Determining inland logistics service attributes: a case study of Chinese landlocked regions

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Abstract

Purpose – Recently, inland Chinese regions have become the major manufacturing base for most manufacturing firms. Accordingly, with this change, many shipping companies attempted to provide proper logistics service activities to maintain their business. Hence, this study aims to empirically examine the logistics service preference segments for Chinese landlocked regions from a manufacturer's perspective. By understanding these attributes, not only shipping companies but also logistics companies can provide proper service to their customers.

Design/methodology/approach – The preliminary logistics service attributes are determined using an interview and in-depth questionnaire with logistics experts from the local private and government sectors in southwest China and few international logistics coordinators. This study conducted importance-performance analysis (IPA) and used a customer dissatisfaction attitude index to evaluate the priorities for improving logistics service attributes. Cluster analysis is subsequently performed to group respondents on the basis of their factor scores.

Findings – Five crucial logistics service dimensions were identified by the factor analysis, namely, packing and storage, logistics supporting, logistics information, transportation planning and information inquiry. The results also revised the IPA model. The top five service attributes that needed to be improved were carrier selection, ship scheduling inquiry, route planning and inquiry, cargo receiving station and freight forwarding. By applying the factor analysis, this study reduced the 27 logistics attributes derived from the literature review to five underlying critical factors.

Originality/value – This study contributes to the inland logistics by investigating the preferences of manufacturers in Chinese landlocked regions. Moreover, in land logistics in China is lacking in the literature; hence, several important implications can be derived from this study's results.

Keywords Cluster analysis, Segmenting, Inland logistics, Landlocked region, Southwest China

Paper type Research paper

1. Introduction

China has established many bonded areas along the coastal cities to attract foreign investors after the economic opening in 1978. As extraordinary economic growth continues in China,

its merchandize trade values were the largest in the world in 2017. The total merchandize trade had increased from US$37.6bn in 1980 to US$4,105bn in 2017, yielding a growth rate of 109.18 times (China Customs, 2017). Meanwhile, China's global GDP share was 18.2% in 2017 [International Monetary Fund (IMF), 2018]. Along with the economic growth, the demand for transportation and logistics has gradually emerged. By the end of 2016, the total logistics cost in China reached US$1,626.7bn, with an annual rate of growth of 5.8%. The total rate of logistics cost of GDP is 14.5% (China Federation of Logistics and Purchasing, 2016). These statistics indicate that the Chinese economy is expected to continue growing into the foreseeable future.

By providing a secure production and logistics environment, China has played the role of the world's factory. Recently, many corporations have been pondering moves to inland areas or expansion of their supply chains into landlocked regions in China such as Shanxi and Sichuan provinces because of the increasing cost (such as rent and wages) and seeking for the potential market. Consequently, the need for inland logistics has been growing and firms wishing to develop inland logistics markets are increasingly addressing the challenges posed by landlocked regions, including lack of seaports, poor infrastructure, transit delays, excessive logistics costs and costly bureaucratic procedures (Pérez-Salas *et al.*, 2014; Hanif and Kaluwa, 2016). To continuously promote economic growth and inland development in China, more logistics network coverage will be expanded, particularly into southwest China (Kearney, 2010).

Inland logistics refers to a trend toward closer integration between maritime and inland transportation (Rodrigue *et al.*, 2010). An outstanding inland logistics service can save transit time and cost. The time and cost reductions yield economic consequences, as producers gain access to inland markets, draw inputs/outputs from a large area and stimulate local production (Lean *et al.*, 2014). As industrial clusters have been moved to inland, the number of new expressways, waterways, railways and airports is increasing for the large logistics demand. In particular, container transportation in China by inland waterway was estimated to grow to more than 12.6%, with 26.99 million tons in 2017 (Ministry of Transportation, 2018). As a result, it is becoming a major task for the logistics service providers focused on the landlocked logistics market to offer practical services to meet inland demands.

Logistics is a strategic area that can provide a key competitive advantage and obtain higher requirements on service levels. Not only the prices but also the quality of service now rate as the most important requirement, followed by service reliability, flexibility and range of product offerings (Kearney, 2010). This implies that the logistics service needs to provide a more integrated, mature and higher-quality service. As companies expand rapidly in landlocked regions, the inland logistics requirements have expanded beyond the predictions; with broader national logistics activity coverage, consistent and correct market segments have become necessary.

Recent logistics research (Lean *et al.*, 2014; Li *et al.*, 2017) has suggested that logistics is now essential for economic development in China. These studies indicated that good logistics services that will benefit the economy include increased land/waterway transportation (Yang *et al.*, 2016), an increased quantity of manufacturers (Shi *et al.*, 2016) and better-quality logistics providers (Shi *et al.*, 2016; Yang *et al.*, 2016). Although these studies contributed new insights into logistics contexts in China, they focused only on coastal areas or large ports in China. Moreover, even though researchers had addressed the Belt and Road Initiative in terms of logistics (Li *et al.*, 2017; Yang *et al.*, 2017; Wei and Sheng, 2018), most studies focused on the supply side as the role of logistics infrastructure, not on the demand for logistics services. This study addresses this research gap as follows.

First, to provide reliable shipping and logistics environment for attracting foreign direct investments and facilitating international trade, this research attempts to determine the major key logistics service attributes in Chinese landlocked regions from the customers' perspective.

Second, a traditional importance-performance analysis (IPA) model has been commonly applied to identify priorities for improving the service attributes. This study hoped to identify the accurate priorities for improving the types of inland logistics service attributes, instead of satisfaction. Thus, the shipper's perceived dissatisfaction with the inland logistics services was used to replace the "performance" variable. An IPA model with a dissatisfaction attitude (DA) index was performed to determine the priorities in improving logistics service attributes for Chinese landlocked regions.

Third, to the best of the authors' knowledge, few studies have examined inland logistics services from the customers' perspective in China. Moreover, understanding the logistics needs of different industries in landlocked regions in China, in detail, is still lacking. However, it is needed to help inland local governments or logistics service providers propose appropriate logistics policies and strategies for improving logistics competitiveness. Solving these questions will not only provide important management implications but also shed light on the new challenges and competitive advantages for logistics service providers. Thus, this research contributes to the application of the revised IPA model to identify priorities in improving landlocked logistics service attributes. Moreover, performing the exploratory factor analysis can identify the crucial logistics service dimensions in Chinese landlocked regions. Finally, by conducting cluster analysis, this study can gain an understanding of the preferences of logistics services for each group and further help decision-makers propose appropriate logistics service strategies for different logistics service preference groups. This can help logistics service providers and government authorities efficiently use and reallocate their resources.

2. Inland logistics service attributes

Logistics refers to "encompassing all activities and methods connected with supplying the military, including storage requirements, transport and distribution" (Krumwiede and Sheu, 2002). It is the management of all activities that facilitates movement and the coordination of supply and demand to make the best use of time and space (Steven, 1989). Thus, logistics is a process that adds value directly and meets customer requirements by providing services such as transportation, storage, customs clearance, inland transport, documentation, packaging and cargo tracking (Yang, 2012).

With the rising of labor and production costs, multinational enterprises have expanded their logistics networks to inland areas or their supply chains to landlocked regions in China to decrease logistics costs. Limited by their geographical locations, landlocked regions lack access to major ports and tend to lack adequate physical transportation and information systems. These regions are often poorly connected with the outside world and usually have slower development than coastal cities. They are broadly recognized as a major impediment to trade. Accordingly, inland logistics is increasingly important to the operation of businesses and the development of a nation's economy. It involves a closer integration between maritime and inland transportation (Rodrigue *et al.,* 2010). In particular, inland logistics is a system that integrates the transportation of manufacturing in inland regions via land, river and sea with air transportation, ports and customer requirements to achieve efficient delivery of commodities (International Maritime Organization, 1991; Lu, 2004).

In inland logistics, transportation and logistics requirements are the driving factor in logistics service (Chen *et al.,* 2010; Hong and Liu, 2007). Previous studies have indicated the importance of transportation or logistics problems in the hinterlands (Monios, 2011; Notteboom and Rodrigue, 2005, 2009; Tran, 2011; Hanif and Kaluwa, 2016). For instance, Tran (2011) studied port selection on liner routes from an inland logistics perspective and found that a decrease in the number of vessel port calls brought the advantages of lower ship operation and inventory costs and port tariffs, but increased the inland transport cost. Meanwhile, Notteboom and Rodrigue (2009) examined logistics integration and network orientation between maritime and inland transport systems with a door-to-door channel approach. They indicated that a multiplication of transportation routes can meet the requirements of inland logistics and assist logistics operators to obtain the most benefit. From the perspective of seaport transportation operators, they not only provide port-to-port cargo delivery but also increase several more value-added services in logistics integration such as inland transportation, packing, labeling, warehousing, barcoding and carrier selection. Researchers also identified that major transport-logistics challenges in landlocked regions included poor infrastructure, coordination problems, logistic costs, delay in transit, corruption at borders and long distances to access the seaports (Buyonge, 2008; Pérez-Salas *et al.,* 2014; Hanif and Kaluwa, 2016; Li *et al.,* 2017).

Given constrained access to major ports, the concept of a dry port had been addressed for inland regions (Roso, 2007; Do *et al.,* 2011; Cullinane *et al.,* 2012; Wei and Sheng, 2018). A dry port serves as an intermodal transport hub in inland regions and integrates them with seaports and cross-border inland ports. Like a seaport, it can provide port services such as storage, consolidation, inspection and quarantine, customs clearance and issuance of bills of lading (Roso, 2007; Wei and Sheng, 2018). The dry port, thus can connect with seaports by providing efficient multimodal transport and customs clearance services, which in turn facilitate the movement and transshipment of sea cargo to inland regions. Constructing a dry port and providing logistics services can improve inland regions' logistical connectivity to the outside world. In particular, to attract foreign direct investments in landlocked regions, the Chinese Government needs to establish its own cross-border logistics networks.

An understanding of logistics requirements in landlocked regions can help decision-makers propose appropriate policies and marketing strategies to meet manufacturers' needs. The aforementioned studies identified the crucial logistics attributes in inland regions. Moreover, an appraisal of prior studies on the types of logistics service indicated that the most common service attributes were related to transportation, warehousing, logistics value-added services, information and financial service. These service attributes used in prior studies included fleet management, warehouse management, freight consolidation, order fulfillment, carrier selection, logistics information systems, order processing, rate negotiation, freight bill payment, electronic transmission capability, intermodal services, customs clearance, picking and packaging, freight forwarding, inland transportation, cargo safety, cargo tracking and tracing, electronic transmission, insurance service and financial service (Dapiran *et al.,* 1996; Murphy and Poist, 2000; Lai, 2004; Lu, 2004; Lieb and Bentz, 2004, 2005; Yang *et al.,* 2009; Liu and Lyons, 2011; Rivera *et al.,* 2016).

In addition, an expert interview with shipping and logistics executives in southwest China revealed that they need not only common logistics service (e.g. shipping or storage) but also other types of service such as cargo receiving stations, route planning and inquiry, special cargo arrangements and cargo surveys. This study, therefore, contends that previous studies and local logistics experts might have different service views, which can be used to segment markets and target marketing strategy. From a literature review and an

Measurement items	Previous research
Bar coding operation	Lu (2003, 2004), Liu and Lyons (2011)
Cargo damage survey and notarization	Outcome from interviews
Cargo packing	Murphy and Poist (1998, 2000), Lieb and Bentz (2004), Liu and Lyons (2011), Rivera *et al.* (2016)
Cargo receiving station	Outcome from interviews
Cargo tracing	Lai (2004), Lu (2003, 2004), Lieb and Bentz (2004, 2005), Lu and Yang (2006), Liu and Lyons (2011)
Carriers selection	Murphy and Poist (1998, 2000), Liu and Lyons (2011)
Container unpacking and stuffing	Murphy and Poist (1998, 2000), Lu (2003, 2004), Lieb and Bentz (2005), Liu and Lyons (2011)
Customer consultation	Lai (2004), Lieb and Bentz (2004, 2005), Liu and Lyons (2011), Lu and Yang (2006), Rivera *et al.* (2016)
Electronic transmission	Murphy and Poist (1998, 2000), Lu (2003, 2004), Lieb and Bentz (2004), Liu and Lyons (2011)
Export clearance inquiry	Lu (2003), Lu et al. (2006)
Financial service	Murphy and Poist (1998, 2000), Liu and Lyons (2011), Lu et al. (2006)
Freight bill payment	Murphy and Poist (1998, 2000), Lieb and Bentz (2005), Liu and Lyons (2011)
Freight forwarding	Lai (2004), Lieb and Bentz (2005), Liu and Lyons (2011)
Frequency of sailings and flights	Lu (2003)
GPRS	Outcome from interviews
Inventory management	Murphy and Poist (1998, 2000), Lai (2004), Lieb and Bentz (2004, 2005), Liu and Lyons (2011)
Logistics information service	Murphy and Poist (1998, 2000), Lai (2004), Lieb and Bentz (2004), Liu and Lyons (2011)
Market information service	Lu (2003, 2004)
Multiple countries distribution	Murphy and Poist (1998, 2000), Lu (2003, 2004), Liu and Lyons (2011)
Picking and packaging	Liu and Lyons (2011)
Product returns and repairs	Murphy and Poist (1998, 2000), Lu (2003, 2004), Lieb and Bentz (2005), and Liu and Lyons (2011), Rivera *et al.* (2016)
RFID	Liu and Lyons (2011)
Route planning and inquiry	Outcome from interviews
Ship scheduling inquiry	Lu (2003), Lu *et al.* (2006)
Special cargo arrangement	Outcome from interviews
Special cargo storage	Lu (2003, 2004), Liu and Lyons (2011)

Table 1.
Critical logistics
measurement items
adapted from
prior research

expert interview, the 27 types of inland logistics services summarized in Table 1 were selected for the questionnaire in this study.

3. Methodology
3.1 Research methods
The four-step analytical process of this research is shown in Figure 1. The first step is the selection of logistics service types for Chinese landlocked regions. To choose the questionnaire items and ensure their quality, the design of the questionnaire on the approach follows that of Iacobucci and Churchill (2010). The content validity of the questionnaire used in this research is tested by applying a literature review and interviews with practitioners. The content validity assessment aims to ensure that the
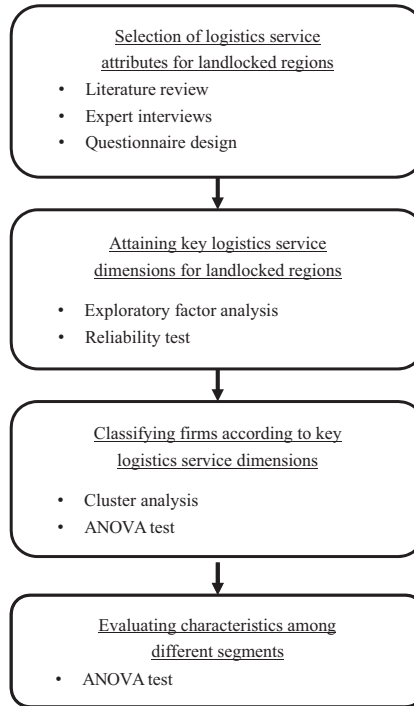
Figure 1.
Analytical steps

selection of scale items extends past solely the empirical issues and includes
theoretical and practical considerations (Hair *et al.,* 2010). All questions are based on
previous studies and discussions with six logistics experts from manufacturing firms
located in Chongqing Lianglu-Cuntan Free Trade Port Area, China. Six executives
from the following industries were represented: food processing, high-tech,
machinery and auto, chemical and manufacturing. Additionally, comments by three
shipping experts whose company provides international logistics services were also
referenced. In total, 27 logistics service attributes are selected in the survey
questionnaire. Each logistics service attribute is assessed by a 5-point Likert scale
ranging from 1 = "strongly unimportant/dissatisfy" to 5 = "strongly important/
satisfy."

The second step is conducting an exploratory factor analysis to identify the key
factors underlying measurement items. Such an analysis can summarize a large
number of types of logistics service into a smaller number of underlying dimensions
and attain key logistics service factors. In addition, a reliability test with Cronbach's
alpha values was conducted to examine the consistency and reliability of these
service factors. The marketing strategy has long been considered very important in
customer service, so a market should be segmented depending on customers'
requirements (Lu, 2003). In the third step, cluster analysis was subsequently used to
distinguish respondents' critical logistics services preferences. The Ward's method
with the hierarchical technique using squared Euclidean distances was chosen to

form clusters. The last step was carrying out an analysis of variance (ANOVA) to segment respondents' logistics services preferences, grouped in terms of the characteristics of their firms. All analyzes in the study were carried out using the SPSS 18.0 for Windows statistical packages.

Identifying priorities in improving inland logistics service attributes can help decision-makers propose appropriate strategies for making such improvements and for meeting customers' requirements. A revised IPA model was, thus, carried out for this study (Hsu *et al.*, 2015). The IPA model was originally developed by Martilla and James (1997) and contributes a two-dimensional plot with mean importance as the vertical axis and mean performance on the horizontal axis (Chen, 2014). Four quadrants with different managerial implications are divided in this plot by crosshairs. This study hopes to identify the priorities for improving the types of inland logistics service attributes, instead of satisfaction; hence, the shipper's perceived dissatisfaction with the inland logistics services was used to replace the "performance" variable.

The IPA technology allows facilitating a matrix-based evaluation of how the characteristics of the quadrants differ from each other. It can identify areas in which resources must be reallocated to improve logistics service quality (Chen, 2014). However, the original IPA model cannot provide accurate priorities for improving the logistics service attributes. To help logistics service providers efficiently use and reallocate their resources, following Hsu *et al.* (2015), this study applied a DA index to determine the priorities in improving logistics service attributes. Given that the higher importance and high dissatisfaction degree should be improved immediately, the DA index could be calculated by the following two equations, the DA index of the *i*th service attributes is defined as follows:

$$d_i = \omega_i^I \times \omega_i^D, i = 1, 2, \ldots\ldots\ldots, 27 \tag{1}$$

We normalize the $d_i, i = 1, 2, \ldots..n$

$$DA_i = \frac{d_i}{\sum_{i=1}^{27} d_i}, i = 1, 2, \ldots\ldots 27 \tag{2}$$

3.2 Sampling
This research empirically investigates and segments the requirements of inland logistics services for landlocked regions in southwest China from the shippers' perspective. A target sample of inland manufacturing firms in Chongqing Free Trade Port Area was selected and a questionnaire was mailed to 800 firms that were listed on Chongqing and Chengdu administration for industry and commence. Two rounds of the survey are conducted in this research. A total of 172 questionnaires were completed and returned with an overall response rate of 21.5%.

3.3 Bias issues
The *t*-test was subsequently used to evaluate whether statistically significant differences exist between these two groups across the 27 measurement items. Result revealed no statistically significant mean differences among any of the items used in

the estimated models, implying that non-response bias did not pose a problem in this study.

The data were obtained from single respondents; hence, a common method bias might have limited the accuracy of this analysis (Malhotra and Mackelprang, 2012). To look for possible common method bias within the data, the present study used Harman's single-factor test (Perols *et al.*, 2013) to evaluate if a significant amount of variance was common across all items. Common method bias was not a significant problem with the data because the independent and dependent variables were loaded on different factors, with the first factor accounting for 26.90% of the total variance.

3.4 Characteristics of respondents

Most of the respondents hold senior managerial positions (30.7%), followed by vice-presidential or above (26.2%) and managerial (23.7%) positions. In total, over 80% of the respondents were in managerial positions or above and were well-qualified to answer the questionnaire survey. Almost a third of the respondents (29.7%) were from the mechanical and automotive industry, followed by traditional manufacturing (18.0%), high-tech (17.4%), mineral and chemical (15.1%), food processing (10.4%) and others (9.3%). For the annual revenue, just over 70% of the respondents reported that their firms' annual revenue was US$100m or less, whereas that of the 7.6% of the respondents' using firms was between US$101m and US$300m. Only 5.2% of the respondents' using firms had annual revenue of US$301m or more.

Respondents are also asked to provide information about their logistics sourcing activities. Just over a third of the responding firms (34.3%) outsourced their logistics activities to express delivery or logistics companies, followed by freight forwarding (25.6%), customs brokers (22.2%) and airline or shipping companies (17.4%). In general, about a third (27.0%) of the responding firms had a co-operative, long-term relationship with logistics companies, followed by customs brokers (18.3%), freight forwarding (17.7%), cargo freight stations (14.9%), shipping companies (13.5%) and airline companies (7.8%). Specifically, most companies made an outsourcing contract with their logistics service providers for one year (48.8%), followed by a half year (22.1%), two years (12.8%) and no tenure (11%).

4. Empirical analysis results

4.1 The priorities for improving for inland logistics service attributes

The mean scores of importance and dissatisfaction for each logistics service attributes are shown in Table 2. The mean scores for importance and dissatisfaction were 3.94 and 1.73, respectively, which divided the matrix into the four quadrants. As shown in Figure 2, six logistics service attributes with high importance and high dissatisfaction fall into Quadrant A (concentrate management here), indicating that these service attributes should be improved immediately. Further, logistics service attributes with high importance and low dissatisfaction fall into Quadrant B (keep up the good work), indicating that managers should keep service quality up to sustain current advantages. Four logistics service attributes with low importance and high dissatisfaction fall into Quadrant C (low priority for management), indicating that these service attributes should be improved, but with low priority. Finally, eight logistics service attributes with low importance and high dissatisfaction fall into Quadrant D (possible overkill), indicating the managers might overkill these services.

Table 2 shows the DA index of each service this study applied to determine the priorities in improving for logistics service attributes. Of the six types in Quadrant A, the DA index

indicates that the top five services that needed to be improved were carrier selection, ship scheduling inquiry, route planning and inquiry, cargo receiving stations and freight forwarding.

4.2 Key logistics service dimensions in landlocked regions

An exploratory factor analysis with varimax rotation was conducted to identify the key inland logistics service dimensions for Chinese landlocked regions. The Kaiser – Meyer – Olkin (KMO) value should be over 0.8 for appropriate data analysis and factor loadings should be greater than 0.5 (Hair *et al.,* 2010). KMO value indicates the degree to which each variable in a set is predicted without error by the other variables. Eigenvalues greater than one were used to decide on the number of factors (Iacobucci and Churchill, 2010). The initial factor analysis resulted in five factors that accounted for 67.089% of the total variance. Six items, namely, "logistics information service," "inventory management," "frequency of sailings and flights," "multiple countries distribution," "cargo tracing" and "radio frequency identification (RFID)" were found to load on two factors or to have a factor loading lower than 0.5 and were, therefore, eliminated in this study. Finally, five logistics service factors were

	Logistics service attributes	Importance Mean	Dissatisfaction Mean	DA (%)
A1	Cargo damage survey and notarization	4.56	1.56	3.89
A2	Customer consultation	4.55	1.58	3.93
A3	Cargo tracing	4.51	1.67	4.12
A4	Financial service	4.46	1.60	3.90
A5	Market information service	4.45	1.56	3.79
A6	Carrier selection	4.40	1.82	4.38
A7	Freight bill payment	4.39	1.49	3.57
A8	Export clearance inquiry	4.33	1.67	3.95
A9	Route planning and inquiry	4.31	1.80	4.24
A10	Freight forwarding	4.28	1.77	4.14
A11	Cargo receiving station	4.27	1.80	4.20
A12	Ship scheduling inquiry	4.20	1.91	4.38
A13	Frequency of sailings and flights	4.12	1.68	3.78
A14	Logistics information service	4.03	1.60	3.52
A15	Special cargo arrangement	4.03	1.83	4.03
A16	Inventory management	3.87	1.68	3.55
A17	Special cargo storage	3.82	1.82	3.80
A18	Container unpacking and stuffing	3.79	1.63	3.38
A19	Multiple countries distribution	3.78	1.78	3.68
A20	Picking and packaging	3.76	1.85	3.80
A21	Product returns and repairs	3.72	1.77	3.60
A22	Bar coding operation	3.63	1.64	3.25
A23	Cargo packing	3.61	1.86	3.67
A24	RFID	3.10	1.68	2.85
A25	Electronic commerce	2.92	1.91	3.05
A26	GPRS	2.83	1.76	2.72
A27	Electronic transmission	2.71	1.92	2.84
		3.94	1.73	

Table 2.
Comparison of the relative importance and dissatisfaction of logistics service attributes

Note: Mean scores based on a five-point scale (5 = very important and dissatisfy; 1 = very unimportant/satisfy)
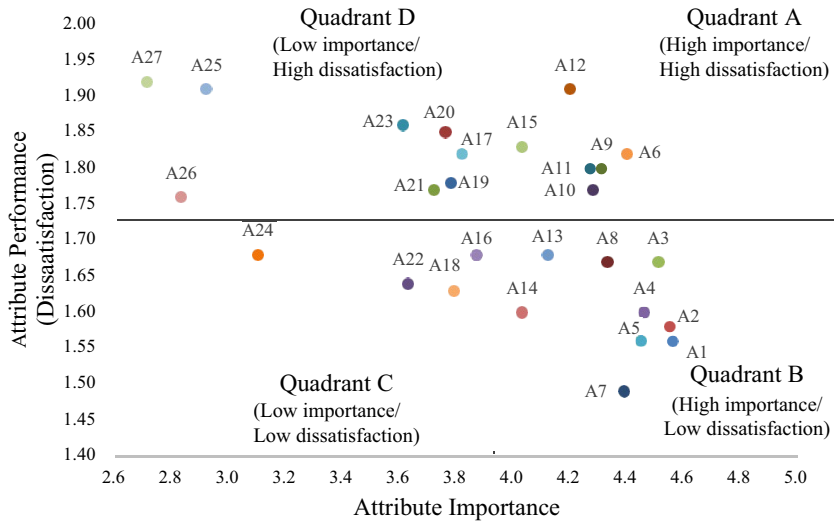
Figure 2.
Importance-
performance analysis
of logistics service
attributes

Logistics service attributes	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Product returns and repairs	*0.838*	0.045	−0.036	0.180	−0.017
Cargo packing	*0.810*	0.127	−0.078	0.149	−0.093
Container unpacking and stuffing	*0.793*	0.086	0.091	0.138	0.032
Special cargo storage	*0.751*	0.001	0.090	−0.008	0.159
Special cargo arrangement	*0.682*	0.110	0.155	−0.101	0.127
Picking and packaging	*0.631*	0.260	0.065	0.217	0.033
Bar coding operation	*0.509*	0.145	−0.018	0.430	−0.029
Financial service	0.105	*0.804*	0.031	−0.100	0.219
Market information service	0.100	*0.790*	0.252	0.036	−0.015
Freight bill payment	0.116	*0.753*	0.059	−0.045	0.204
Freight forwarding	0.045	*0.746*	−0.058	0.195	0.152
Customer consultation	0.195	*0.728*	0.229	−0.059	0.007
Cargo survey	0.079	*0.686*	0.265	−0.070	0.168
Route planning and inquiry	0.009	0.237	*0.863*	−0.042	0.117
Carriers selection	0.071	0.103	*0.848*	−0.033	0.092
Cargo receiving station	0.108	0.174	*0.813*	0.056	−0.006
Electronic transmission	0.245	−0.077	−0.130	*0.889*	−0.037
Electronic commerce	0.326	−0.030	−0.080	*0.808*	0.014
GPRS	−0.093	−0.009	0.238	*0.678*	0.302
Ship scheduling inquiry	0.109	0.255	0.077	0.166	*0.857*
Export clearance inquiry	0.068	0.355	0.117	0.014	*0.814*
Eigenvalues	5.831	3.649	1.865	1.805	1.119
Percentage variance	27.766	17.376	8.879	8.596	5.330
Mean value of factor	*3.77*	*4.45*	*4.32*	*2.82*	*4.27*
Standard deviation of factor	*0.73*	*0.73*	*0.75*	*1.15*	*0.84*
Cronbach α	*0.864*	*0.873*	*0.847*	*0.782*	*0.823*

Table 3.
Inland logistics
service dimensions
formulation – factor
analysis

identified that accounted for 67.946% of the total variance. The final results of the factor analysis are shown in Table 3 and can be described as follows.

Factor 1 consisted of seven items, namely, "product returns and repairs," "cargo packing," "container unpacking and stuffing," "special cargo storage," "special cargo arrangement," "picking and packaging" and "bar coding operation." Product returns and repairs had the highest factor loading on this factor. As most items were related to cargo services, this factor was identified as "logistics value-added service." It accounted for 27.766% of the total variance.

Factor 2 is composed of six items, namely, "financial service," "cargo survey," "market information service," "freight bill payment," "freight forwarding," "customer consultation" and "cargo survey." Financial service had the highest loading on this factor. Because most of the items were related to supporting services, this factor was, therefore, named "logistics supporting services." It accounted for 17.376% of the total variance.

Factor 3 is composed of three items, namely, "route planning and inquiry," "carrier selection" and "cargo receiving station." Route planning and inquiry had the highest loading on this factor. As those items were related to planning service, this factor was, therefore, identified as "transportation planning service." It accounted for 8.879% of the total variance.

Factor 4 is composed of three items, namely, "electronic transmission," "electronic commerce" and "general packet radio service (GPRS)." As those items were related to information service, it was, therefore, identified as "logistic information service." Electronic transmission had the highest loading on this factor, which accounted for 8.596% of the total variance.

Finally, Factor 5 consisted of two items, namely, "ship scheduling inquiry" and "export clearance inquiry." Ship scheduling inquiry had the highest loading on this factor. As those items were related to information inquiry, this factor was, therefore, identified as "information inquiry service." It accounted for 5.330% of the total variance.

4.3 Reliability test

Before proceeding with cluster analysis, this study assessed the reliability of each dimension on the Cronbach's alpha coefficients for deciding whether the aforementioned factors were consistent and reliable. As shown in Table 4, all Cronbach's alpha values for all factors are shown in Table 4 and showed that all values were well above the suggested threshold of

| | Segments | | | | | |
Factor	1	2	3	F ratio	p-value	Scheffe
F1: Packing and storage service	0.54[a]	0.03	−0.52	27.40	0.000**	(1,3)[b]; (2,3)
F2: Logistics supporting service	−0.23	−0.85	0.46	22.43	0.000**	(1,2); (1,3); (2,3)
F3: Transportation planning service	−0.08	−0.10	0.10	0.68	0.508	–
F4: Logistics information service	−0.39	−0.30	0.46	17.56	0.000**	(1,3); (2,3)
F5: Information inquiry service	0.43	−1.87	0.13	98.07	0.000**	(1,2); (1,3); (2,3)

Notes: [**]Significance level $p < 0.01$. [a]Factor scores were derived from data pooled across the three segments. The description of segments is based on factor scores with a mean of zero and standard deviation of one. [b]Value in parentheses indicates a significant difference between segments at the $p < 0.05$ significance level

Table 4.
ANOVA analysis of
factor differences
across the
three segments

0.70, confirming a satisfactory level of reliability in this study (Hair *et al.,* 2010). The mean for the five factors is between 2.82-4.45.

Table 4 also shows the respondents' aggregated perceptions of the importance of each key logistics service dimension. Logistics supporting service was perceived as the most important logistics service dimensions in landlocked regions by respondents, followed by transportation planning, information inquiry, logistics value-added and logistics information.

4.4 Inland logistics service preferred groups
With the limitation of resources, it is imperative for firms to realize customers' logistics service attributes preference segments, which in turn propose customized marketing strategies to meet customers' requirements. Thus, the market can be segmented into different groups based on customers' preference of different logistics service attributes. To segmenting logistics service market, a cluster analysis with a dendrogram using the Ward's approach was performed to segment the responding firms into various groups based on factor scores for each of the five factors. The result of the cluster analysis, in Table 4, suggested that three groups were identified: 73 in Segment 1, 22 in Segment 2 and 77 in Segment 3. The segmentation will be discussed in the next section.

One-way ANOVA is applied to examine factor differences across the three segments. Results, shown in Table 4, indicated that with the exception of transportation planning service, significant differences in factor scores were found between the three clusters at the $p < 0.01$ significance level. A schffe test was subsequently used to measure all groups' factor scores and identify, which of the pairs show significance (Hair *et al.,* 2010). The results indicated that differences in the four factors across the three segments can be identified. Factors 1, 2, 4 and 5 were found to significantly differ between Segments 1 and 3 and Segments 2 and 3, whereas Factors 2 and 4 were found to significantly differ between Segments 1 and 2.

A comparison of factor score coefficients shows that Segment 1 had its highest centroid scores on Factor 1 (logistics value-added service) and Factor 5 (information inquiry service). Segment 3 had the highest positive scores on Factor 2 (logistics supporting service) and Factor 4 (logistics information service). However, Segment 2 had low or negative scores on all logistics service factors. Accordingly, the three segments were named "logistics value-added and information inquiry service

Type of firm of respondents' firms	Firm	1 (%)[a]	Firm	2 (%)	Firm	3 (%)
Food processing industry	7	9.6	1	4.5	10	13.0
High-tech industry	16	21.9	4	18.2	10	13.0
Machinery and auto industry	20	27.4	6	27.3	25	32.5
Metal and chemical industry	13	17.8	5	22.7	8	10.4
Manufacturing industry	10	13.7	4	18.2	17	22.1
Others	7	9.6	2	9.1	7	9.1
Total firms	73		22		77	

Table 5. Characteristics of segments

Note: [a] % of the segment

preferred group," "no particular preference group" and "logistics supporting and information service preferred group."

After segmenting the logistics service market, the logistics service providers need to target their niche market and formulate an effective service strategy based on their resources and capabilities. Hence, it is imperative for logistics service providers to know customers' requirements and realize the characteristics of customers in each segment. As shown in Table 5, each segment was cross-tabulated with the industry type of respondents' firms. For Segment 1, 27.4% of the respondents' firms were in the machinery and auto industry, 17.8% were in the metal and chemical industry and 13.7% were in the manufacturing industry. Meanwhile those in Segment 2 were in the machinery and auto industry (27.3%), followed by metal and chemical industry (22.7%), high-tech industry (18.2%) and manufacturing (18.2%). The machinery and auto industry accounted for 32.5% of respondents' firms in Segment 3, followed by manufacturing industry (22.1%), high-tech (13.0%), food processing (13.0%) and metal and chemical industry (10.4%). Accordingly, the machinery and auto industry preferred logistics value-added and information inquiry service as well as logistics supporting and information services, whereas the high-tech industry and metal and chemical industry preferred logistics value-added and information inquiry service; food processing and manufacturing preferred logistics supporting and information services.

5. Discussion and conclusion
5.1 Summary and findings
This study contributes to the inland logistics by investigating the preferences of manufacturers in Chinese landlocked regions, specifically in Chengdu and Chongqing cities. The main findings are summarized as follow.

First, from the perspective of manufacturers, five important logistics service attributes from the perspective of manufacturers are cargo damage survey and notarization, customer consultation, cargo tracing, financial service and market information service are concluded. Unlike most of previous studies that emphasized the importance of cost and transportation-related service, this study found that cargo damage survey and notarization is rated as the most necessary services for shippers in landlocked regions. The risk and cost for landlocked logistics were perceived to be high; therefore, it is essential to provide cargo damage survey and notarization service for shippers when goods were suffered damage or lost in logistics operations. On the other hand, electronic data interchange, electronic commerce, ship scheduling inquiry, cargo packing and picking and packing were found to be the most unsatisfying types of service as perceived by respondents. Facing the logistics challenges such as poor infrastructure, distant access to seaports, the lack of reliability of transport systems and coordination problems (Pérez-Salas *et al.,* 2014), logistics service providers need to establish an information system to enhance both internal and external information integration. This can effectively transfer data and share logistics information within the whole supply chain.

Second, given the results of the revised IPA model, the top five service attributes that needed to be improved were carrier selection, ship scheduling inquiry, route planning and inquiry, cargo receiving station and freight forwarding. The delays in transit and at border customs clearance were very common for landlocked regions. Thus, answering logistics information inquiry and providing consultation services on carrier selection, an alternative transportation mode, route planning and inquiry can improve the market position of

logistics service providers. In addition, because of distant access to seaports and vast territory of southwest China, logistics service providers can adopt the hub-and-spoke concept to set up many cargo receiving stations for providing freight forwarding and consolidating services.

Finally, factor analysis was carried out and the 27 logistics attributes derived from the literature review were reduced to the following five underlying critical factors: logistics value-added service, logistics supporting service, transportation planning service, logistics information service and information inquiry service. Cluster analysis was subsequently conducted to classify the respondents into different logistics service preference groups on the basis of these factor scores. The three segments are the:

(1) logistics value-added and information inquiry services preference group;

(2) no particular preference group; and

(3) logistics supporting and information services preference group.

Results also indicated that there were significant differences in the four service factors across the three segments. Thus, the target markets with specific logistics services preferences can be identified by logistics service providers for proposing customized marketing strategies.

5.2 Managerial implications

In light of the fact that inland logistics in China is lacking in the literature, several important implications can be derived from the results. First, a strategy of appealing to all market segments usually leads to a fuzzy image in the marketplace. With the limitation of firms' resources, it is imperative for the logistics service providers to analyze customers' preference segments and modify their current strategy to more accurately meet customers' requirements. Correct marketing strategy can ensure there will be no conflicts between these different segments' real needs and can help logistics service providers gain competitive position in this dynamic marketplace. For instance, logistics supporting and information service is the greatest concern in the third segment. Given that logistics operating costs are higher and cargo is subject to various threats (Buyonge 2008), the following are essential to machinery and auto and metal and chemical industries: financial service, freight bill payment, cargo insurance, cargo damage survey and notarization, market information service, freight forwarding and logistics information inquiry and consultation services.

Second, logistics value-added service was the crucial issue to high-tech, machinery and auto and metal and chemical industries in the Segment 1. Logistics service providers must provide logistics value-added services such as product returns and repairs, packing, unpacking and stuffing, storage, picking and packaging and bar coding operation services for these industries. Moreover, in today's time-based competition marketplace, logistics information inquire was perceived important to high-tech, machinery and auto and metal and chemical industries. Thus, logistics service providers establish a platform for integrating whole supply chain partners. Through information integration, they can provide instant and accurate information such as cargo tracing, ship scheduling and export customs clearance for customers.

Third, the manufacturers preferred to outsource the logistics services to freight forwarders, express delivery companies and customs brokers. Logistics service providers should integrate the different functions of local logistics companies and processes to reduce

the logistics cost. By providing integrated logistics service, they can attract more manufacturers willing to have long-term cooperation with them.

Finally, the results indicated that inland logistics services are most concerned with cargo damage survey and notarization, customer consultation and cargo tracking, which are different from prior studies focus on coastal areas. Most of the manufacturers in southwest China are import/export oriented. Information integration and warehousing, thus play an important role in inland logistics for facilitating the flow of goods and information. Furthermore, cargo is subject to various threats in the long-distance transit. It is, therefore, important to provide consultation service and cargo damage survey and notarization service for shippers when goods were damaged or lost in logistics operations.

5.3 Limitations and direction for future research

The findings of this research and its resulting implications are subject to limitations. First, this study was limited to examining the logistics service attributes based on the perceptions of manufacturers in a specific area (Chongqing and Chengdu). However, it is useful to compare them with inland logistics services in other parts of the world. Further research is suggested to collect data from other inland regions for comparison. Second, this study primarily focused on how manufacturing firms select logistics service in Chinese landlocked regions. The performance analysis is important for a firm to measure the efficiency of resource allocation and the outcome of corporate objectives. Another direction for future research might be to evaluate logistic performance from the shippers' point of view. Third, not only China has inland regions but also we conduct possible research in other region and countries such as Africa, Southeast Asia (Laos) and Mongolia. Fourthly, recently the service trans China rail has becoming common than before, we suggest considering this part in the future research. Finally, the issue of cause and effect such as the effect of logistics service on financial performance, was not addressed in this study. Structural equation modeling may be necessary to examine the outcomes of logistics service.

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Further reading

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