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SELECTING FEEDER POINTS FOR AIRLINE TRANSOCEANIC ROUTES: THE GUANGZHOU–LOS ANGELES ROUTE OF CHINA SOUTHERN AIRLINES

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Abstract: Once an airline joins a global alliance, a practical question follows: which cities at either end of a transoceanic trunk route can serve as feeder points for connecting traffic with partner carriers? Sound choices raise the synergy of the whole network and widen the market that the trunk route reaches. Work on route network planning says a great deal about hub layout and route optimisation, yet offers little operational guidance on picking feeder points under an alliance arrangement. This paper builds an evaluation framework around four dimensions, namely city regional profile, route mileage rationality, market development and market competition, and breaks them into ten weighted indicators. Scores are produced by two analysts working independently and then reconciled. The framework is applied to the Guangzhou–Los Angeles (CAN–LAX) route of China Southern Airlines: ten candidate cities on the North American side and nine on the Asian side are scored and ranked, and six feeder points are retained at each end, Atlanta, New York, Minneapolis, Detroit, Mexico City and Salt Lake City at LAX, and Ho Chi Minh City, Nanning, Hong Kong Region, Haikou, Bangkok and Kunming at CAN. Base status and capacity input turn out to be what separates the leading cities from the rest, while intense competition works against cooperation in mature markets. The procedure draws only on data carriers already hold, which makes it usable in real alliance negotiations.
Keywords: Airline alliance; Transoceanic route; Feeder point selection; Indicator system; Expert scoring; Guangzhou–Los Angeles route

1 INTRODUCTION

Airline alliances have been the main organisational form through which carriers extend their networks and share markets since the 1990s. Code sharing, connecting services and reciprocal frequent-flyer schemes let a member airline reach points served by its partners without committing aircraft of its own, and the pool of origin–destination markets it can sell expands accordingly. For a Chinese carrier in the middle of internationalising, the choice of feeder points at the two ends of a transoceanic trunk route largely decides how much traffic the trunk can gather and how much synergy it generates.

China Southern Airlines (CZ) joined SkyTeam in 2007, and the alliance network has since given it access to close to a thousand destinations. A trunk route such as Guangzhou–Los Angeles (CAN–LAX) is worth more than the non-stop traffic between the two cities. Traffic from feeder points at either end can be organised as feeder–CAN–LAX–feeder, so the route works as a corridor rather than a point-to-point link. Deciding which of the many candidate cities deserve a connecting product is therefore a genuine planning problem rather than a formality.

Work on air cargo and on aviation networks has concentrated on three areas: the evolution of route networks [1-8], the siting of hub airports [9-13], and network optimisation [14]. Campbell's integer programming formulation of discrete hub location is still the benchmark against which later hub models are measured [15]. Where siting is concerned, most of this literature compares multi-attribute decision methods, among them the analytic hierarchy process (AHP), fuzzy clustering and fuzzy linguistic evaluation. What it does not offer is a procedure that an airline planner can actually run. This paper supplies one for CAN–LAX: an indicator system, a set of weights and a scoring routine, with six cities retained at each end.

2 INDICATOR SYSTEM AND SELECTION METHOD

2.1 Scope of the Candidate Pool

Feeder points are not picked from all cities at once; the alliance narrows the pool first. SkyTeam had 19 member carriers as of January 2014. For the North American legs that connect at LAX, the usable partners were Delta (DL) and Aeroméxico (AM) together with their affiliates. For the Asian legs that connect at CAN, China Southern (CZ), China Airlines (CI), China Eastern (MU), Vietnam Airlines (VN) and Xiamen Airlines (MF) were the carriers able to operate or to cooperate. Candidates were drawn from the main stations of these partners, which keeps clear of the two familiar obstacles, traffic rights and route start-up.

2.2 The Indicator System

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Demand at a connecting city depends on more than its location and its economy. Its position inside the partner network, the detour the routing imposes, and how far the market has already been developed all count as well. Four first-level indicators were therefore defined: city regional profile, route mileage rationality, market development and market competition, and each was broken down into second-level indicators, ten in all, as set out in Table 1.

Table 1 Indicator System and Weights for Transoceanic Feeder Points

First-level indicator (weight)	Second-level indicator	Meaning	Weight
Route mileage rationality (10%)	Route detour	Whether candidate–hub–transoceanic hub routing detours or doubles back	10%
City regional profile (50%)	Economy	GDP, pillar industries, foreign trade, population, Fortune Global 500 headquarters	10%
	Tourism	Abundance of tourism resources and seasonal traffic	10%
	Culture	Universities, religious sites, sports events and other cultural attractions	10%
	Hub	Airport throughput, hub status, ground access and distribution	10%
	Politics	Administrative rank, international organisations, conference business	10%
Market development (25%)	Rights	Whether code-share and similar cooperative rights are already held	5%
	Capacity	Weekly frequency × average seats	10%
	Base	Whether the city is an important base of a partner carrier	10%
Market competition (15%)	Share	The partner's share in that market	15%

The weights say something about the decision itself. City regional profile carries half of the total, because economic, tourism, cultural and political resources set the long run base of connecting demand. Market development takes a quarter, on the grounds that cooperation is realistic only where rights and capacity already exist. Market competition, at 15%, is there to discount the value of mature markets. Route mileage rationality, at 10%, works as a constraint rather than an attraction.

The four dimensions were kept deliberately few. Every further indicator costs collection time and invites double counting, since tourism and culture already overlap at the margin and capacity input carries part of what market development means. A longer list would have looked more thorough on paper without doing much to the ranking, and would have been harder to defend in front of a partner carrier.

2.3 Scoring

Each candidate was scored out of 100 on every indicator. Two analysts worked on the Asian and American pools separately, without conferring, and each compared candidates vertically within an indicator. The two score sheets were then cross-checked, adjusted where the discussion justified it, and merged into a final score. Cities were ranked by total score and the top six were retained at each end.

Three indicators need a word on how they were scored. Base status was graded, with an important base scoring 10, an ordinary base 5 and a non-base airport 0. Capacity input was converted from the relative weekly seats of each candidate. Market competition was converted from the partner's passenger share in that market. Flight schedules and share statistics came from IATA's PaxIS (Passenger Intelligence Services) system, supplemented by public city and economic data.

3 THE CAN–LAX ROUTE AS A CASE

3.1 North American Side: Candidates and Scores

Ten cities were shortlisted from the main stations of Delta and Aeroméxico, taking account of city size and of how well the connection fits at LAX: Salt Lake City (SLC), Minneapolis/St. Paul (MSP), Detroit (DTW), New York (JFK/LGA), Cincinnati (CVG), Memphis (MEM), Atlanta (ATL), Mexico City (MEX), Seattle (SEA) and Phoenix (PHX). All ten already had a DL or AM service to Los Angeles, so neither rights nor route start-up stood in the way. Table 2 gives the capacity input.

Table 2 Capacity Input of Candidate Cities at the LAX End (Sample Week, 1–7 January 2014)

Destination	Airport code	Weekly flights	Average seats	Weekly seats	Base
Salt Lake City	SLC	51	140.2	7,151	Yes
Minneapolis/St. Paul	MSP	43	203.7	8,757	Yes
Detroit	DTW	40	212.3	8,490	Yes
New York	JFK/LGA	42	210.3	8,832	Yes
Cincinnati	CVG	12	156.0	1,872	Yes
Memphis	MEM	11	144.9	1,594	Yes
Atlanta	ATL	79	219.2	17,313	Yes (DL headquarters)
Mexico City	MEX	35	132.2	4,628	Yes
Seattle	SEA	32	85.2	2,727	No

Destination	Airport code	Weekly flights	Average seats	Weekly seats	Base
Phoenix	PHX	27	71.5	1,931	No

Note: all figures are Delta (DL) operations except LAX–MEX, which is Aeroméxico (AM) capacity.

Scoring followed the framework of Table 1; the results appear in Table 3.

Table 3 Scores of Candidate Cities at the LAX End (Out of 100)

Code	Mile.	Econ.	Tour.	Cult.	Hub	Pol.	Rights	Cap.	Base	Comp.	Total	Rank
SLC	7	6	8	8	9	6	5	7	5	8	69	6
MSP	8	7	8	8	7	6	5	8	5	13	75	3
DTW	10	5	8	7	8	5	5	8	5	14	75	4
JFK/LGA	10	10	10	10	10	10	5	8	5	3	81	2
CVG	10	4	7	5	7	3	5	2	5	14	62	7
MEM	10	6	5	6	7	3	5	2	5	12	61	8
ATL	10	9	9	6	10	8	5	10	10	15	92	1
MEX	5	9	9	8	8	9	5	5	5	10	73	5
SEA	5	8	8	9	5	6	5	3	0	6	55	9
PHX	10	6	8	6	5	7	5	2	0	5	54	10

Note: Mile., route mileage rationality; Econ., economy; Tour., tourism; Cult., culture; Pol., politics; Cap., capacity input; Comp., market competition.

Atlanta leads with 92. Delta's headquarters base, the largest weekly capacity in the sample (17,313 seats) and the strongest share in the market all pull in the same direction. New York comes second at 81: it takes full marks on economy, tourism, culture, transport and politics, yet earns only 3 on competition, because the market is crowded and Delta is not the dominant carrier there. Minneapolis and Detroit tie at 75, Mexico City follows at 73 and Salt Lake City at 69. The six retained at the LAX end are therefore Atlanta, New York, Minneapolis, Detroit, Mexico City and Salt Lake City.

3.2 Asian Side: Candidates and Scores

Nine cities were shortlisted from the main stations of CZ and VN: Haikou (HAK), Nanning (NNG), Kunming (KMG), Chengdu (CTU), Guiyang (KWE), Hong Kong Region (HKG), Bangkok (BKK), Ho Chi Minh City (SGN) and Singapore (SIN). Capacity input is given in Table 4 and scores in Table 5.

Table 4 Capacity Input of Candidate Cities at the CAN End (Sample Week, 1–7 January 2014)

Candidate city	Code	Weekly flights	Average seats	Weekly seats	Base
Haikou	HAK	72	152.2	10,959	No
Nanning	NNG	41	157.0	6,436	Yes (secondary)
Kunming	KMG	38	150.2	5,708	No
Chengdu	CTU	44	166.4	7,320	No
Guiyang	KWE	42	160.9	6,756	No
Hong Kong Region	HKG	7	158.7	1,111	No
Bangkok	BKK	35	165.0	5,775	No
Ho Chi Minh City	SGN	28	166.7	4,669	Yes (VN main base)
Singapore	SIN	21	145.0	3,045	No

Note: CAN–SGN combines China Southern (CZ) and Vietnam Airlines (VN) capacity; the other routes are CZ operations.

Table 5 Scores of Candidate Cities at the CAN End (Out of 100)

Candidate city	Code	Mile.	Econ.	Tour.	Cult.	Hub	Pol.	Rights	Cap.	Base	Comp.	Total	Rank
Haikou	HAK	9	7	7	6	8	8	5	10	0	8	68	4
Nanning	NNG	9	8	6	7	7	7	5	6	5	11	71	2
Kunming	KMG	7	9	8	7	8	8	5	5	0	8	65	6
Chengdu	CTU	6	10	8	8	8	8	5	7	0	4	64	7
Guiyang	KWE	7	8	6	6	7	6	5	6	0	8	59	9
Hong Kong Region	HKG	8	10	9	9	10	8	5	2	0	8	69	3
Bangkok	BKK	9	9	8	8	8	9	5	5	0	6	67	5
Ho Chi Minh City	SGN	9	7	7	3	7	7	5	4	10	15	74	1
Singapore	SIN	8	9	8	8	8	8	5	3	0	4	61	8

Note: Mile., route mileage rationality; Econ., economy; Tour., tourism; Cult., culture; Pol., politics; Cap., capacity input; Comp., market competition.

Ho Chi Minh City finishes first with 74, lifted by VN's main-base status, which scores 10, and by the high competition score of 15 that comes with a duopoly market. Nanning follows at 71, Hong Kong Region at 69, Haikou at 68, Bangkok at 67 and Kunming at 65. Chengdu earns full marks on economy, but the routing is noticeably circuitous and the market is crowded, so it ends seventh. The six retained at the CAN end are Ho Chi Minh City, Nanning, Hong Kong Region, Haikou, Bangkok and Kunming.

3.3 The Preferred Set and What It Means for the Network

Taken together, the twelve feeder points allow products such as Ho Chi Minh City–CAN–LAX–Atlanta or Nanning–CAN–LAX–New York, which pull traffic from points that CZ could not serve on its own into a single network.

For CZ the set also settles a scheduling question. Each feeder point has to be reachable from CAN inside a bank that allows a workable connection to the LAX departure and back, so the twelve points are not equally useful on the day an agreement is signed. The dense ones, Atlanta and Ho Chi Minh City in particular, can be sold as through itineraries almost at once, while the rest need schedule coordination before the connection looks attractive to a passenger.

4 DISCUSSION

4.1 On the Choice of Data Vintage

One point needs explaining: the schedules and market shares used here date from around January 2014. Two reasons support that choice. Alliance connecting cooperation runs on a long cycle, from first contact and negotiation through the code-share agreement and the coordination of slots and baggage systems, to the period in which the product is marketed and traffic is built up; a siting decision has to rest on the operating data available when talks begin, not on data that move afterwards. Second, from late 2019 the pandemic and its aftermath pushed traffic, frequency and market shares far away from normal. Routes were suspended and restored, and alliance relationships shifted, so data from that period cannot show what alliance cooperation normally looks like and make a poor sample against which to test a selection method. The early-2014 snapshot matches the decision setting and keeps the comparison consistent.

4.2 Ex-Post Comparison with the Cooperation Network

To see whether the result holds up, the six LAX-side points were set against the connecting network that CZ actually built through LAX. Public code-share arrangements between CZ and Delta cover North American cities reached through LAX under CZ's own code, and Atlanta, New York, Salt Lake City and Detroit are among them. Table 6 puts the two side by side.

Table 6 Selected Points at the LAX End against Cities Later Connected

Rank	Selected city	Code	Total score	Connecting service later operated
1	Atlanta	ATL	92	Yes (DL headquarters base)
2	New York	JFK/LGA	81	Yes
3	Minneapolis/St. Paul	MSP	75	Not found in public code-share schedules
4	Detroit	DTW	75	Yes
5	Mexico City	MEX	73	Not found in public code-share schedules
6	Salt Lake City	SLC	69	Yes
—	San Francisco (not shortlisted)	SFO	—	Yes (a major node in practice)

Four of the six, namely Atlanta, New York, Detroit and Salt Lake City, match what CZ later operated, and the top-ranked city is Delta's headquarters base, which supports the reading that base status and capacity dominate the value of cooperation. Minneapolis and Mexico City scored well but do not appear in the public cooperation list, a sign that expert scoring can be optimistic about a city's potential; a quantitative quality of service index (QSI) estimate of connecting traffic would help correct that bias. San Francisco (SFO) is the more interesting omission. It became an important node in the CZ–Delta cooperation yet never entered the shortlist, because the pool was drawn from partner stations alone, and future work should widen the pool to take in high-traffic markets around those stations. One further caveat: CZ left SkyTeam in 2019 and has since worked with American Airlines and others, so what is reported here is the logic of the SkyTeam period. The same procedure can be re-run under the new arrangement.

4.3 Reading the Results

Three things stand out. Base status and capacity input are what separate the leaders from the rest: ATL leads the LAX end on Delta's base and the largest capacity, and SGN leads the CAN end on the main-base status of Vietnam Airlines. Cooperation pays best where the partner keeps its core hub, since that is where flight banks connect and where the partner's willingness and operational support are strongest.

City attractiveness and competition pull in opposite directions. New York, Hong Kong Region and Chengdu are attractive on almost every count, but their markets are mature and crowded, the partner's share is modest, and the marginal gain from a connecting product is therefore small. Memphis, Cincinnati and Ho Chi Minh City are less attractive as cities, yet the partner holds a large share and the competitive structure is favourable, so the marginal return is larger.

Mileage rationality acts as a constraint. Chengdu and Seattle lose points for circuitous or northward routing. A feeder point cannot be judged on city appeal alone; the connecting path has to stay reasonably direct, otherwise the product loses on elapsed time against competing itineraries.

5 CONCLUSIONS

Selection of feeder points at the two ends of an alliance transoceanic route is an operational question that route planning research has not addressed directly. This paper answers it with an evaluation system of four first-level and ten second-level indicators, scored by two analysts independently and then reconciled. Applied to CAN–LAX, the procedure ranked ten North American and nine Asian candidates and retained six points at each end. Base status, capacity input and competitive structure decided most of the value of cooperation, and city attractiveness had to be traded against competition. The method uses data that carriers already hold, and the steps are short enough to repeat each time a route is negotiated. Two extensions are worth pursuing: a QSI-based estimate of the connecting traffic that a feeder point would add, and a shift from pure expert scoring towards combined subjective and objective weighting such as AHP or the entropy method.

COMPETING INTERESTS

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