Seamless Service Strategies for Passenger Transportation in Taiwan

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Abstract

This study adopts the concept of seamless passenger transportation and employs ABC analysis, the Kano model, and the Importance-Satisfaction model to explore the current intermodal transportation functions in 30 eastern Taiwan railway stations. We discuss each type of station's seamless transportation demand and service patterns by different service demands of travel trips and transportation service demand as well as by the local resources' characteristics at each station. Finally, we propose strategies for integrating relevant transportation resources that improve seamless transportation service quality in order to achieve the goal of developing green transportation systems.

Keywords: Seamless passenger transportation ·Multi modal transport system ·ABC analysis ·Kano model, Importance-Satisfaction model

1. Introduction

In the development of an urban transport system, seamless passenger transportation (SPT) is a very vital concept, emphasizing the efficiency of modern transportation systems in which businessmen or visitors care about the convenience, accessibility, and timeliness of interchange. Multi modal transport system (MMTS) relates to a single trip, consisting of a combination of vehicle modes (bus, metro, car, tram, etc.) or service modes (private/public) between which the traveler has to make a transfer. Here, SPT is an important characteristic of such a system (Kumar et al., 2009b). Goldman & Gorham (2006) point out that since 1987 the Brundtl and Commission report grabbed worldwide attention to the concept of sustainable development, with many scholars and policy professionals working to apply its principles in the urban and metropolitan context.

However, the transportation sector has proven to be particularly difficult territory for the advancement of a sustainable development policy (Goldman & Gorham, 2006). At the same time, travel is increasing in all regions of the world and is generally growing faster in the long run than the reduction rate of energy and pollution intensity. To develop Taiwan's green transportation systems and strengthen rail transport services, the Council for Economic Planning and Development (CEPD), Executive Yuan on March 2007 implemented "The Master Plan of Eastern Taiwan Sustainable Development," which presents the SPT concept based mainly on rail transport, supplemented with road transport, and strengthened by MMTS. The Taiwan Railways Administration (TRA), the government-owned agency that controls and runs all conventional railroad lines in the country, has provided travel and transportation services for more than a hundred years and plays a very important role in travel and transportation functions. TRA also has its own plans to develop green transportation and to reach the goals of sustainable development and carbon reduction.

However, how to effectively improve the performance of eastern railway stations and to meet passenger demand to bring about SPT are important issues that need to be deliberated. Goetz & Vowles (2000) indicate that the speeds and performance of the line-haul portion of intercity travel have generally been maintained or experienced some improvement in the last forty years, and it is at stations and the intercity portion of travel where the problems are concentrated. In the study, we adopt the concept of SPT to explore the current intermodal transportation functions among 30 eastern Taiwan railway stations, consider the extension functions of stations with railway tourism, integrate local activity demands, and create SPT service strategies. Furthermore, this study employs ABC analysis of inventory management to investigate whether SPT in Taiwan's railway system is really effectively utilized. We then employ both the Kano model and Importance-Satisfaction model (I-S model) to look for better strategies that allow for the least effort in interchange, have shorter travel time, and provide maximum comfort for tourists. For the sake of simplicity and consistency herein, this study focuses on one vehicle mode, considers SPT only for tourists, and refers to their transfer from railway to other transport modes in a short time.

Literature review

Seamless passenger transportation (SPT)

In response to their own pressures they face from increasing globalization, customers in the transport sector are now demanding the creation of a seamless transport market, in which national and modal boundaries neither delay movements nor hinder choices of the most appropriate route/mode combination for the movement required (Willoughby, 2000). The development of such a seamless transport market will be assisted and supported by a wider spread and deepening integration of a variety of approaches to the management of transport movements.

Travel often brings along several processes and aspects that result in travelers sometimes considering it a stressful experience. Hence, SPT means a 'free-from-disturbance' journey. The main purpose of SPT is to interconnect different systems of travel services. Therefore, how to offer an easy, comfortable, and unconcerned travel and railway experience is the main goal of an SPT program. Larwin (2005) indicates that a seamless system is characterized as a network of services where transfers involve little or no additional time or fare burden to the passenger. The challenge is to avoid bad transfers with long out-of-vehicle time, poor waiting conditions, and perhaps a fare surcharge. Hine & Scott (2000) emphasize the need to reduce the deterrence effects and costs associated with an interchange. Thus, a key policy goal is to now offer increasingly seamless public transport journeys.

According to a general scheme for urban inter-modal transport system and seamless passenger transportation, urban areas can be categorized into three concentric areas according to the relative level of supply of private and public transport. In city centers, public transport supply is the densest and most frequent, where on-street parking and car access is controlled. In central city areas, public transport and car parking opportunities offer similar levels of supply. In hinterland areas, public transport supply is low, and the population has grown to be dependent upon cars for transportation. The interchange area for a park & ride trip, in which the traveler has to make a transfer, should aim at achieving efficiency through the coordinated use of different transportation modes.

From the viewpoint of transportation policy, the concept of SPT may influence the decision making of public transportation so as to insure an informed, safe, and user-friendly journey (Hone & Scott, 2000). Therefore, in this paper we define SPT as providing passengers with an easy, reliable, and comfortable transfer to different vehicle modes or service modes at rail stations, which are the composite system of MMTS (Givoni & Rietveld, 2007).

SPT functions and services

The merit of SPT is to provide convenient, diversified tools to improve interchange efficiency between different modes at transfer points (such as stations). To design an SPT strategy, it is essential to provide passengers with an efficient interchange function to different vehicle modes or service modes at rail stations. Therefore, this paper focuses on the extension of services that stations fundamentally provide, in order to find the role that a station plays in the process of developing a strategy for seamless passenger transportation. Figure 1 illustrates the features and services of railway stations and the improvement strategies.

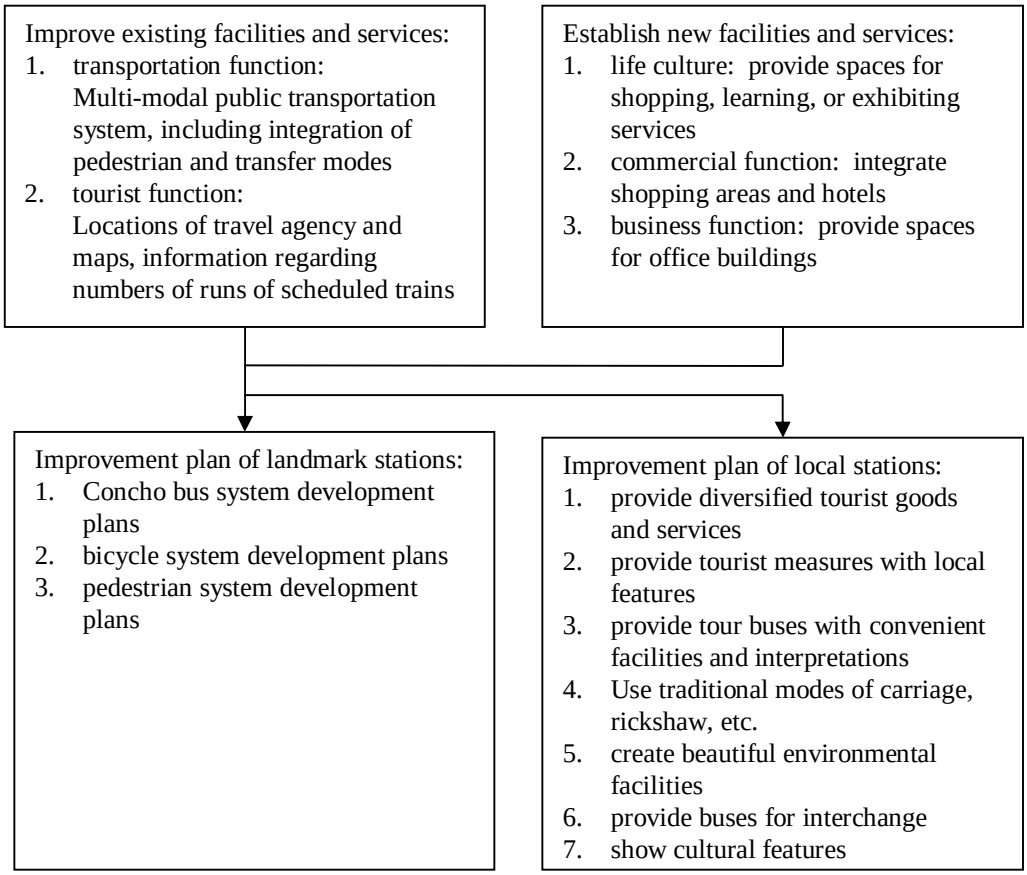

Figure 1: Features and Services of Stations and Improvement Strategies

Ezzedine *et al.* (2008) point out that many urban networks are just designed to carry flows of passengers to and from workplaces and do not take into consideration passenger expectations and the integration of the system into its environment, thus limiting their transport function. SPT contains a very important 'integration' concept. However, if the facilities of the intermodal travel system cannot connect and integrate other transit modes effectively, and the competent authorities cannot integrate transportation planning and management, then the public transport supply will be rather low. We describe cases of an intermodal travel system as follows. With increasing numbers of passengers filling up existing systems that are unable to cope with such increased demand, a growing and disturbing trend is the diminution in the quality of passenger travel (Goetz & Vowles, 2000). Intermodal passenger transportation in a single journey encompasses a variety of transportation services and integration of transport service modes, such as park and ride, train to a plane, automobiles on trains, trains on boats, automobiles, bicycles, etc. For example, to encourage commuters to take a bus, MRT, railway, and/or other public transportation, solutions can include providing interchange services, building P&R that employs an edge-of-city-center car park with links to shopping and business districts provided by a minibus service, or setting up bicycle parking spaces at the station for easy transfer.

In the United States, much of the progress that has been made toward the development of an intermodal transportation system has been on the freight side, led largely by private sector initiatives. Conversely, progress toward developing an intermodal system on the passenger side has lagged, especially in comparison with systems in Europe (Goetz & Vowles, 2000). Their study points out that this difference is due to the large role that the public sector in Europe plays in passenger transportation, particularly at the intercity scale (Goetz & Vowles, 2000). The development of intermodal systems in Taiwan is similar to that in Europe, because TRA is state-owned. The station service function in regards to passenger transport experience before and after arrival is very important. In the early years, the functions of railway stations were relatively simple - to provide ticketing, waiting, riding, etc. - and they met basic travel needs. However, with social and economic progress, adjustments in living habits, and increasing travel demand, such traditional services can no longer meet customers' travel needs and need to change in order to survive under fierce competition.

Station service functions can also be judged according to location of the station and providing services. For example, city stations are located in populated and interchange areas, and so their infrastructure or services are often better equipped than other local stations. Aside from the original functions of railway transportation, tourist travel has become one of the more important extended utilities. On the aspect of railway tourism demand, attracting customers completely depends on the support of station functions. Table 1 presents the better functions that railway stations offer to invite tourists for visiting.

Table 1: Characteristics of Landmark, General, and Local Stations

Categories	Landmark Stations (A)	General Stations (B)	Local Stations (C)
Features of Stations	• Passengers are mainly commuters and tourists. • The associated cluster effect is evident, since they are interchanges of travel modes and places of cultural activities and shopping areas for citizens.	• Passengers are mainly local residents, while others are commuters and tourists. • The size of station B is usually smaller than A, but larger than C, and is still an important transport hub.	• Passengers are mainly local residents and a few tourists. • The stations are gateways to outside connections and aggregation. • The in and out populations at these stations are less than stations A and B; the infrastructure is relatively insufficient, and so the cluster effect is not evident.

Multi modal transport system (MMTS)

There is no doubt that the transport systems in developed countries also exhibit serious problems, and multi-modal transport might be an effective approach to solve these mobility problems (Van Nes, 2002). Lo et al. (2003) note that multi-modal trips are common in metropolitan areas and how to set up a transfer model is an important issue. Because a metropolis transport network is usually dynamic, massive, and complicated, it is a difficult task to find the most efficient route, especially after including a variety of transport modes such as bus, train, etc. (Chiu et al., 2005). Transport models should be applied to support the planner in the process of decision making and to replicate the system's behavior (Friedrich, 1999).

The multi-modal oriented design concept considers the element of a friendly mobile environment interchange and seamless passenger transportation. A typical layout at an MMTS terminal integrates bus, feeder services, and bicycles with a rapid transit system. The design provides an access pattern for multiple modes while assuring integration, safety, and ease of use for all persons. Horn (2002) indicates that MMTS should include conventional timetable services (buses, trains, etc.), taxis (both single- and multiple-hire), and other demand-responsive services, and the critical issues are paying more attention to the supply rather than the demand side of transportation activity. Jansen et al. (2004) point out that the system has been used heavily for many simulation studies and daily planning to support both operations and commerce. The aim in MMTS should be for SPT, according to Bovy et al. (1996 & 1999), or for a level of interconnectivity that corresponds to the integration of services over the whole chain (Veeneman et al., 1997). Bockstael-Blok (2001) offers a chain perspective that implies potential travelers seek transport between two or more activity locations, proposes to improve the services provided by MMTS, and presents a specific way to look at transport systems. Any transfer in a journey is in principle unfavorable for travelers. An easy and comfortable transfer at a station requires the proper design of interchange with minimum transfer penalties, and this is the path towards SPT (Kumar et al. 2009a).

Kano model

Since its introduction in the 1980s, Kano's two-dimensional model (see Figure 2) is a useful tool to classify and prioritize customer needs based on how they affect customer satisfaction (Kano et al., 1984). Kano's indices, in accordance with the Kano principles, are proposed to incorporate quantitative measures into customer satisfaction (Xu et al., 2009). The Kano model is used to better understand the relationship between performance criteria and customer satisfaction and to resolve the trade-off dilemma in multiple-criteria optimization by identifying the key criteria in customer satisfaction (Chen & Chuang, 2008). The Kano model allows the identification of exciting requirements, usually associated with innovations (Tontini, 2007). Based on the Kano model analysis, an approximate transformation function is proposed to adjust the improvement ratio of each customer attribute.

Customers' raw priorities are thereby adjusted accordingly for achieving the desired customer satisfaction performance (Tan & Shen, 2000). The research of Kano et al. (1984) is the first to thoroughly address the non-linear relationship between quality attribute performance and overall customer satisfaction. Their approach, however, has been found to be too complex and difficult to implement. Several researchers have since proposed different methods to classify quality attributes (Anderson & Mittal, 2000; Matzler et al., 2004; Matzler & Sauerwein, 2002; Witell & Löfgren, 2007).

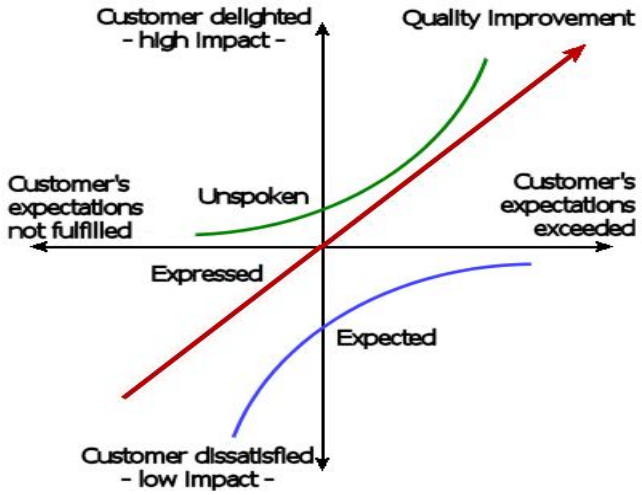

Figure 2: Kano Model

Research Methods

This study targets the supply and demand analysis mode. First, TRA eastern stations are categorized by ABC analysis to ensure cumulative in-and-out passenger numbers of each station. Next, the Kano model expresses customers' satisfaction toward the services provided for finding attractive products and then improves them. Finally, the I-S Model solves the problem of cognitive differences between service providers and customers and then offers solutions for improvement.

ABC analysis

Prioritizing items for management attention has been advocated in operations management for a long time, by normally using ABC analysis (Flores & Whybark, 1986). The well-known ABC classification is simple-to-understand, easy-to-use, and can be widely applied to inventory managers with minimal backgrounds in optimization (Ng, 2007). In the paper, we propose an extended version of the Ng model (Ng, 2007) for multiple criteria inventory classification based on the calculated in-and-out passenger numbers of a station using the ABC principle. Hadi-Vencheh (2010) point out that the Ng model is also very flexible as it could easily integrate additional information from decision makers for inventory classification. With proper transformation, we obtain the numbers without a linear optimizer (Flores & Whybark, 1987). TRA's eastern stations are categorized by ABC analysis to ensure cumulative in-and-out passenger numbers of a station (see Table 2).

Table 2: ABC Analysis to Categorize Eastern Railway Stations

Types	Items %	Sales %	Ways to categorize
A	10%	70%	Type A station has the highest percentage of cumulative in-and-out passenger numbers of any station (65.78%)
B	30%	20%	Type B station is 23.68%
C	60%	10%	Type C station is 10.54%

Improved Kano model

According to the Kano model, this study reforms the origin model (see Figure 3). The X-axis represents the average number of customer satisfaction. The Y-axis represents the correlation variable (R^2) of customer satisfaction compared to total customer satisfaction. The four quality differences are reserved (attractive, one dimension, indifference, and must be).

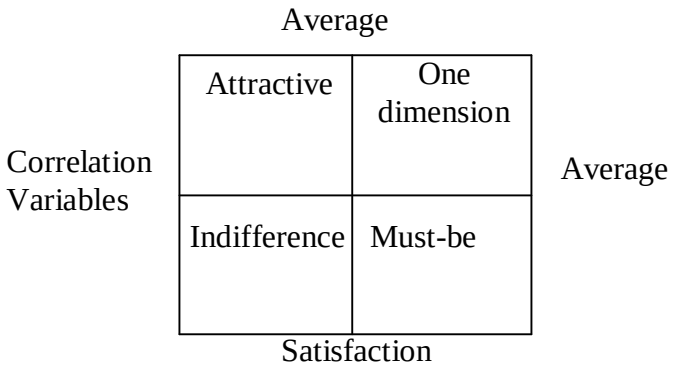

Figure 3: Reformed Kano Model

Importance-Satisfaction model

The Importance-Satisfaction model (I-S model), based on the importance and satisfaction surveys of the quality attributes, is a simple and powerful tool for enterprises to find out the excellent attributes and the "to be improved" attributes, which require improvement actions immediately (Yang, 2003). The introduction of the I-S model in this paper allows enterprises to classify the attributes straightforwardly. This study analyzes a station's extended functions and services on SPT via the aspects of supply and demand. For the supply aspect, ABC analysis defines three different types of stations and their functions. For the demand aspect, the Kano model and I-S model analyze passengers' reactions to a station's services. Both aspects are pioneering in helping to see the cognitive differences between service providers and passengers. This study does not try to offer answers, but rather provide a new way to analyze differences.

Empirical Evidence and Discussion

ABC analysis towards TRA's eastern railway stations

TRA categorizes railway stations into 6 types: special class station, first class station, second class station, third class station, simple station, and staffless station. This study adopts a simple method, ABC analysis (the so-called Pareto Analysis), to categorize 30 stations scattered on the North-link line, Hualien-Taitung Line, and South-link line in accordance with "The Master Plan for Sustainable Development of Eastern Taiwan." As per the statistical data in 2009, the stations are divided into 3 categories from their passenger cumulative in-and-out percentages: Station A (Landmark station, 65.78%), Station B (General station, 23.68%), and Station C (Local station, 10.54%) (see Figure 4).

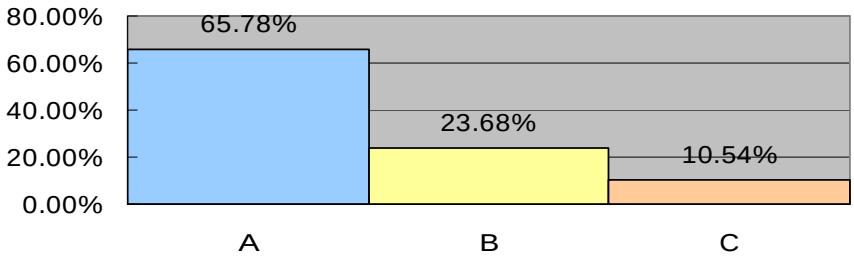

Figure 4: Station Categorizing by ABC Analysis

Table 3 presents the classifications of stations A, B, and C as well as their functions and characteristics.

Table 3: Stations A, B, and C and Station Functions

Category	Functions	Examples
Station A / Landmark Station	✓ External Connection: network between urban and rural areas ✓ Internal Function: diverse development (urban to urban)	Hualien Station: is in the city center, where there are great numbers of passengers. Hualien City is also the development center of politics, economics, and culture for the region????????.
Station B / General Station	✓ External Connection: interchange for Stations A and C ✓ Internal Function: equilibrium development (urban to suburbs)	Ruisui Station: is a general station with tourists, computer navigation system service, taxis, car rental service, hotels, etc.
Station C / Local Station	✓ External Connection: network improvement and strengthening station function ✓ Internal Function: local development (local linkage)	Zhiben Station: is a local station busy during the weekend where most passengers are local residents. Besides Mandarin Chinese, Hoklo, Hakka, and English languages, the train announcement also includes Amis language (aborigine language) (Liu, 2009).

Table 4 shows the infrastructures of stations A, B, and C, which provide seamless passenger transportation service in Hualien County.

Table 4: Stations A, B, and C as Well as Infrastructure in Hualien County

Category	Stations	Infrastructure at Stations
Station A / Landmark Station	Hualien	In Hualien, there are 4 taxi ranks, 9 car rentals, 2 bus stations, and a tourist navigation system.
Station B / General Station	Fenglin, Guangfu, Ruisui, Yuli	In Station B, there are no????? taxi ranks (besides Yuli), no bus stops (only in Yuli), and no tourist computer navigation system at all. Only car rentals are at all type B stations.
Station C / Local Station	Heping, Xincheng (Taroko), Beipu, Ji'an, Zhixue, Shoufeng, Fengtian, Nanping, Wanrong, Fuyuan, Dongli, Dongzhu, Fuli	There is no bus stop, no taxi ranks, no???? car rentals, no bicycle rentals???, and few tourist navigation systems.

Table 5 describes the infrastructures of stations A, B, and C, which provide seamless passenger transportation service in Taitung County.

Table 5: Stations A, B, and C as Well as Infrastructure in Taitung County

Category	Stations	Infrastructure at Stations
Station A / Landmark Station	Taitung	In Taitung, there are no taxi ranks, 9 car rentals, 2 bus stations, and no tourist computer navigation system.
Station B / General Station	Chishang, Guanshan	In type B station, two stations have taxi ranks and car rentals, but no bus station and no tourist computer navigation system at all. Guanshan has bicycle rentals, but Chishang does not.
Station C / Local Station	Ruiyuan, Luye, Kangle, Zhiben, Taimali, Jinlun, Longxi, Dawu, Guzhuang	Taxi ranks only at Luye and Zhiben. Car rentals only at Luye, Kangle, and Zhiben. There are no bus stations, no bicycle rentals, and no tourist computer navigation systems.

Kano model analyses

This study uses the improved Kano model to realize the correlations between passengers' satisfaction. In Figure 5, service items 3, 4, and 6 are scattered in the attractive zone, meaning they are highly correlated with satisfaction and must necessarily be improved. Service item 7 is in the one dimension zone, which should keep service quality. Service items 1, 2, 5, and 8 are in the indifference zone, implying they are not that important to passengers, but the quality of services should remain the same as before (see Table 6).

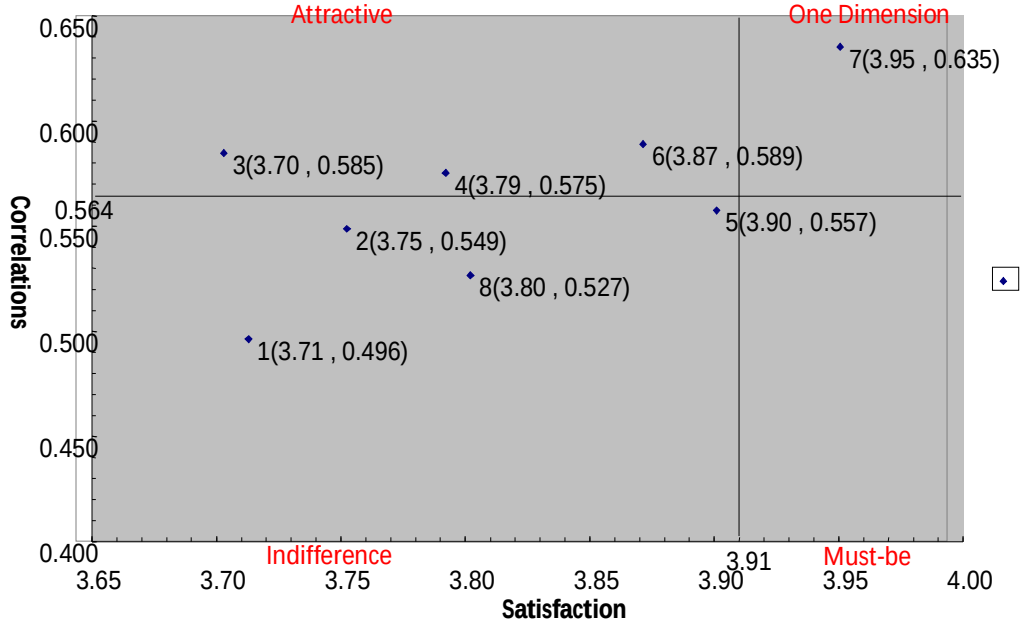

Figure 5: Kano Model Analysis of TRA Cruise Train to Hualien

Table 6: Analysis on the Kano Model

Zones	Service Items
One Dimension	7. Interactions between narrators and passengers
Attractive	3. The guidance of scenic spots around the station; 4. Easy to go to scenic spots around the station; 6. Narrators' navigating ways
Indifference	1. The arrangement of scenic spots around the station; 2. The introduction to scenic spots around the station; 5. Narrators' navigating contents; 8. Travel services of scenic spots around the station
Must-be	None

Importance-Satisfaction model (I-S model)

According to the improvement variables, the service items' order to improve is 3, 4, 1, 8, 2, 6, 7, and 5. Moreover, 3, 4, 1, and 8 are in the "to be improved zone", which means they need to be improved. The surplus zone is scattered with items 6, 7, and 5, which means though they are service surplus, their service quality still needs to be maintained (see Figure 6).

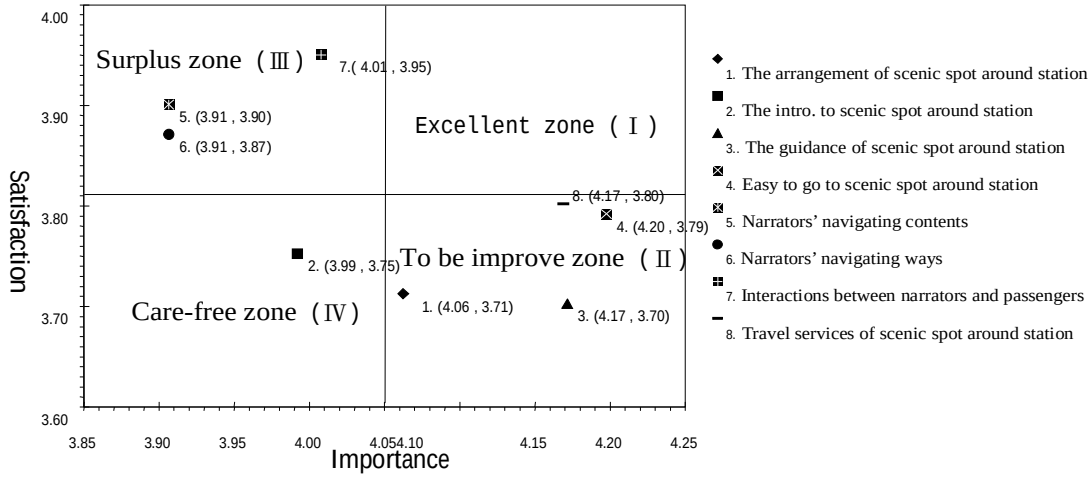

Figure 6: I-S Analysis on Hualien

In order to realize passengers' reaction and satisfaction toward a station's provided services, this study employs both the Kano model and I-S model to look for possible analysis methods for future research method construction. The research targets passengers who took the TRA cruise train, whose travel theme was titled "the travel of city culture in Hualien" on September 19, 2009. This is a return journey in which the cruise train departed from Taipei Main Station, stopped shortly at Fulong Station, finally arrived at Hualien, and then went back to Taipei directly. There were 78 effective questionnaires collected: 50 were female and 28 were male. Most tourists (75 people) live in northern Taiwan and most were taking the TRA cruise train for the first time (60 people). Table 7 shows the items to be improved.

Table 7: Service Items of Station and Arrival

1.	The arrangement of scenic spots around the station
2.	The introduction to scenic spots around the station
3.	The guidance of scenic spots around the station
4.	Easy to go to scenic spots around the station
5.	Narrators' navigating contents
6.	Narrators' navigating ways
7.	Interactions between narrators and passengers
8.	Travel services of scenic spots around the station

Discussion

In Station A/Landmark Stations, each item shown in both Table 8 and Table 9 seems to present no huge problems. However, Station B/General Stations and Station C/Local Stations lack many facilities, which influenced the willingness of tourists to come. Although ABC category analysis cannot see any demand from customers or passengers, it is still useful to see which facilities have to be improved in the future.

Table 8: Intermodal Transportation in Hualien stations

Stations	Travel and Transportation Infrastructures								Passengers' Demand			Services	
	Station types	Total Train no. of north/ south - bound lines	Trains no. for disab. 【＊1】	Taxi ranks 【＊2】	Bus stations 【＊3】	Car rentals	Hotels	Cycle rentals	Total in-and-out pass. no. of stations 【＊4】	Monthly in-and-out pass. no. of stations 【＊4】	Daily in-and-out pass. no. of stations 【＊4】	Tourist computer nav. system 【＊5】	Cruise train stops 【＊6】
Heping	C	18	6	0		0	0	No	119164	9930	326	No	5
Sincheng	C	26	10	0		0	0	Prep.	76238	6353	209	Yes	6
Beipu	C	6	0	2		7	0	No	24206	2017	66	No	7
Hualien Arr.	A	84	50	4	2	9	20	Prep.	8914461	742872	24423	Yes	13
Hualien Dep.		36	8										
Jian	C	24	8	2		0	2	No	329362	27447	902	Yes	0
Jhihsyue	C	12	4	1		0	0	No	93846	7821	257	No	0
Shoufong	C	24	8	1		0	0	Prep.	262713	21893	719	Yes	2
Fongtian	C	8	2	0		0	0	No	70376	5865	193	No	0
Nanping	C	2	0	0		0	0	No	17968	1497	49	No	0
Fonglin	B	26	6	1		1	1	No	375590	31299	1029	Yes	0
Wanrong	C	8	2	0		0	0	No	46040	3837	126	Yes	8
Guangfu	B	28	8	2		1	2	Prep.	510898	42575	1400	Yes	1
Fuyuan	C	10	4	0		0	0	No	55765	4647	153	No	0
Rueisuei	B	30	8	1		3	4	Prep.	539324	44944	1478	Yes	4
Yuli	B	36	8	0	1	2	8	Prep.	1111339	92616	3045	Yes	3
Dongli	C	8	2	0		0	0	No	32476	2706	89	No	1
Dongjhu	C	8	2	0		0	0	No	24533	2044	67	No	0
Fuli	C	28	8	0		1	0	Prep.	231225	19269	633	Yes	1

Notes:

＊1 Train no. of disab. is calculated by numbers of disable carriage settled on north/ south-bound line trains.

＊2 Taxi ranks only have independent ranks without park and ride zone.

＊3 Only independent bus stations are calculated without bus stops.

＊4 (1) Total passenger numbers of station in-and-out = exit numbers + entry numbers (TRA, 2008)

(2) Monthly passenger numbers of station in-and-out = Total passenger numbers of station in-and-out/12 (TRA, 2008)

(3) Daily passenger numbers of station in-and-out = Total passenger numbers of station in-and-out/360 (TRA, 2008)

＊5 Tourist computer navigation system is combined with 3D, which shows partly scenic pictures and maps, addresses, and introductions of 150 scenic spots in Hualien.

＊6 Cruise train stops are calculated.

Table 9: Intermodal Transportation in Taitung stations

Stations	Travel and Transportation Infrastructures								Passengers' Demand			Services	
	Station types	Total train no. of north/ south-bound lines	Train no. of disab. 【＊1】	Taxi ranks 【＊2】	Bus stations 【＊3】	Car rentals	Hotels	Cycle rentals	Total in-and–out pass. no. of stations 【＊4】	Monthly in-and–out passenger no. of stations 【＊4】	Daily in-and–out Pass. no. of stations 【＊4】	Tourist computer nav. system 【＊5】	Cruise train stops 【＊6】
Chihshang	B	30	8	1		2	5	No	369024	30752	1011	No	2
Guanshan	B	32	8	1		2	4	**Yes**	535393	44616	1467	No	1
Rueiyuan	C	10	4	0		0	1	No	61250	5104	168	No	0
Luye	C	22	8	1		2	1	Prep.	149914	12493	411	No	1
Taitung	A	36	8	0	2	9	1	Prep.	3836283	139690	10510	No	1
Kangle	C	18	6	0		1	0	No	2095	175	6	No	0
Jhihben	C	32	8	2		2	2	No	56718	4727	155	No	1
Taimali	C	24	8	0		0	3	No	20533	1713	56	No	2
Jinlun	C	18	6	0		0	0	No	6385	532	17	No	3
Longsi	C	16	6	0		0	0	No	3820	318	10	No	4
Dawu	C	24	8	0		0	0	No	30473	2539	83	No	5
Gujhuang	C	4	0	0		0	0	No	111	9	0	No	6

Notes:

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＊5 Tourist computer navigation system is combined with 3D, which shows partly scenic pictures and maps, address, and introduction of 150 scenic spots in Hualien.

＊6 Cruise train stops are calculated.

The Kano model shows the attractive quality zone where items 3, 4, and 6 necessarily and immediately need to be kept up and improved. On the other hand, the I-S model tells the different points of view in customers' minds, showing the importance and satisfaction on items 1, 3, 4, and 8, which are in the "to be improved zone". Both methods are convincing enough to make strategies by different aspects. Moreover, it is worth noticing that this study provides integrative ways to measure and find out what TRA should do, but it is still not a solid solution. This study provides a way on how to adapt to a dynamic ever-changing world (see Table 10).

Table 10: I-S Analysis on Station and Arrival Services

Service Items	**I**	**S**	**Improvement Variable**	**Zones**
3. The guidance of scenic spots around the station	4.17	3.70	-0.11	To be improved zone
4. Easy to go to scenic spots around stations	4.20	3.79	-0.10	To be improved zone
1. The arrangement of scenic spots around stations	4.06	3.71	-0.09	To be improved zone
8. Travel services of scenic spots around stations	4.17	3.80	-0.09	To be improved zone
2. The introduction to scenic spots around the stations	3.99	3.75	-0.06	Care-free zone
6. Narrators' navigating ways	3.91	3.87	-0.01	Surplus zone
7. Interactions between narrators and passengers	4.01	3.95	-0.01	Surplus zone
5. Narrators' navigating contents	3.91	3.90	0.00	Surplus zone

Conclusion and Suggestions

Conclusion

In comparison to intermodal freight transportation in the U.S. or intermodal passenger transportation in Europe, the development of an intermodal passenger transportation system in Taiwan continues to be improved. Passenger transportation in Taiwan will benefit from intermodal initiatives taken up by both the public and private sectors.

In conjunction with other strategies to develop new technologies, improve operational efficiency, and enhance capacity, an intermodal approach helps solve many of the problems that plague Taiwan's passenger transportation system. Taiwan's eastern railway stations have been listed as important items that need improvement, following the details of "The Master Plan of Eastern Taiwan Sustainable Development" that state: "rail transportation mainly, road transportation secondly, and strengthening seamless transportation services". However, according to the statistics, no matter for the supply aspects or demand aspects, seamless passenger transportation for the eastern stations requires large-scale upgrading. Since problems may change at different times, this study does not intend to provide a result to solve dynamic problems, but instead offers a pioneer analysis method for seamless passenger transportation research. In other words, a station that provides seamless passenger transportation can be considered as supply, while passengers' importance and satisfaction can be considered as demand. By using ABC analysis, the Kano model, and the I-S model, service provides can realize what items are deficient and what passengers want. If such a method can be constructed, it will not be difficult to solve the cognitive differences between service providers and passengers.

Suggestions

This study is aimed at railway stations, their provided services, and customers' satisfaction. We offer the following strategies.

1. Review station functions and strengthen SPT

For infrastructures, no matter whether stations A, B, or C lack public transport, taxi ranks, car rentals, bicycle rentals, and/or tourism computer navigation systems, TRA should improve the all-round services so that seamless passenger transportation can be strengthened on a grand scale.

2. Raising passenger satisfaction and railway usage

According to the Kano model analysis, the cruise train service items in the attractive zone must be improved at once. These items include increasing scenic spot guidance, making easier planning for customers, and training navigators to have better narration and interaction skills, so that customers may enjoy high quality services.

3. Paying more attention to the "to be improved items" and perfecting SPT

In the I-S model analysis, the "to be improved zone" items imply that they need to be improved. Aside from some items that the Kano model lists, arranging tours of scenic spots due to different customer preferences and finalizing the set-up of tourism computer navigation systems can also satisfy some customer demands.

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