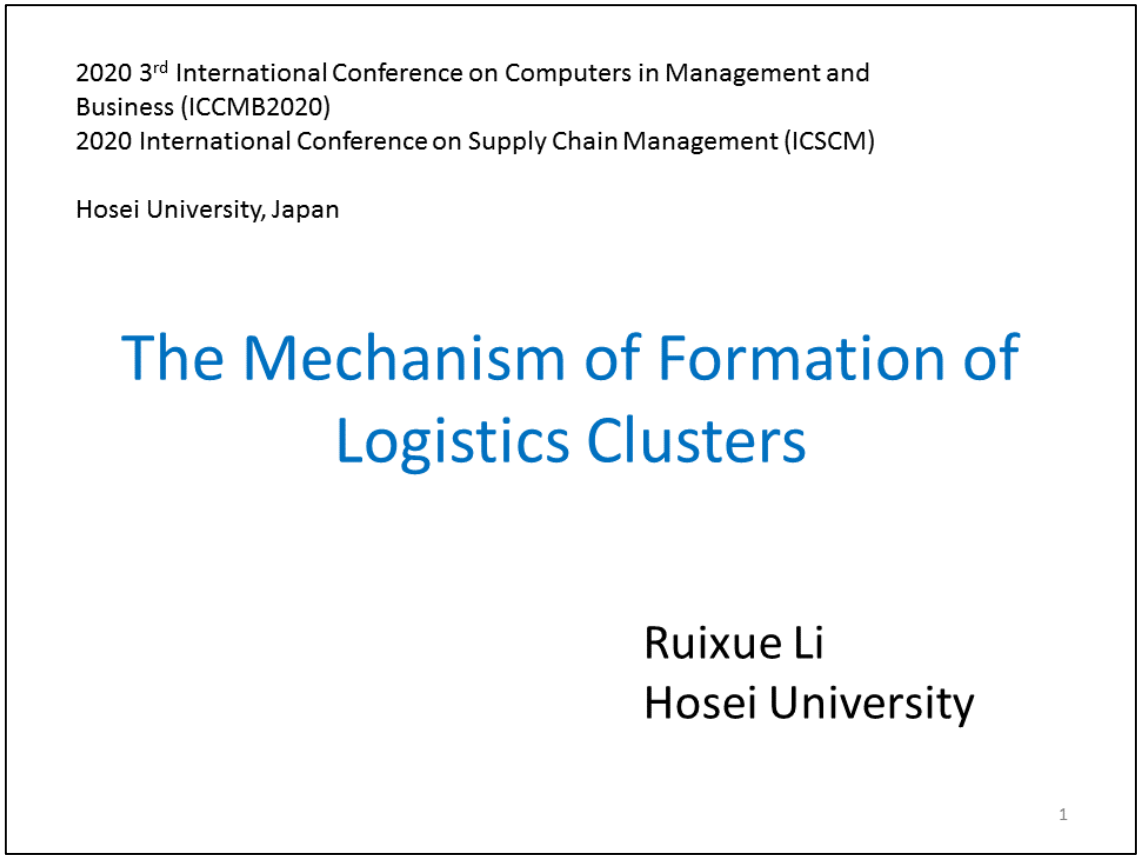
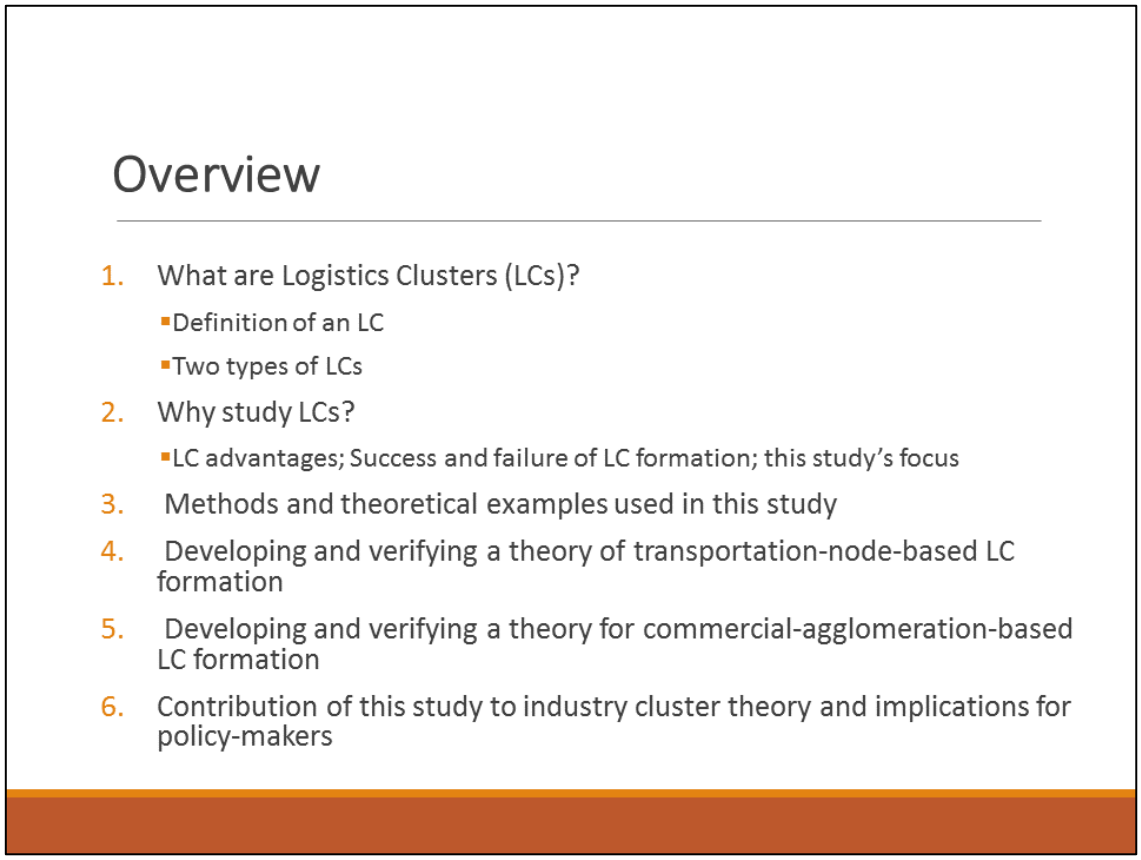
# The Mechanism of Formation of Logistics Clusters

Ruixue Li

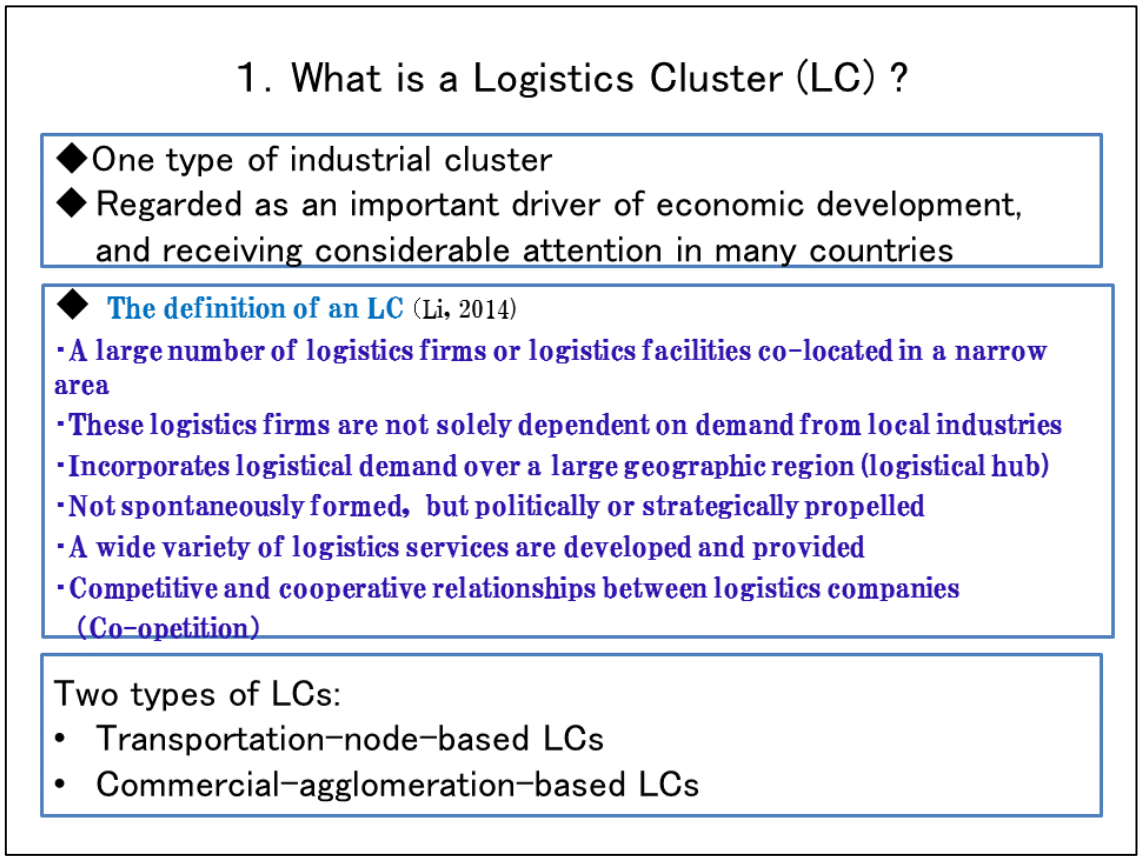



Good morning, everyone. My name is Ruixue Li. I work here at Hosei University, and I would like to welcome you. Hosei University is located almost in the center of Tokyo, in a district named Fujimi, which means 'see Mt. Fuji.' Actually, if the weather is clear, you can see Mt. Fuji from a high building. At break time, you can go to the Boissonade Tower, which is the highest building on our campus, about 50 meters north of here, to have a look at Mt. Fuji, weather permitting. By the way, I also recommend that you obtain a night view of Tokyo from there.

I appreciate the opportunity to share the findings of my recent study, and I am honored to be a keynote speaker. My presentation topic is the mechanism of formation of logistics clusters (LCs).




This is an overview of my presentation.
First, I will present the definition of LCs used in my study, and the main types of LCs.
Second, I will explain why I decided to study LCs, present a brief review of previous studies, and talk about the research question and this study's focus.
After explaining the main methodology I selected for this study, I will talk about what I have discovered regarding the formation mechanisms of LCs.
Finally, I will outline this study's contribution to industry cluster theory, and implications for policy-makers in relation to LC issues.




I believe that you are all aware of the concept of industry clusters. Since the late 19th century, numerous academics and policy-makers including some prominent economists, such as Marshall (1880), Isard and Vietorisz (1955), Isard and Schooler (1959), Piore and Sable (1984), Krugman (1991), and Porter (1998), have examined various issues relating to industry clusters.

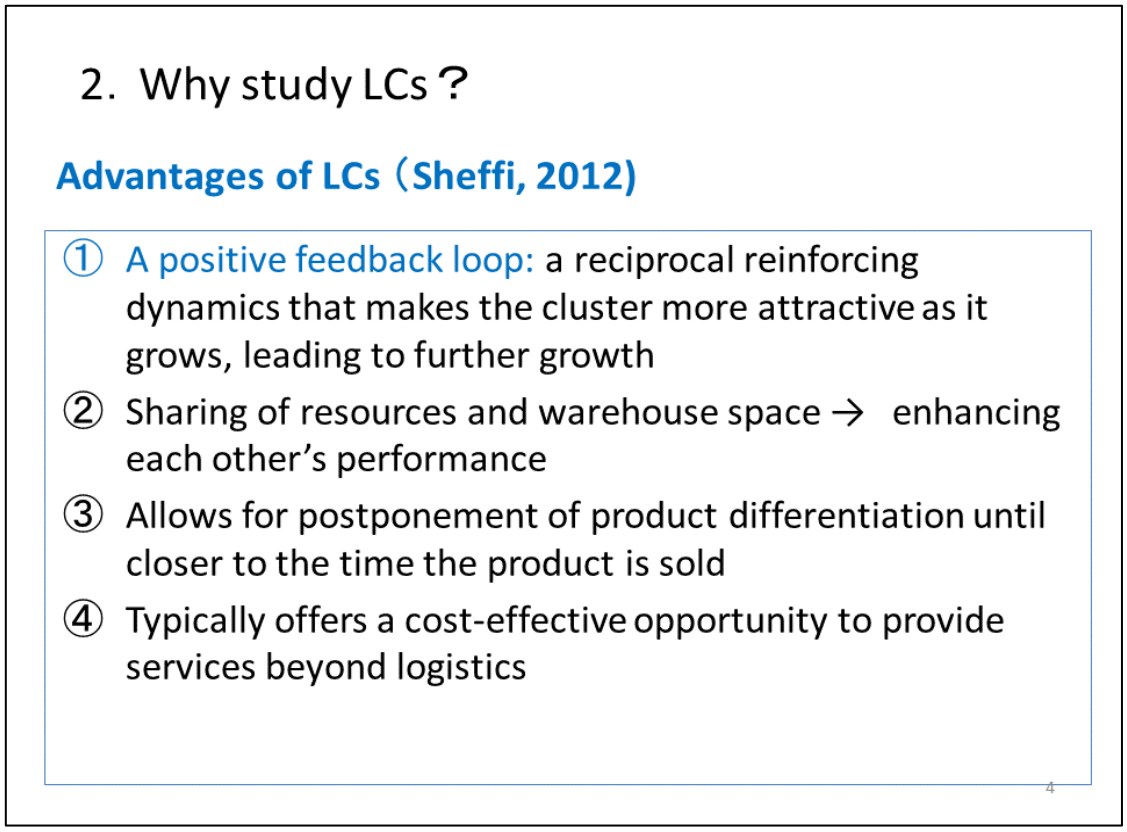
However, even though various kinds of industry clusters have been mentioned in previous studies, most studies have focused on clusters in the manufacturing, information technology, R&D, and distribution industries.

In recent years, the spotlight has focused on LCs because in many countries, LCs are regarded as important drivers of economic growth. Increasing numbers of people are thinking that logistics could be a key industry, instead of merely providing support for other industries. Additionally, many LCs did not form spontaneously, but rather were intentionally created by governments or private organizations.

Therefore, in this study, I provide a definition of LCs that includes the following features:

- Many logistics firms or logistics facilities are co-located in a narrow area, which becomes a logistical hub.
- These logistics firms do not rely solely on logistical demand from local industries.
- Logistical demand over a large geographic scale is incorporated within the logistical hub.
- These LCs did not form spontaneously, but were either politically or strategically propelled or created.
- A wide variety of logistics services are developed and provided in LCs.
- In LCs, a relationship of co-opetition (i.e. competition and cooperation) is created among logistics companies.

With this definition in mind, I categorized LCs into two types based on their place of origin: transportation-node-based LCs, and commercial-agglomeration-based LCs.




As I mentioned earlier, most previous studies on industry clusters have failed to pay attention to LCs. In one of the few previous studies on LCs, Professor Sheffi noted the various economic advantages provided by LCs.

First, LCs can provide a positive feedback loop. This means that as an LC grows, better service can be provided to shippers at lower cost, enabling the LC to attract even more shippers. This results in the LC growing even more, making the shippers' operations even more efficient. In this way, a reciprocal reinforcing dynamics makes the LC more attractive as it grows, leading to further growth.

Second, because many logistics assets are interchangeable, companies in LCs can share resources such as transportation facilities and warehouse space, enhancing their performance and efficiency.

Third, LCs enable product differentiation to be postponed until closer to the time when the products are sold. For instance, some value-adding activities such as product-kitting, retail display preparation, end-stage customization, and coping with regulatory edicts can be performed in LCs.

Fourthly, LCs typically provide a cost-effective opportunity to handle operations beyond logistics, such as product returns, repair, refurbishment, and fulfillment of prescriptions. In this way, LCs provide fertile ground for the formation of new logistics-dependent businesses.

## 2. Why study LCs？

**Numerous LCs have been generated in various countries**

- LC formation projects have been launched in various cities and regions to leverage the advantages of LCs
  - e.g., Zaragoza, Memphis, Busan, and Naha
- Development of a global supply chain requires LCs
  - nodes and connectors in the global supply chain (Li & Liu, 2006)
- Various strategies for creating LCs are used by these countries' governments, for instance, building or enhancing logistics nodes such as airports, ports, and logistics parks, deregulation, and preferential policies
  - more than 1,000 logistics parks have been generated in mainland China (CLPF, 2019)

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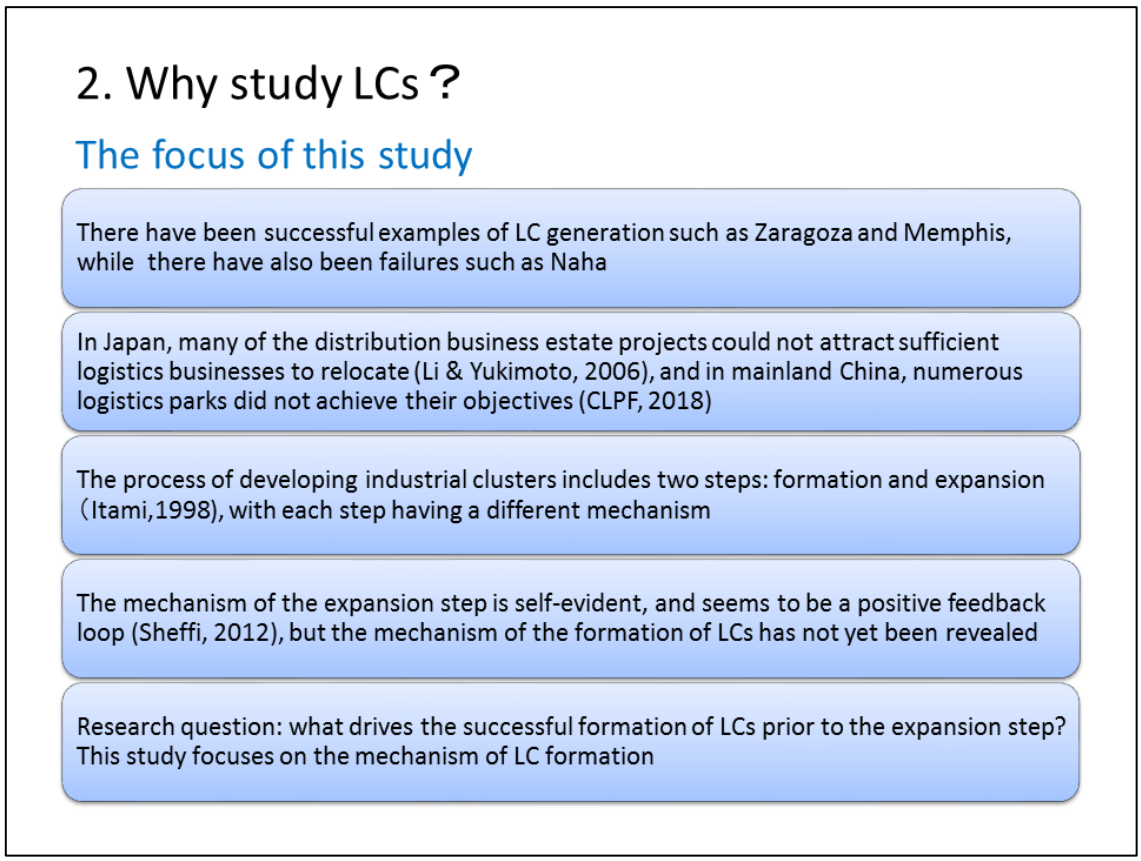
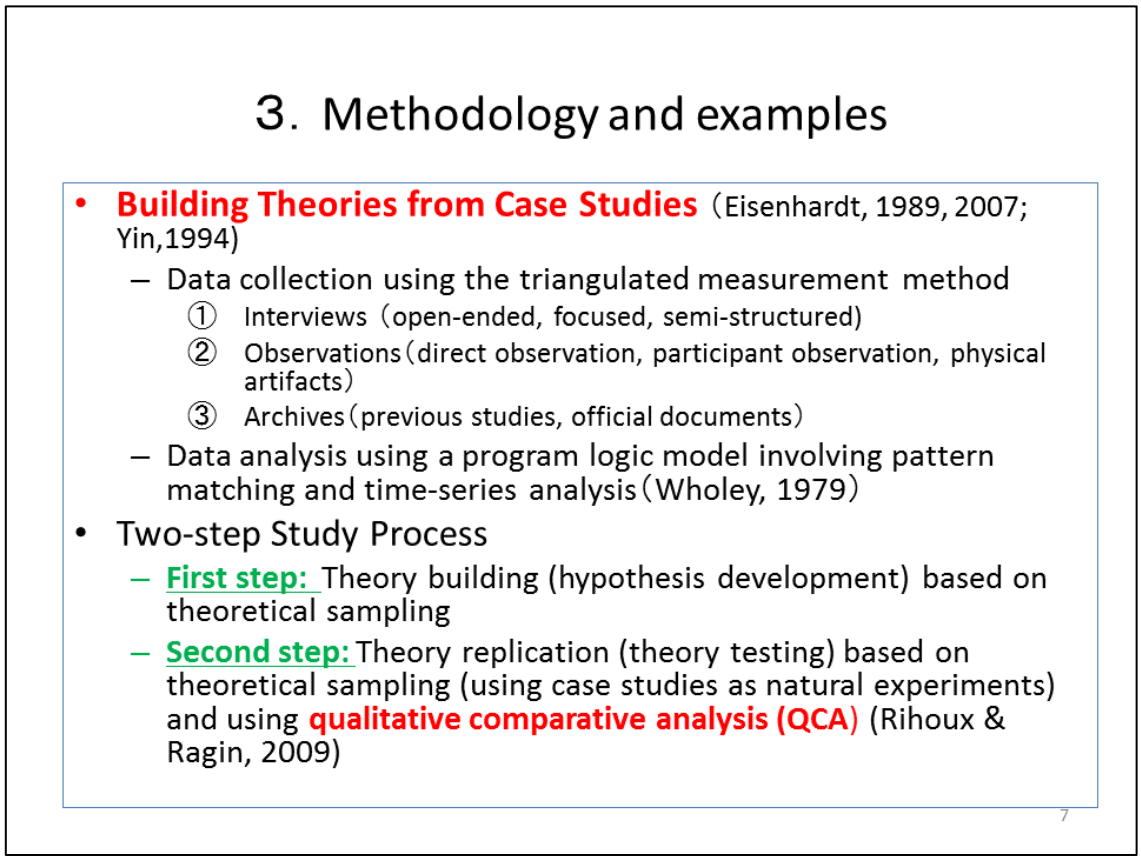
Numerous regions in various countries have launched LC projects over the last couple of decades in an attempt to leverage the economic advantages provided by LCs.
Zaragoza in Spain, Memphis in the US, Busan in Korea, and Naha in Japan are just some examples.
These LCs are playing crucial roles in the global supply chain.
Various governments have used similar strategies to establish LCs, including building or enhancing logistics nodes such as airports, ports, and logistics parks, deregulation, and preferential policies.
China Logistics and Procurement Federal (CLPF) has reported that more than 1,000 logistics parks have been created in mainland China.




Of the numerous LC projects, while some have succeeded, such as those in Zaragoza and Memphis, others have failed to achieve their objectives. While Sheffi identified a positive feedback loop in relation to LCs, this positive feedback loop does not occur from the beginning of the LC, and many LC projects have failed to reach the stage where the positive feedback loop has started to operate.

The process of LC development includes two steps: formation and expansion. The positive feedback loop is the mechanism underlying the expansion step, but the mechanism underlying the formation step is yet to be discovered. Thus, my study is focused on this issue.

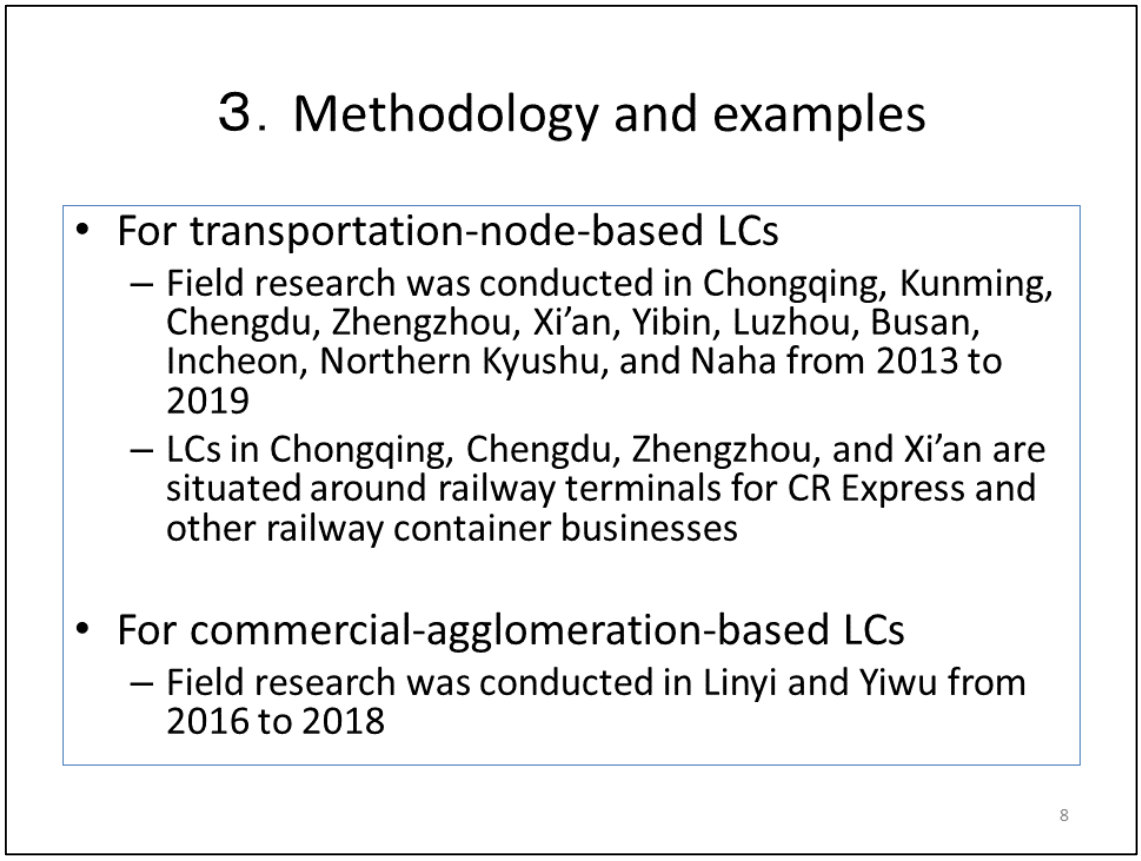



I employed two methods in conducting this study. One involved developing a theory based on case studies, as advocated by scholars such as Robert Yin and Elsenhardt, while the other involved the qualitative comparative analysis (QCA) approach developed by Rihoux and Ragin.

These two methods are both suitable for small and medium-sized samples. The quantitative analysis method was not chosen for this study because it is difficult to obtain a large sample of LCs.

The procedure of developing a theory based on a case study includes two steps. The first step is to propose a theory or hypothesis, while the second step is to test the hypothesis or perform theory replication. In this process, selection of theoretical samples, analyzing data from specific cases, and searching for cross-case patterns are crucial. Each case study is treated as a natural experiment.

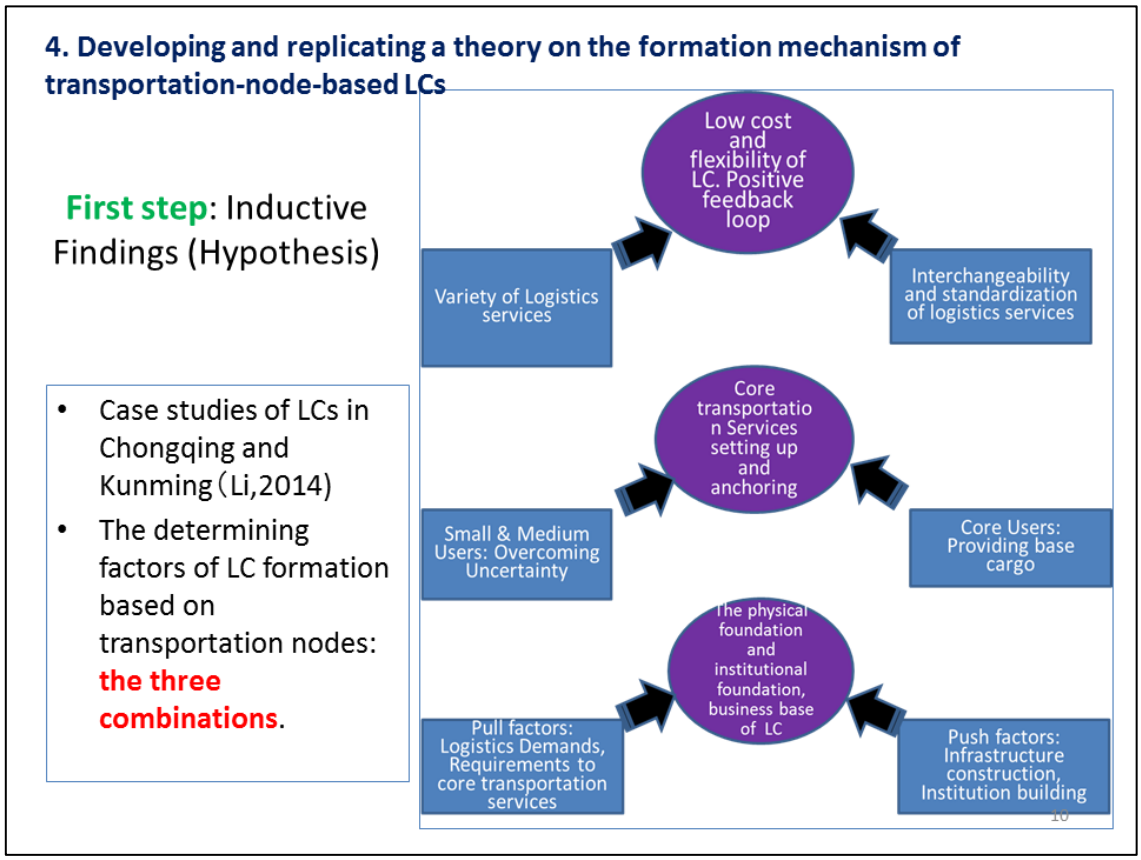
After developing a theory based on a case study, I am using the QCA method to test my theory. This QCA is not yet complete, and so I will not refer to it in today's presentation.




To obtain data for analysis, I conducted a series of field studies of LCs in 13 cities in three countries in East Asia from 2013 to 2019. Of these 13 LCs, 11 were transportation-node-based LCs, and two were commercial-agglomeration-based LCs.

Among the transportation-node-based LCs, Chongqing, Chengdu, Zhengzhou, and Xi'an shared the same type of transport node, namely, a railway container terminal. China Railway Express (CR Express), which connects China and Europe, departs from and arrives at these terminals. I will mention CR Express again later.


The 13 cities where I conducted field research are indicated by the red dots on the map.




Next, I would like to talk about developing and replicating a theory on the formation mechanism for transportation-node-based LCs. I will omit the details of the field studies, and instead focus on the inductive findings from case studies of the Chongqing and Kunming LCs.

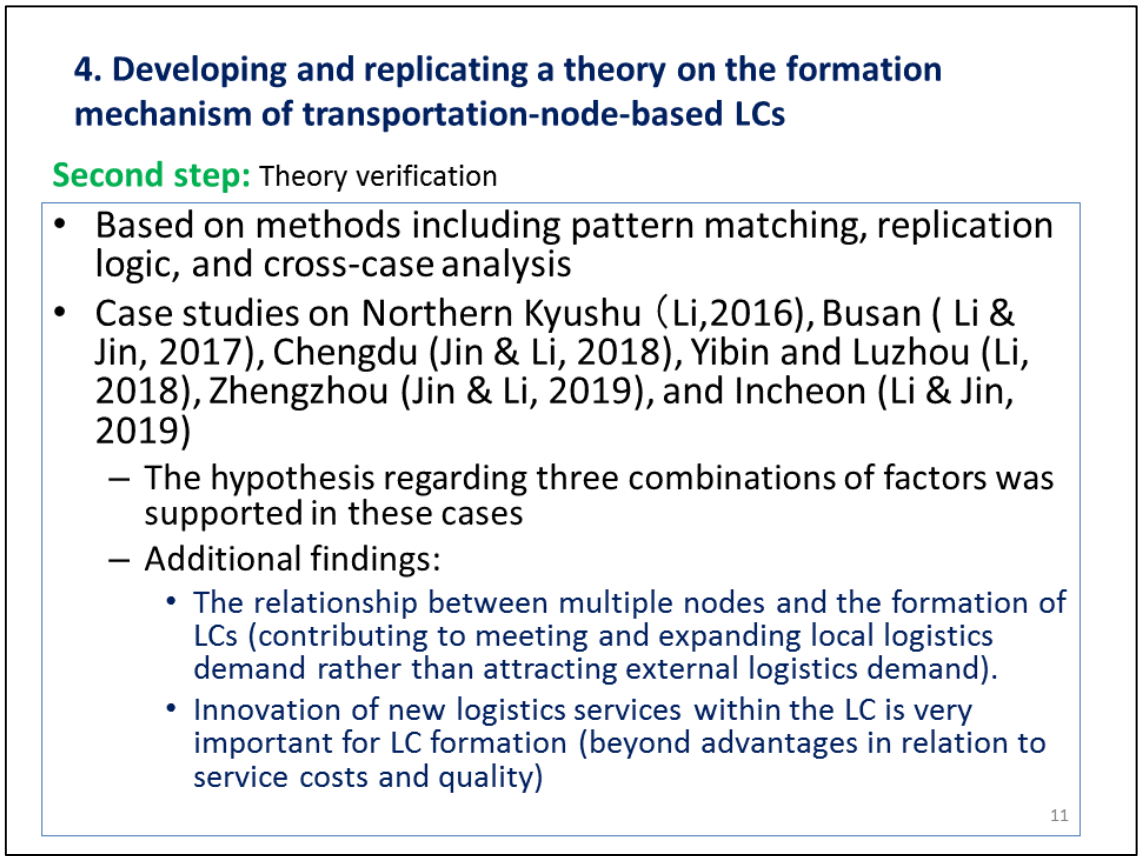
After analyzing the data from these LCs, I found that three combinations of factors determined LC formation.

The first combination consisted of pull factors from local industries and push factors from local governments. That is, strong logistical demand and detailed requirements from local industries were combined with infrastructure construction and institution development by governments. This combination meant that the fundamental requirements for LCs, especially core transportation services, such as CR Express mentioned earlier, were established and became a critical business base in the LCs.

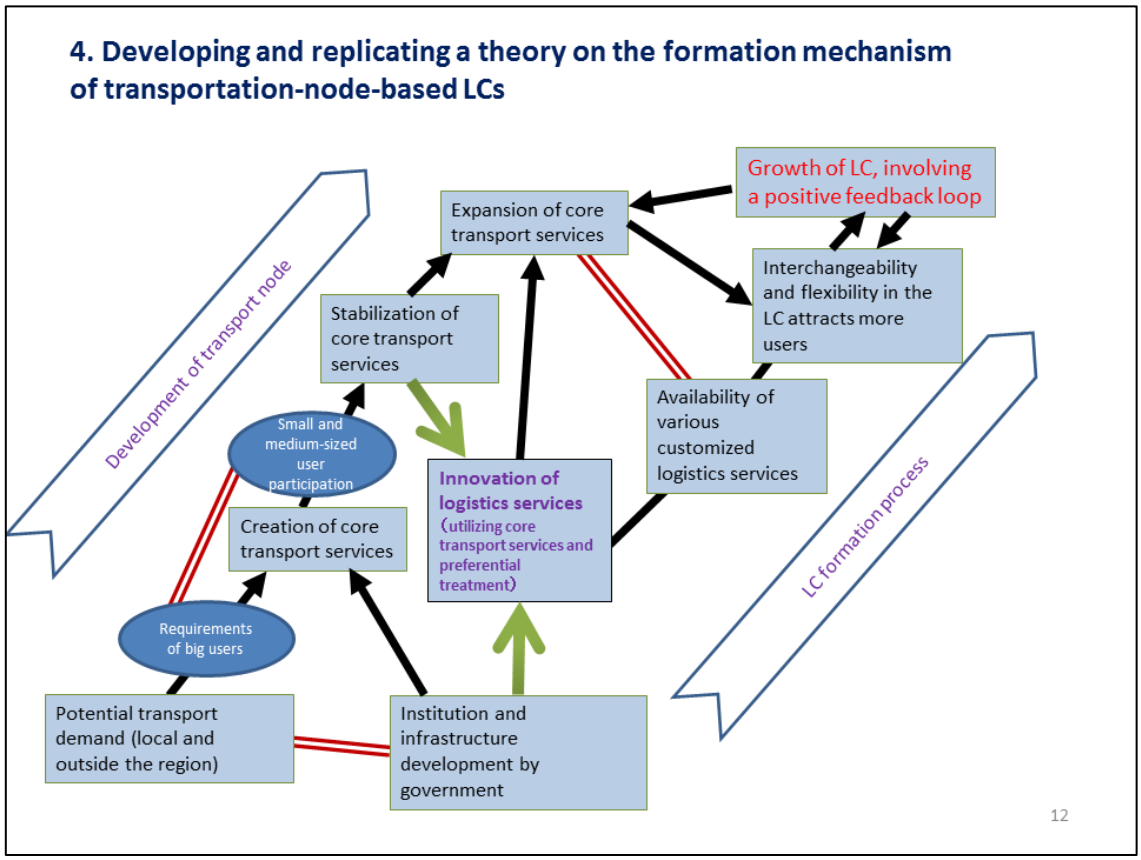
The second combination consisted of big users and small and medium-sized users. Big users, such as big shippers and big forwarders, provide the base cargo for core transportation services, while numerous small and medium-sized users can contribute to reducing demand uncertainty. This combination enables core transportation services such as CR Express to become stable and reliable.

The third combination involves a variety of interchangeable logistics services. Some logistics services are standardized, while others are customized. A combination of these two types of services enables logistics companies to respond to various requirements flexibly and efficiently. Eventually, a positive feedback loop starts to operate, signaling that an LC has formed.

This three-combination framework, which was inductively derived from case studies of LCs in Chongqing and Kunming, can be regarded as a hypothesis on the formation mechanism for transportation-node-based LCs.



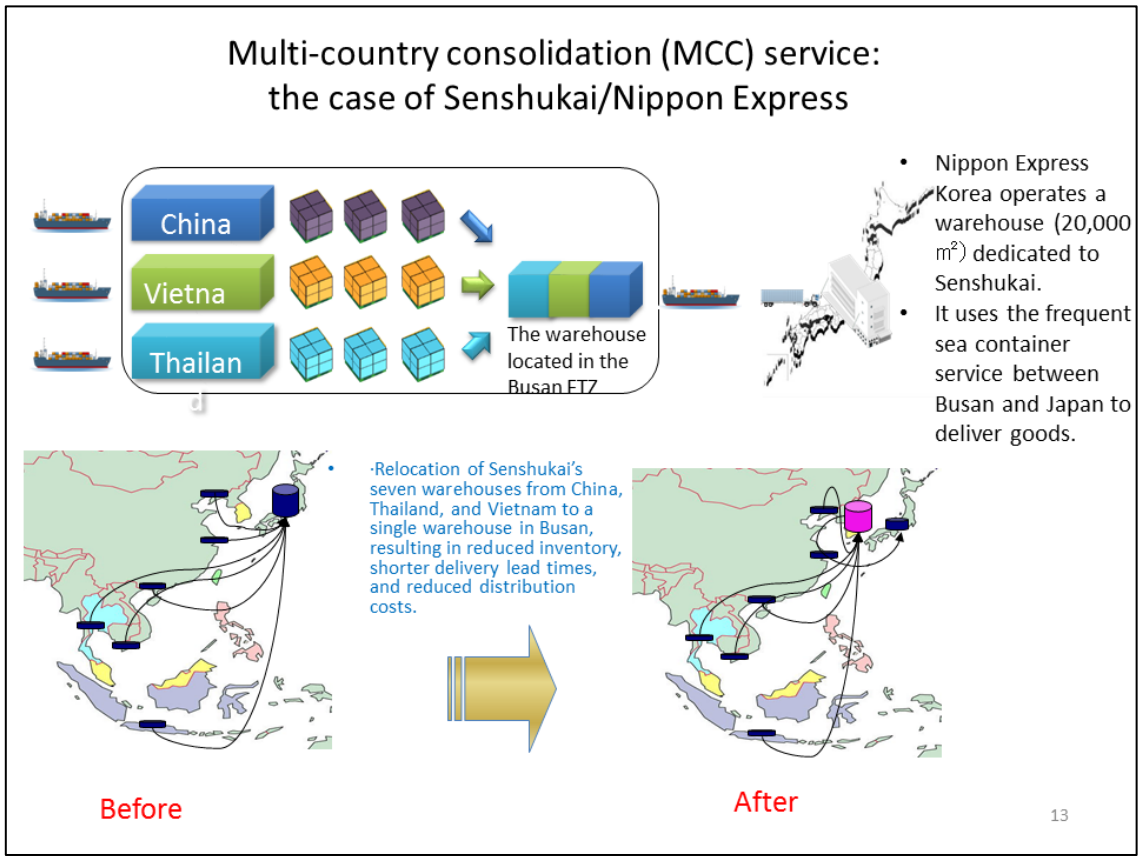

For the second step, I used case studies of Northern Kyushu, Busan, Chengdu, Yibin, Luzhou, Zhengzhou, and Incheon to test and revise the three-combination framework hypothesis. Pattern matching, replication logic, and cross-case analysis were applied during the testing process.




The results of these case studies provided support for the three-combination framework hypothesis. The first combination includes infrastructure development by governments and transport demand from local industries. This combination leads to the establishment of core transport services. The second combination includes big users and small and medium-sized users. This combination allows the core transport services to become stable and reliable. The third combination includes core transport services, which are standard services, and various customized logistics services. This combination results in interchangeability and flexibility of logistics services in LCs, and results in more and more users joining the LCs.

In addition, I found that innovation in relation to logistics services is a very important factor in the LC formation process. Logistics companies are able to develop new logistics services by taking advantage of stable core transport services.

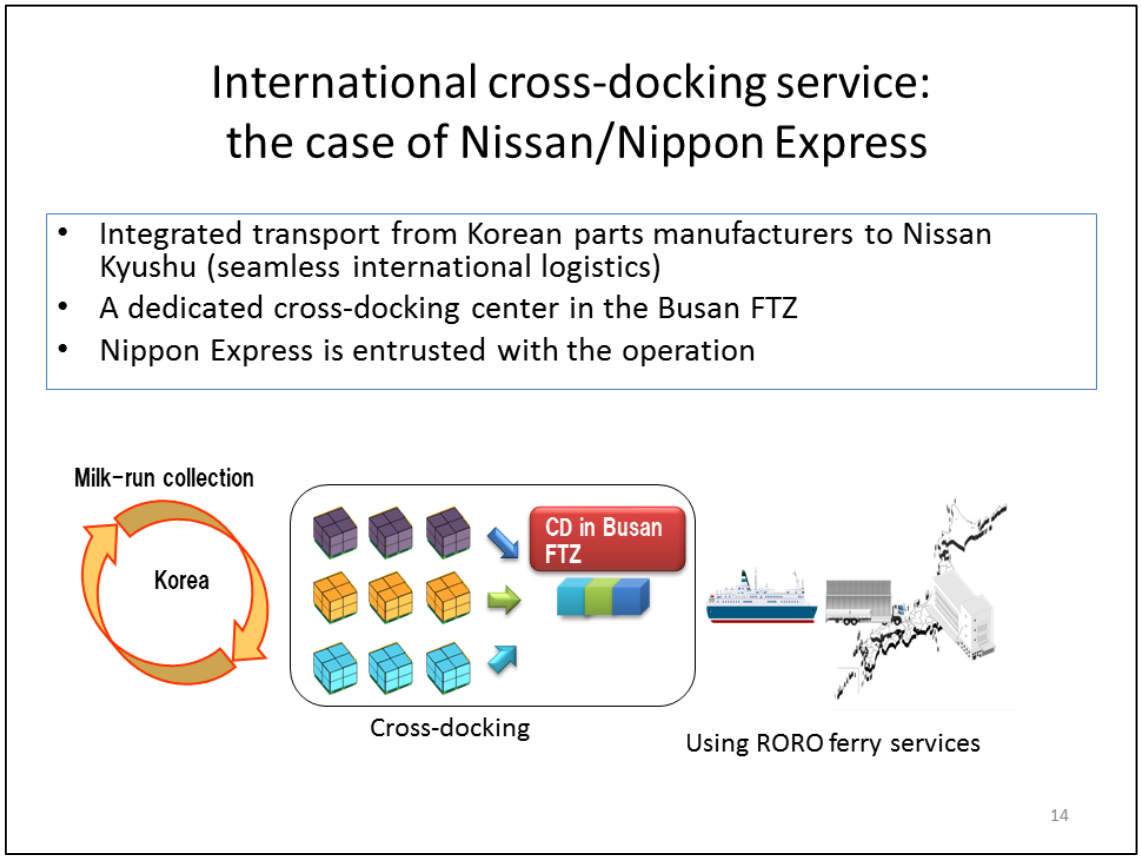
It is innovation in terms of logistics services that links the transport node development process and the LC formation process.




Let me present some examples of logistics service innovation in the Busan LC.

The logistics company Nippon Express Korea designed a supply chain solution for Senshukai, a big catalog marketing company in Japan. Senshukai sources goods from several Asian countries, and previously held inventory in seven warehouses located in China, Thailand, and Vietnam, transporting goods from these warehouses to Japan as required. However, inefficient supply chain operations meant that Senshukai incurred high logistics costs.

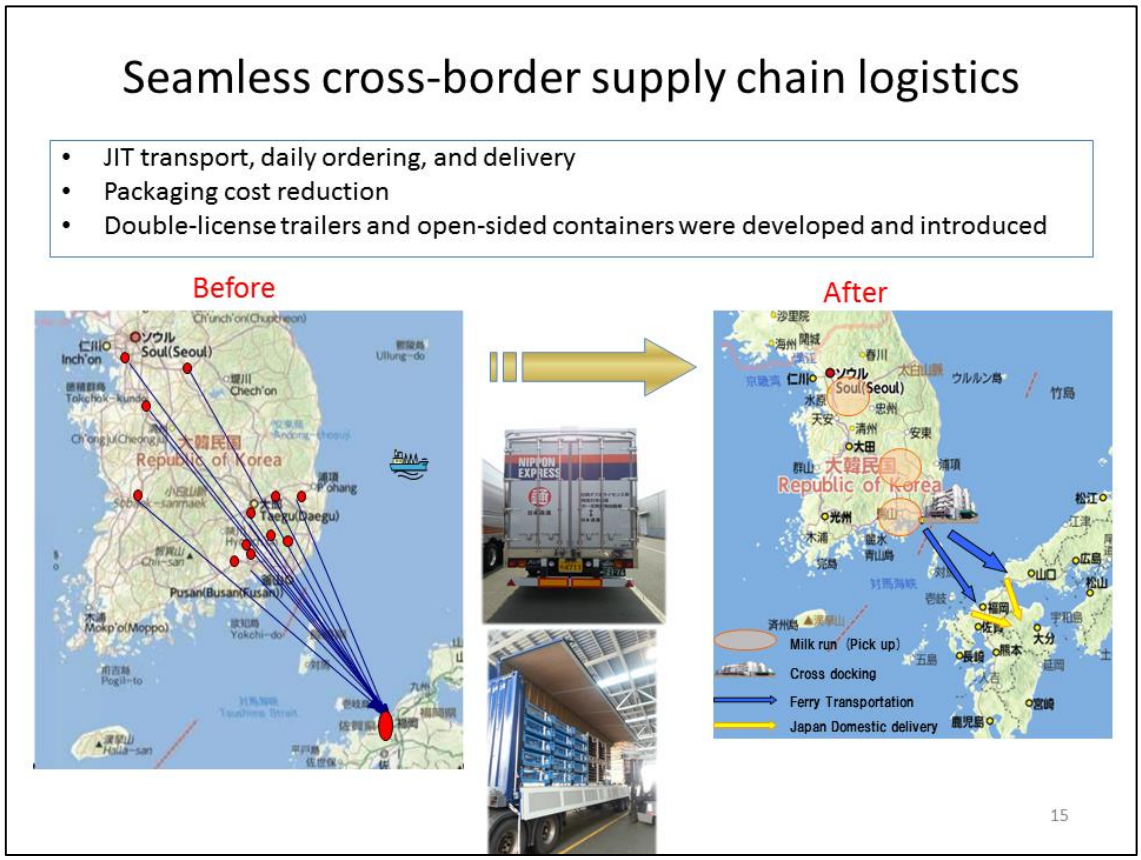
After being approached by Senshukai, Nippon Express suggested that they establish a global distribution center in Busan to replace the seven existing warehouses. This solution enabled inventory reduction, shorter delivery lead times, and lower warehousing and transportation costs by taking advantage of frequent and cheap sea container services between Busan and Japan, cheap land rental costs in the Busan Free Trade Zone (FTZ), and various preferential treatments from the Korean government.




Another example involves international cross-docking services.

The giant automobile manufacturer Nissan sources a lot of parts from Korean companies, and most of these parts are supplied to its Kyushu plant.

Nippon Express set up a cross-docking center in the Busan FTZ after it was entrusted with Nissan's supply chain operations. This enabled Nippon Express to integrate transport from Korean parts suppliers to Nissan's Kyushu plant, providing seamless international logistics.




In the past, transportation was managed by each parts supplier, and it took a long time for every shipment to arrive. Now, parts are collected daily via a ‘milk run,’ gathered at the cross-docking center in the Busan FTZ, and then loaded onto a roll-on/roll-off (RORO) ferry operating between Busan and Kyushu.

Both examples involve developing special logistics solutions for specific customers by taking advantage of the LC’s business base, which consists of core transport services and preferential policies.

Service development contributes to the growth of core transport services, while extending the diversity and flexibility of the logistics services in the LC. This in turn attracts more shippers and logistics companies to the LC.

**4. Developing and replicating a theory on the formation mechanism of transportation-node-based LCs**

Cross-case analysis of LC formation and CR Express

| | | Chongqing | Chengdu | Zhengzhou | Xi'an | Yiwu |
|---|---|---|---|---|---|---|
| ① A large number of logistics firms or logistics facilities co-located in a narrow area | | ○ | ○ | △ | △ | ◎ |
| ② These logistics firms are not solely dependent on demand from local industries | | ○ | ○ | ○ | ○ | × |
| ③ Incorporate logistical demand over a large geographic region (logistical hub) | | ○ | ○ | ◎ | ◎ | × |
| ④ Not spontaneously created, but politically or strategically propelled | | ○ | ○ | ○ | ○ | ○ |
| ⑤ A wide variety of logistics services are developed and provided | | △ | △ | × | × | × |
| ⑥ Competitive and cooperative relationships develop between logistics companies in the LC (co-opetition) | | △ | △ | × | × | △ |
| | CJ | ○ | ○ | △ | △ | × |

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I also conducted a cross-case analysis of five areas in China, all of which have CR Express terminals and aim to create a LC around these terminals. First, I assessed each area in terms of whether they exhibited the features mentioned earlier. Based on this assessment, Chongqing and Chengdu have generated a rough LC around their CR Express terminals, while Zhengzhou and Xi'an are in the early stages and Yiwu has not yet commenced the development of an LC. However, in this analysis, the examination of Yiwu only included a narrow area around the railway freight terminal, and did not include the entire Yiwu commercial agglomeration, which I will discuss later.


This is a photo of a CR Express train, and a route map for the CR Express railway transport service.

**4. Developing and replicating a theory on the formation mechanism of transportation-node-based LCs**

**Cross-case analysis of LC formation and CR Express**

| | LC formation | Combination 1 | Combination 2 | Combination 3 | Service innovation |
|---|---|---|---|---|---|
| CR Express Node (Chongqing) | ○ | ○ | ◎ | ○ | △ |
| CR Express Node (Chengdu) | ○ | ○ | ◎ | ○ | △ |
| CR Express Node (Zhengzhou) | △ | △ | ○ | △ | △ |
| CR Express Node (Xi' an) | △ | △ | ○ | △ | △ |
| CR Express Node (Yiwu) | × | ○ | × | △ | △ |

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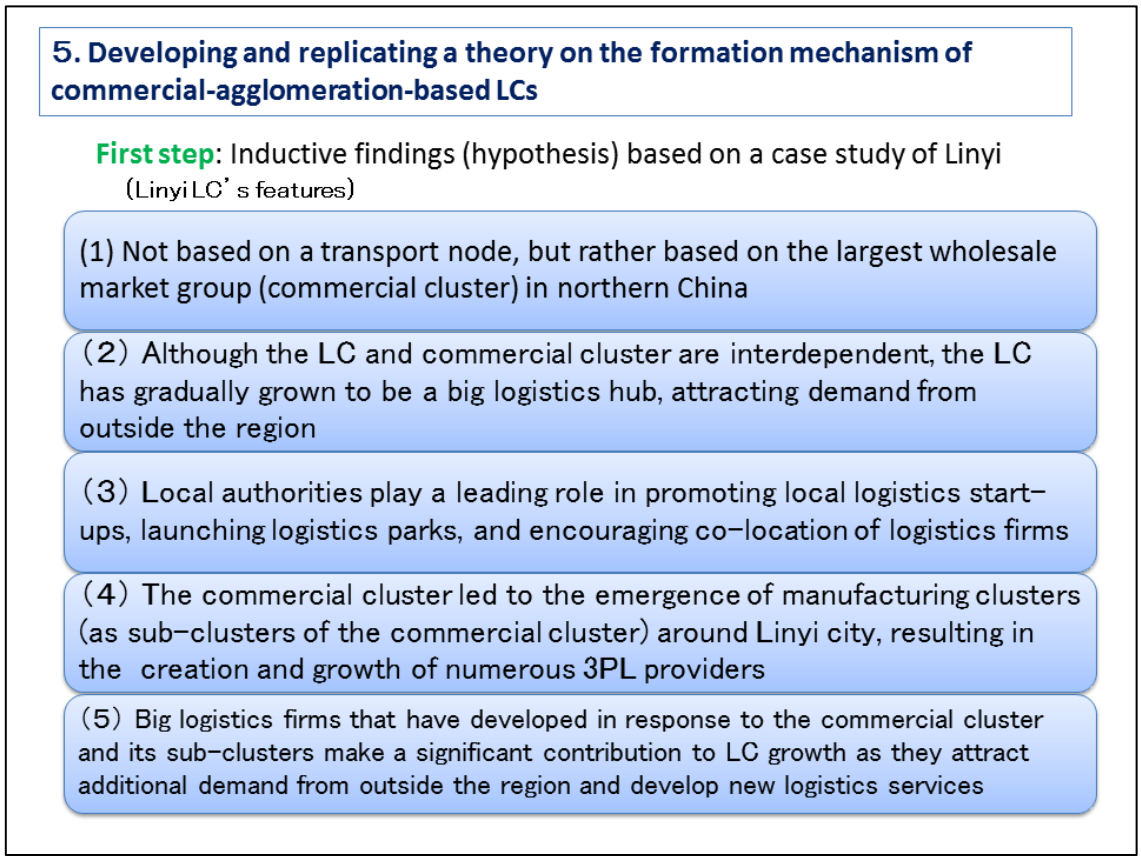
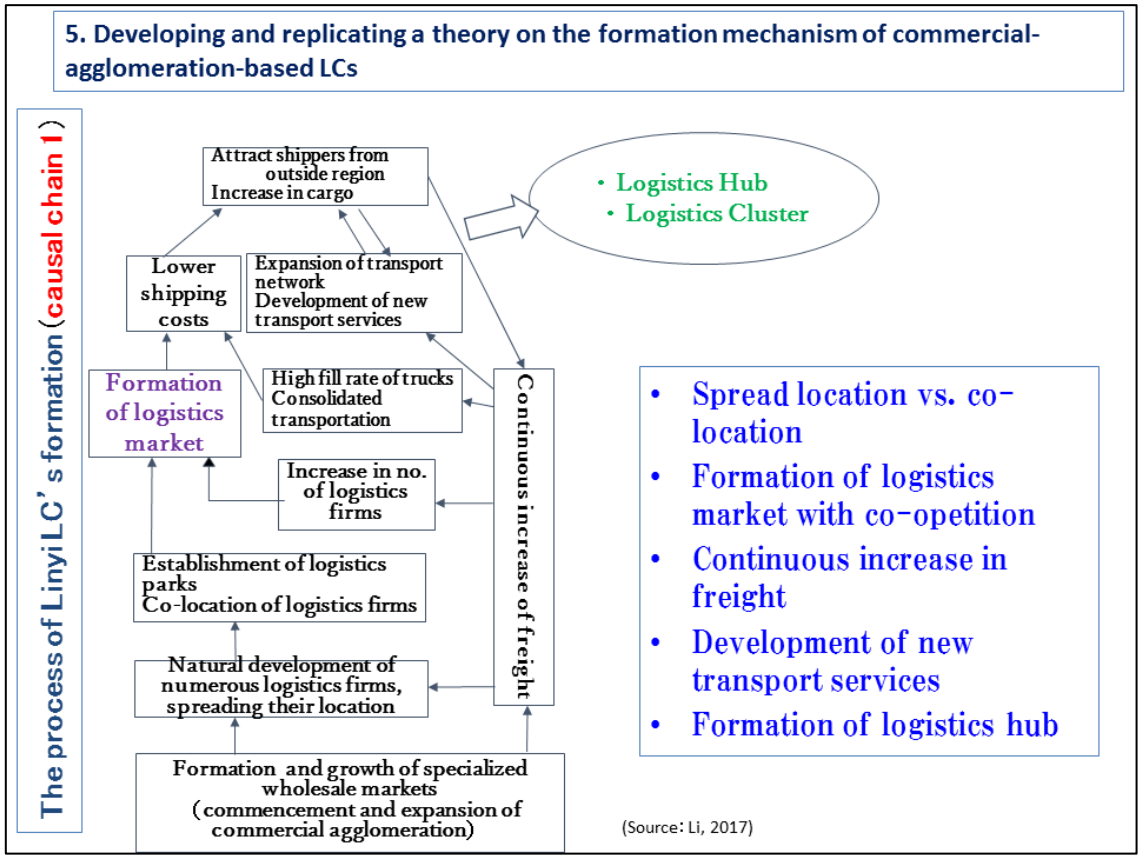
Next, I investigated whether the three combinations of factors and service innovation existed in each area. As can be seen in the table, the three combinations of factors were much more evident in Chongqing and Chengdu than in the other areas. Thus, the relationship between LC formation and the three combinations of factors can be confirmed in these areas. Meanwhile, many third-party logistics (3PL) companies have developed new services, such as supply chain services for vehicle parts or electronic components for global car manufacturers and electronics companies, by utilizing CR Express and the preferential treatment offered by governments. Even though these new services have not reached a large scale in these areas, they have certainly contributed to the expansion of CR Express and the flexibility of the LCs.



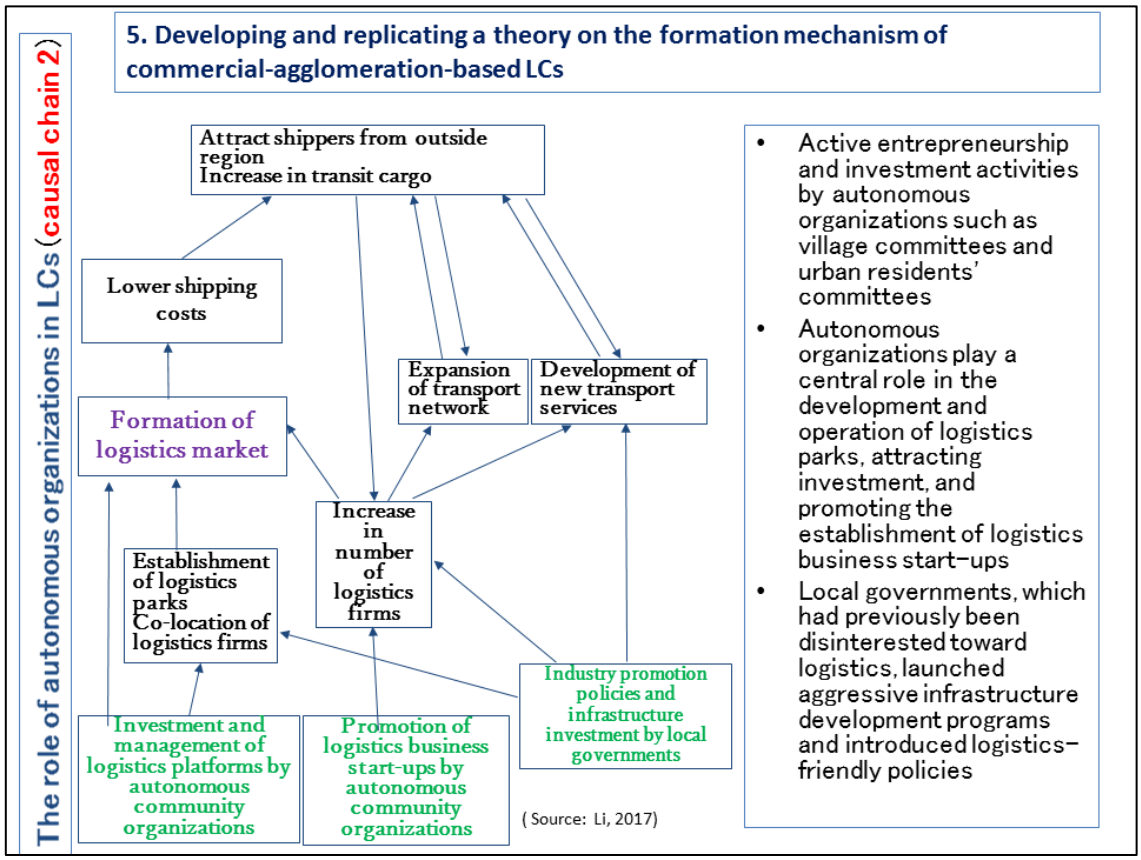

In addition to case studies on transportation-node-based LCs, I also undertook similar research on commercial-agglomeration-based LCs in an attempt to identify the formation mechanism for these types of LCs. I selected Linyi as an example of a commercial-agglomeration-based LC and conducted an in-depth case study to develop an inductive hypothesis.

In Linyi, there are more than 130 wholesale markets where around 60,000 types of goods are sold by about 50,000 dealers, and more than 300,000 people visit these markets each day. Because of these wholesale markets, Linyi is regarded as the largest traditional commercial cluster in northern China. A large-scale LC has developed in response to this commercial cluster, even though Linyi does not contain any significant transportation nodes.

Although Linyi's LC and commercial cluster are interdependent, the LC has gradually grown to become a significant logistics hub, attracting demand from outside the Linyi region.

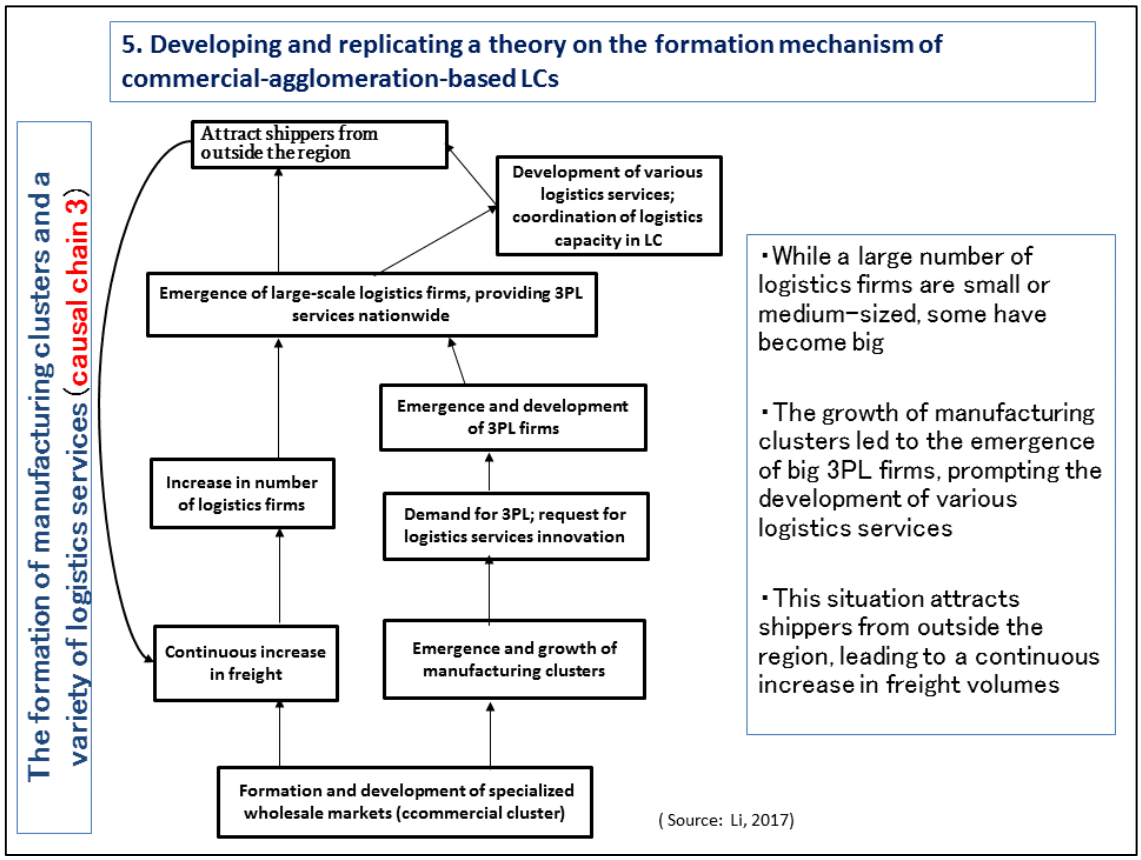



The case study on Linyi's LC identified three causal chains in the process of LC formation. The formation and growth of the wholesale markets meant that numerous logistics firms developed to accommodate the continuous increase in freight, but they spread their locations. After the establishment of logistics parks, various logistics firms and shipping agents began to gather in logistics parks in an effort to consolidate their location. Gradually, the logistics parks became logistics markets, with intense competition and flexible cooperation between logistics firms, which resulted in lower shipping costs. This attracted shippers from beyond the Linyi region, leading to a further increase in freight volumes and the expansion of the transport network. Eventually, Linyi became a logistics hub and an LC.

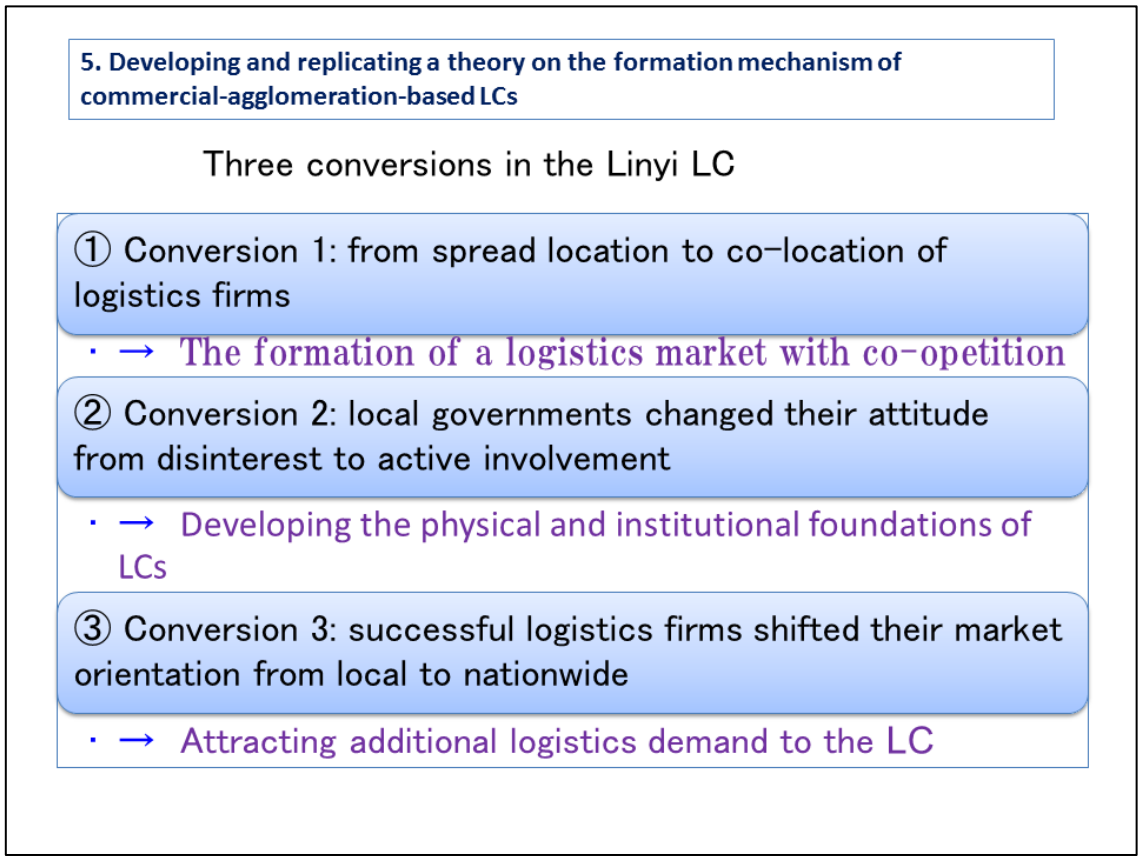



The second causal chain involves the role of autonomous organizations in LC formation. The logistics parks were built and run by autonomous organizations including village committees and urban residents committees. In addition, some autonomous organizations encouraged residents to develop logistics businesses. These efforts contributed to the formation of a logistics market and the expansion of the transport network.

Local governments, which used to pay little attention to the logistics industry, gradually engaged in infrastructure investment and introduced logistics-friendly policies, resulting in an increase in the number of logistics firms and the development of new transport services.




The third causal chain is related to the formation of manufacturing clusters and a variety of logistics services. The commercial cluster led to the growth of manufacturing clusters around Linyi, which in turn led to the emergence and development of 3PL firms, some of which became large in scale, developing various logistics services and providing 3PL services nationwide. These big 3PL companies attracted logistics demand from beyond the Linyi region to the Linyi LC, contributing to the continuous increase in freight volumes.

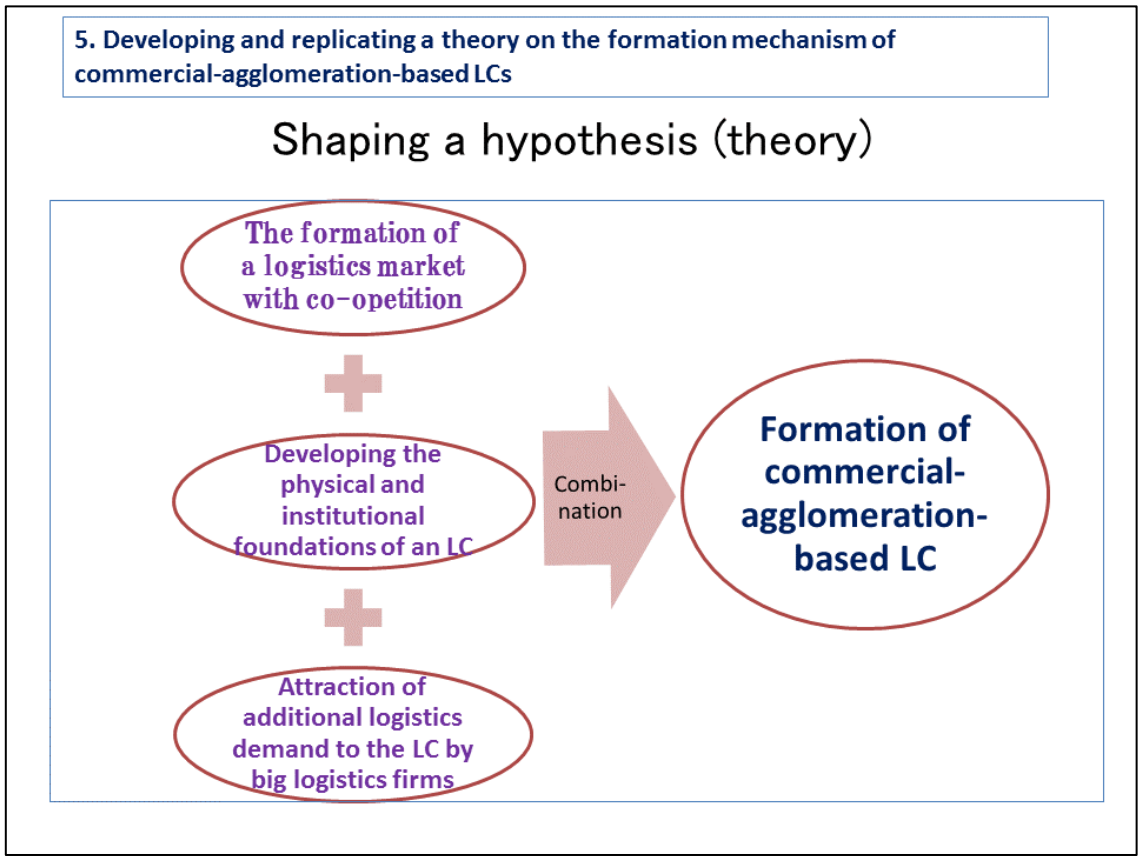



In summary, the case study of the Linyi LC identified three conversions in the process of LC formation.

The first was the conversion from a spread location to a consolidated location, resulting in the formation of a logistics market with co-opetition.

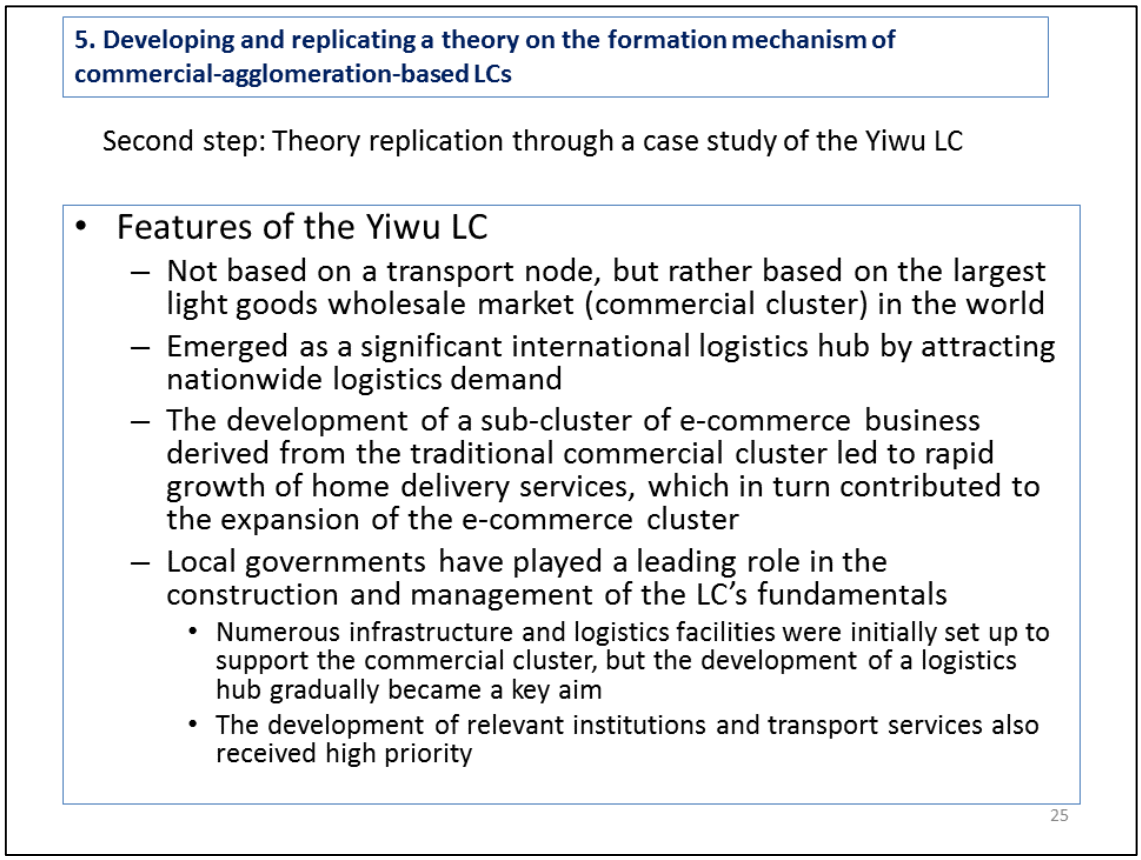
The second conversion was that local governments changed their attitude toward the logistics industry from disinterest to active involvement. This conversion had a positive effect on the development of the physical and institutional foundations of the LC.

The third conversion involved some of the local logistics firms shifting their market orientation from local to nationwide. This attracted logistics demand from other regions to the LC.




Thus, based on the case study of the Linyi LC, a hypothesis on the formation mechanism for commercial-agglomeration-based LCs can be proposed.

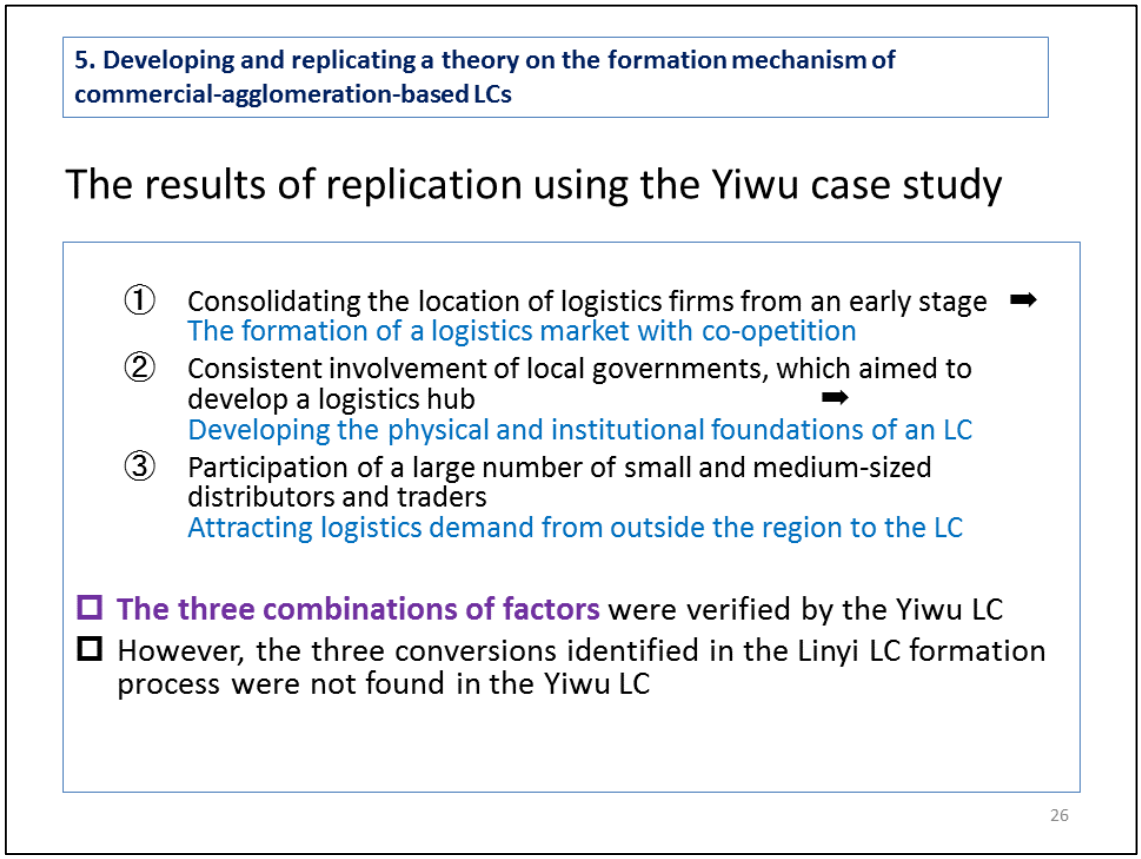
That is, the combination of the following three factors leads to the formation of commercial-agglomeration-based LCs: the formation of a logistics market with co-opetition, the development of the physical and institutional foundations of an LC, and the attraction of additional logistics demand to the LC by big logistics firms.




Next, I conducted a further case study to test the hypothesis.

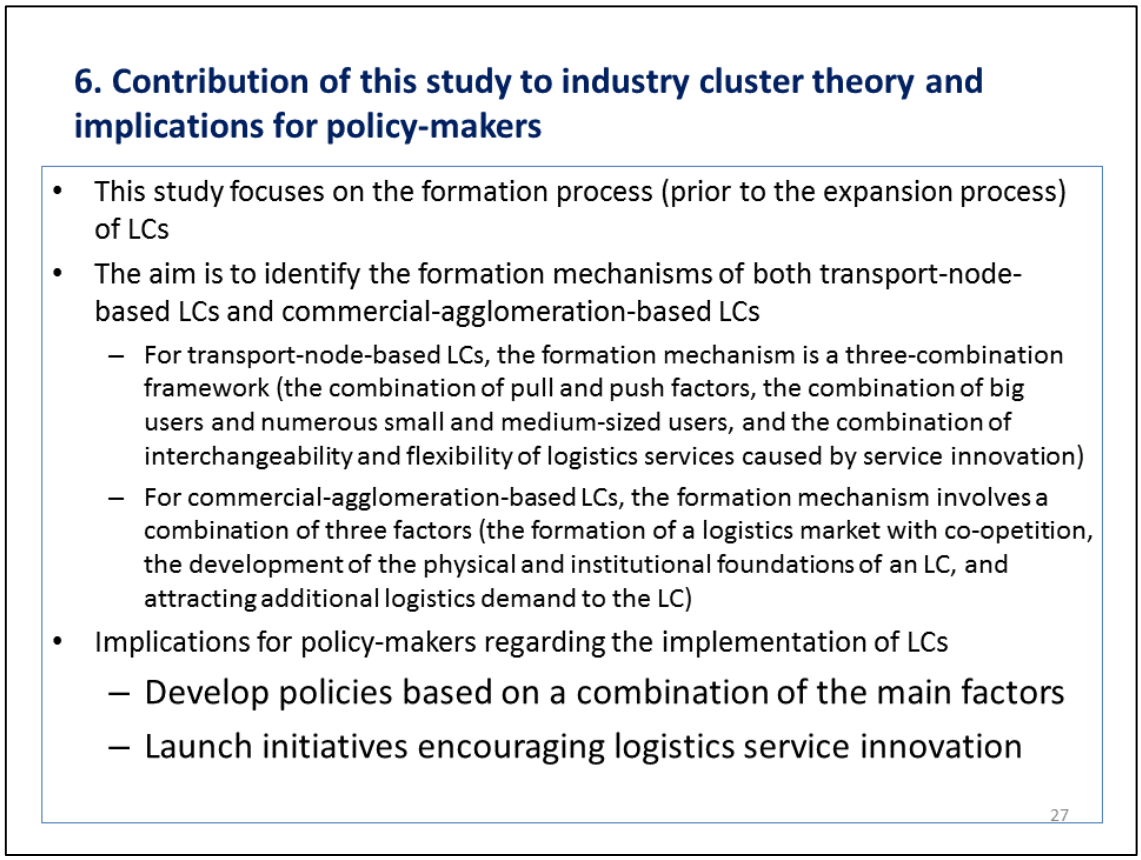
To enable theory replication, I selected the Yiwu LC because this region has a lot of similarities to the Linyi region:

- The Yiwu LC did not originate from any transport nodes, but from a commercial cluster, namely, the largest consumer goods wholesale market in the world
- Yiwu emerged as a significant international logistics hub by capturing nationwide logistics demand
- Sub-clusters of electronic commerce businesses derived from the traditional commercial cluster led to rapid growth in home delivery services
- Local governments have played a leading role in the construction and running of the LC's fundamental elements, including infrastructure and institutions. Numerous infrastructure and logistics facilities were initially established to support the commercial cluster, but the creation of a logistics hub gradually became one of the main aims of the governments.

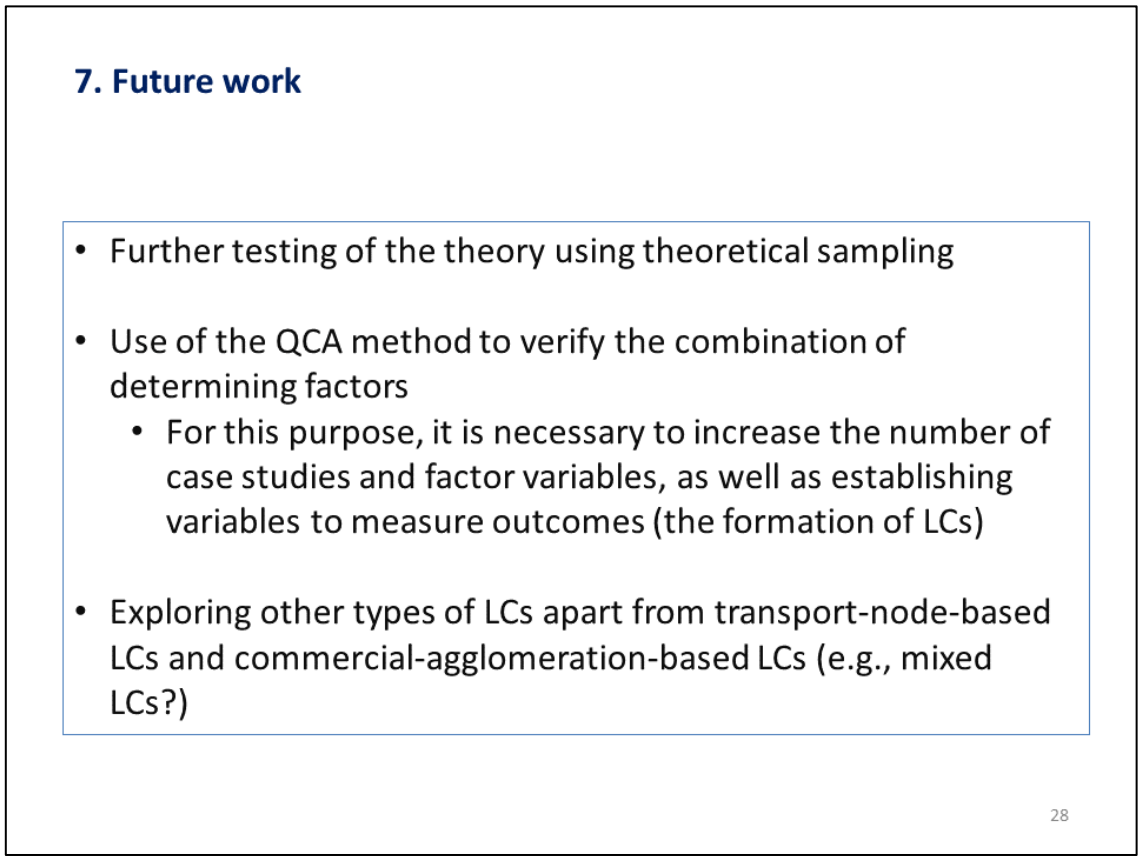



The replication case study shows that the three factors, the formation of a logistics market with co-opetition, the development of the physical and institutional foundations of an LC, and the attraction of logistics demand from beyond the region to the LC, can be found in the Yiwu LC.

However, the three conversions found in the Linyi LC formation process did not exist in the Yiwu LC. For example, logistics firms co-located in the same area from an early stage, and local governments have long been involved in creating an LC. In addition, logistics demand has been attracted from other regions not by the big 3PL providers, but by numerous small and medium-sized distributors and traders.




Let me provide a brief summary of this study. In terms of exploratory research, the study is focused on the formation process of LCs, which precedes the expansion process.
By building a theory based on case studies, the formation mechanisms for transport-node-based LCs and commercial-agglomeration-based LCs are revealed, that is, a three-combination framework and a three-factor combination, respectively.




Several issues remain to be addressed in future research. I want to conduct further testing of the theory using theoretical sampling and natural experiments.
In the meantime, I will use the QCA method to verify the two theories proposed in this study. To do so, it is necessary to add further case studies and factor variables, as well as establishing measurement variables in relation to the formation of LCs.
I also want to explore various other types of LCs apart from the two types addressed in this study.

Thank you for your attention.

**Acknowledgments**

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