IMPORTANCE-SATISFACTION ANALYSIS OF RAIL SERVICES IN THE UK WITH RESPECT TOTRAVEL TIME USE

Yosritzal
Lecturer
Department of Civil,
Faculty of Engineering
Andalas University
Kampus Unand Limau Manis
Padang, 25163
Telp: (0751) 72496
yosritzal@gmail.com

Dilum Dissanayake
Lecturer in Transport Modelling
Transport Operation Research
Group (TORG)
Newcastle University
Newcastle Upon Tyne, NE1 7RU
dilum.dissanayake@ncl.ac.uk

Margaret Bell
Science City Professor of
Transport and Environment
Transport Operation Research
Group (TORG)
Newcastle University
Newcastle Upon Tyne, NE1 7RU
margaret.bell@ncl.ac.uk

Abstract

The availability of information and communication technology such as Wi-Fi and electric socket on-board is expected to change consumer attitude and behaviour toward rail services as time spent travelling could be more productive and enjoyable. However, do the availability of Wi-Fi and electric power socket on-board were more importance than other performance attributes in consumers' perception? This paper presents the result of an importance-satisfaction analysis of several attributes of train services in the UK. The study found that ticket price; reliability and seating guarantee were more importance than other attributes whilst Wi-Fi and electric socket were less importance. The results indicated that travel time use is just a complementary of the main objective of travel, which is to arrive at the destination.

Keywords: importance-satisfaction analysis, performance, rail services.

INTRODUCTION

The advancement in information and communication technology is raising a hope that travel time can be used for more productive and enjoyable activities such as working on computer, browsing internet, accessing social media, and shopping on-line (Lyons and Urry, 2005). Therefore, some train operators facilitated those activities by providing Wi-Fi and electric power socket on-board of their train. Given that most of cellular operators are providing internet access through their cellular data services such as through 3G and 4G broadband, do the Wi-Fi access and electric power socket still needed by their consumers? Moreover, will the money invested by train operators to provide Wi-Fi access and electric power socket on-board give them more benefit and increase their patronage? An Importance-Satisfaction Analysis (ISA) might provide the information to answer the questions.

Importance-Satisfaction Analysis (ISA) is one of the tools that provide information of consumer opinion about the level of importance and their satisfaction of the evaluated attributes. It is importance for train operators to take more attention on the most importance attributes with low satisfaction level rather than investing in a less importance attributes. This paper presents an importance-satisfaction analysis of rail services attributes with respect to availability of information and communication technology making possible to spend travel time more productively and enjoyable.

An overview of the ISA is presented in section 2 followed by methodology framework of this research in section 3. Section 4 presents data description and section 5 presents data analysis and discussion. Finally, conclusion drawn from the analysis is presented in section 6.

OVERVIEW OF THE IMPORTANCE-SATISFACTION ANALYSIS (ISA)

The Importance-Satisfaction Analysis (ISA) is an extension of The Importance-Performance Analysis (IPA) tool employed to evaluate the priority among several issues, based on the preferences of the consumer. The analysis can be used to establish the degree of impact on consumer satisfaction against the level of importance of an intervention (Martilla and James, 1977; Graf *et al.*, 1992).

The ISA (or IPA) has been previously applied in many research areas such as tourism (Sorensson and Friedrichs, 2013; Coghlan, 2012; Tonge and Moore, 2007; Arabatzis and Grigoroudis, 2010), bank services, industry (Lo *et al.*, 2012; Matzler *et al.*, 2004; Hu *et al.*, 2009), and education (Wang and Tseng, 2011; Lewis, 2004). The method was also applicable in the research of public transport such as in Yahya and Bell (2011) and Freitas (2013). In rail transportation research, Chou *et al.* (2011) employed the ISA to understand passengers' perceptions of the high-speed rail performance in Taiwan and Korea to be able to identify the top-priority quality that needed to be addressed to improve customer satisfaction.

Figure 1. Importance-satisfaction assessment matric (Graf *et al.*, 1992)

The first step in carrying out ISA is to generate a list of attributes of the services that are relevant to the objective of the study. The second step is to collect data where respondents are asked to rate on the Likert-scale, the degree of the importance and their satisfaction with each of the attributes. According to Martilla and James (1977), a five- or seven-point scale will yield a good spread of ratings. The third step is to calculate the central tendency of the rating for each attribute. Theoretically, median values are more preferable, however, Martilla and James (1977) argue that both the median and mean values can be used because referring to Martilla and Carvey (1975), minor violations of the interval scale assumption are not considered to be serious, especially when the mean and median values are consistently appear reasonably close. The fourth step is to plot the central tendency values on a four quadrants separated by a cross hair line as shown in **Figure 1** as proposed by Graf *et al.* (1992) and Martilla and James (1977).

The graph is two-dimensional where the importance scale represents the vertical axis and the satisfaction scale constitutes the horizontal axis. Attributes residing in the first quadrant

(top right) exhibit those attributes with high importance and high satisfaction as perceived by the consumer. For these attributes, level of service provision or response to consumer issues should continue to be maintained and thus labelled "*keep up the good work*". Attributes in the second quadrant are those attributes considered to have a lower level of importance and a higher level of satisfaction. These attributes are exceeding expectations and could be considered potentially "*overkill*".

Yahya and Bell (2011) on a study of Quality Bus Partnership (QBP) reported that there is a possibility that the attributes fall in the overkill quadrant because expectation is met and therefore, customers are satisfied, or that the reason why these attributes are considered of lower importance is because of item high satisfaction. Therefore it follows that a lapse in service quality may result in a shift into either quadrant III or IV. The attributes in the third quadrant are considered of lower importance and lower satisfaction. These attributes are less important and less satisfied and labelled a "*low priority*". In the last quadrant attributes have a higher level of importance and lower level of satisfaction and labelled as "*concentrate here*", suggesting that to obtain maximum benefit from expenditure of resources and/or managerial attention, items in this quadrant should be given top priority in any intervention effort. However, Graf *et al.* (1992) notified that the one intervention might positively impact more than one item at any quadrant.

The most commonly used approach in defining the cut-off points to establish the four quadrants found from the previous studies was using the grand means of all attributes such as in Graf *et al.* (1992); Lo *et al.* (2012); Sorensson and Friedrichs (2013). Another study used of the mid-point of the Likert-scale (e.g. three for a five point scale) and the mid-point of the observed data (e.g. four when data spread between three and five) as a cross-hair line such as Lewis (2004). Oh (2001) carried out a critical review on the use of actual means and mid-point of Likert-scale as the cross-hair point in several studies and concluded that the use of the mid-point of the Likert-scale is when attempting to compare the importance to the performance. However, when attempting to conduct a relative interpretation of attributes within importance and performance, the actual means was recommended.

An inconsistency was found in previous studies where Graf *et al.* (1992); Lo *et al.* (2012); Sorensson and Friedrichs (2013); Freitas (2013); Chou *et al.* (2011); Wang and Tseng (2011); Coghlan (2012); Tonge and Moore (2007); and Hu *et al.* (2009) put the importance scale on the vertical axis and the satisfaction on the horizontal axis, whilst Arabatzis and Grigoroudis (2010); Matzler *et al.* (2004); and Yahya and Bell (2011) put the importance scale on the horizontal axis and the performance scale on the vertical axis. However, the different in assigning the scale on the axis did not influence the interpretation of the results.

In this study, the Importance-Satisfaction Analysis was used to investigate respondents' opinions about several variables related to train services in the information and communication era.

METHODOLOGY FRAMEWORK

In order to achieve the objectives of this study, a framework for the methodology was developed. Along with the socio-demographic of respondents' data, their activities whilst travelling and their opinion to the presented statements were also collected during the survey. There were 15 statements related to train services attributes presented in this study. Likert-scale technique was used in accessing respondents' response to each statement. The statements were:

1. Availability of real-time information (online and at station)
2. Availability of Wi-Fi on train
3. Availability Wi-Fi at station
4. Frequency of train services
5. Able to guarantee a seat
6. Electric power socket
7. Availability of quiet coach
8. Reliability of train services
9. Availability of catering services such as buffet car and/ or trolley
10. Easily accessible services in the station
11. Easily accessible facilities
12. Easily accessible transport links to and from station
13. A waiting room at station
14. Direct train services
15.

For each statement, respondents were asked to show their opinion on the level of importance of the attribute for them and their satisfaction to the current condition of attribute. Kolmogorov-Smirnov and Saphiro-Wilk tests were employed to evaluate the response is normally distributed or not. Mean of the responses will be use to represent the data in ISA if the data is normally distributed, otherwise, the median will be used.

In ISA, each attribute was placed in the corresponding coordinate where the axis (X) represented level of importance and the ordinate (Y) represented the level of satisfaction. Based on the position of the point in the coordinate, the attribute can be evaluated in four categories such as very importance and low satisfaction, very importance and high satisfaction, less importance and high satisfaction, and less importance and low satisfaction. For each category, a recommended action is proposed.

DATA DESCRIPTION

Data for this study was collected on-board of East Coast Mainline trains travelling between Newcastle and London. Respondents were approached and asked whether they would participate in the study or not. Those who agreed to participate were given the questionnaire form to complete. As much as 266 usable responses were collected during the survey. The total number of samples on the southbound (Newcastle to London) and the northbound journey (London to Newcastle) were almost equal. About 66% of the data were collected on the weekdays and the rest were collected on the weekend.

In terms of age, 64% of the respondents were in the range of 25-54 years old, 19% under 25, 23% were 55 or over and the rest were preferred not to say. From the gender perspective, 56% were male and 44% female. The figures were compared with the UK population of 49% and 51%, male and female, respectively (Office for National Statistics, 2011). About 78% of them are either employed or self-employed. The data reflected the type of service mainly being for business, which explained the higher proportion of males.

Regarding the activities conducted whilst travelling, respondents were asked to choose one or more activities in which they were engaged and also to choose which one of those selected was the main activity. **Table 1** shows the activities of respondents during the journey.

Table 1. Activities conducted during the journey (only activities engaged by more than 5% respondents is presented)

No	Activity	Frequency$^\alpha$	Percentage (%)	Main Activity$^\beta$	Percentage (%)
Electronic based activities (EB)					
1	Working on computer	47	17.7	16	6.0
2	Reading/Writing e-mails	115	43.2	18	6.8
6	Text messaging/making phone calls	177	66.5	16	6.0
7	Listening to Radio/Music	50	18.8	14	5.3
Non-electronic based activities (NEB)					
13	Reading printed book/ magazine/newspaper for leisure	184	69.2	111	41.7
15	Chatting with other passengers	58	21.8	14	5.3
Personal engagement activities (PE)					
18	Enjoying the view	157	59.0	23	8.6
19	Thinking	167	62.8	16	6.0

$^\alpha$ Participant can choose more than one activities.

$^\beta$ Participant chooses one activity that spent most of travel time

In this study, the activities were differentiated into 3 groups i.e. electronic based (EB), non-electronic based (NEB) and personal engagement (PE). Electronic based activities are activities that are conducted using one or more electronic devices such as a laptop, mobile phone, and multimedia player. Non-electronic based activities are the activities that require an interaction with other passengers or a non-electronic device such as using a pen and paper, reading a book/magazine/newspaper, chatting with other passengers, and eating or drinking. Personal engagement activities are those that can be conducted without involving other passengers or any devices. Such activities include enjoying the view, sleeping and thinking. Being bored or anxious is included in personal activities. The NEB activity was the most reported activity followed by EB and PE. Interestingly 29% of responders were engaged in an EB activity, whilst just over half (52%) an NEB activity. Almost a fifth (19%) took part in a PE activity.
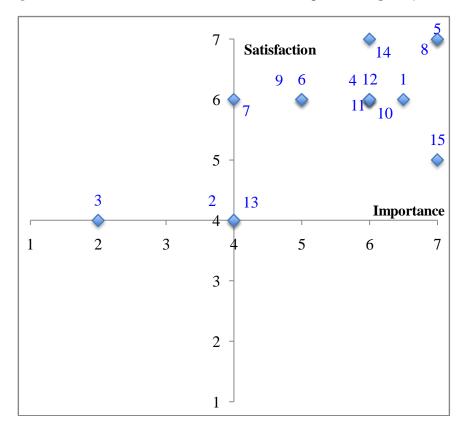
THE IMPORTANCE-SATISFACTION ANALYSIS (ISA)

The importance and satisfaction analysis (ISA) in this section aimed to investigate the importance of attributes related to the electric devices compared to other attributes and how satisfied the responders were with the attributes. Kolmogorov-Smirnov and Saphiro-Wilk tests confirmed that the distribution of the responses for each attribute data was statistically significantly different from normal; therefore the median was used in the further analysis as shown in **Table 2**. As discussed in previous section, ISA was carried out to compare the importance to the satisfaction of responders and therefore, the mid-point of the Likert-scale was used as the cross hair as was suggested by Oh (2001). **Figure 2** shows the results of the ISA.

Table 2. The mean and median of the Likert-score of *importance* and *satisfaction*

Attribute of train services	Importance	Satisfaction
Availability of real-time information (online and at station)	7	6
Availability of Wi-Fi on train	4	4
Availability Wi-Fi at station	2	4
Frequency of train services	6	6
Able to guarantee a seat	7	7
Electric power socket	5	6
Availability of quiet coach	4	6
Reliability of train services	7	7
Availability of catering services such as buffet car and/ or trolley	5	6
Easily accessible services in the station	6	6
Easily accessible facilities	6	6
Easily accessible transport links to and from station	6	6
A waiting room at station	4	4
Direct train services	6	7
Ticket price	7	5

In **Figure 2** the median of the Likert score of each attribute over all responders were plotted for *satisfaction* (*y* axis) as a function of *importance* (*x* axis). The axes or cross hairs mark the mid-point of the Likert-scale of all the scores over all respondents and over all 15 attributes for *importance* (x) and *satisfaction* (y). The numbers alongside the points label each attribute as defined in the key. In this way, this two dimensional grid illustrates perceived *importance* and how satisfied customers were against the *quality* attributes.

Key:

1	Availability of real-time information (online and at station)	9	Availability of catering services such as buffet car and/ or trolley
2	Availability of Wi-Fi on train	10	Easily accessible services in the station
3	Availability Wi-Fi at station	11	Easily accessible facilities
4	Frequency of train services	12	Easily accessible transport links to and from station
5	Able to guarantee a seat	13	A waiting room at station
6	Electric power socket	14	Direct train services
7	Availability of quiet coach	15	Ticket price
8	Reliability of train services		

Figure 2. Importance-Satisfaction Analysis using median of the Likert score.

Figure 2 shows that all scores for the satisfaction were above the mid-point of the Likert scale suggesting that the quality of the attributes were acceptable and satisfied the responders except for attribute number 3 (the availability of Wi-Fi at station). This is reasonable because the Wi-Fi service at the station was not available at the time when interview was carried out, however, it was not considered as important for the responders. It is clear that the attributes related to the electronic devices such as Wi-Fi services either on board (attribute number 2) or at stations (attribute number 3) and electric power sockets on board (attribute number (6) were not so important for the responders compared to other attributes such as reliability, ticket price and guarantee of a seat. However, **Figure 2** shows that the score for most of the attributes were 5 or more suggesting that responders were satisfied with the services. An improvement is required for the attribute of travel cost because the attribute is very important but the satisfaction level is the lowest among the most important attributes.

An exploration to examine the skew in the data confirmed that for those attributes related to the electronic devices, the data were skewed to the left (approaching 1) for the *importance* whilst for the *satisfaction*, the skew was very low for attribute number 2 and 3 and skewed to the right for the attribute number 6. As discussed earlier in this section, it is reasonable that the satisfaction of the Wi-Fi service at the station (attribute number 3) cannot be evaluate by responders, as it was not available at the time. However, for the attribute number 2, that responders were neither satisfied nor dissatisfied might be because they did not use the service, as they already had internet access through their smart phone. The availability of the electric power socket on board was fairly important for responders and they were satisfied with the service, as the data were skewed to the right.

There was a doubt whether the profiles of the *importance* and the *satisfaction* were influenced by the main activity of responders (EB, NEB and PE as defined in **Table 1**), and therefore a contingency table analysis was carried out. The results are presented in **Table 3** and **Table 4**.

Table 3. Contingency table for the importance of the attribute related to electronic devices and main activity of responders

Main activity	Number of response by score							Total
	1	2	3	4	5	6	7	
	Less importance				Very importance			
1. Availability of Wi-Fi on trains								
EB	12	6	6	10	11	15	13	73
NEB	48	12	13	20	19	11	14	137
PE	15	7	5	6	7	1	4	45
Total	75	25	24	36	37	27	31	255
Pearson Chi-square Significance								0.04
2. Availability of Wi-Fi at stations								
EB	25	9	12	12	7	1	7	73
NEB	63	20	12	16	11	6	7	135
PE	16	5	10	6	2	2	4	45
Total	104	34	34	34	20	9	18	253
Pearson Chi-square Significance								0.30
3. Availability of electric power socket on boards								
EB	7	4	4	9	7	13	29	73
NEB	22	11	13	14	29	21	28	138
PE	10	3	7	7	7	8	3	45
Total	39	18	24	30	43	42	60	256
Pearson Chi-square Significance								0.00

Table 4. Contingency table for the satisfaction of the attribute related to electronic devices and main activity of responders

Main activity	Number of response by score							Total
	1	2	3	4	5	6	7	
	Less satisfied				Very satisfied			
1. Availability of Wi-Fi on trains								
EB	7	3	3	20	11	9	16	69
NEB	14	6	9	43	13	16	11	112
PE	5	4	6	7	2	5	4	33
Total	26	13	18	70	26	30	31	214
Pearson Chi-square Significance								0.11
2. Availability of Wi-Fi at stations								
EB	9	2	3	26	8	9	8	65
NEB	14	9	4	52	14	9	5	107
PE	8	3	3	10	2	3	3	32
Total	31	14	10	88	24	21	16	204
Pearson Chi-square Significance								0.46
3. Availability of electric power socket on boards								
EB	8	1	1	7	5	10	40	72

Pearson Chi-square Significance								0.46
3. Availability of electric power socket on boards								
NEB	9	2	4	19	17	28	45	124
PE	3	1	1	6	2	7	16	36
Total	20	4	6	32	24	45	101	232
Pearson Chi-square Significance								0.07

Pearson Chi-square test confirmed that the main activity closely related to the level of importance of the availability of Wi-Fi and electric power sockets on the train and this is statistically significant at the 95% level of confidence. Those who engaged in EB tend to place a higher score on those attributes. However, the response to the availability of Wi-Fi at a station was not statistically significantly different between the groups. Pearson Chi-square test also confirmed that different in responses of the satisfaction to the attributes 2, 3 and 6 was not statistically significantly different at the 95% level of confidence. Table 4 shows that most of the responses lied in the mid values (4) suggesting that respondents was not be able to decide whether they were satisfied or unsatisfied with the attributes because they did not use the service or they expect more improvement.

CONCLUSION

The perception of respondents towards attributes of train services has been examined using ISA. The following findings can be drawn from the study carried out:

1. Regardless the activity of respondents during the journey, the most importance attributes were reliability of train services, able to guarantee a seat and ticket price, whilst the attributes related to travel time use such as the availability of Wi-Fi and electric socket on-board were less importance compared to other attributes.
2. Overall, level of satisfaction of respondents towards the most importance attributes were high except for ticket price suggesting that respondents demanded the ticket pricing policy to be reviewed.
3. The availability of free Wi-Fi and electric socket on-board were more importance for those who engaged in EB activity compared to those who engaged in NEB and PE activity suggesting that there were a segment of users who demanded facilities to conduct more productive and enjoyable activities.

Based on the conclusions above, it is recommended to train operators to investigate further the characteristics of the users who demanded the facilities in order to provide a more effective policy. There is also a possibility that the reliability of the Wi-Fi provided is lower than users' expectation therefore they preferred to use their personal broadband service provided by their cellular operator. In this case, the improvement of the reliability of the Wi-Fi services might increase the number of users.

REFERENCES

Arabatzis, G. and Grigoroudis, E. (2010) 'Visitors' satisfaction, perceptions and gap analysis: The case of Dadia-Lefkimi-Souflion National Park', *Forest Policy and Economics*, 12, pp. 163-172.

Chou, J. S., Kuo, T. C. and Ou, N. C. (2011) 'Deploying effective service strategy in the operations stage of high-speed rail', *Transportation Research E*, 47, pp. 507-519.

Coghlan, A. (2012) 'Facilitating reef tourism management through an innovative importance-performance analysis method', *Tourism Management*, 33(767-775).

Freitas, A. L. P. (2013) 'Assessing the quality of intercity road transportation of passengers: an exploratory study in Brazil', *Transportation Research Part A*, 49, pp. 379-392.

Graf, L. A., Hemmasi, M. and Nielsen, W. (1992) 'Importance-Satisfaction Analysis: A diagnostic tool for organizational change', *Leadership & Organization Development Journal*, 13(6), pp. 8-12.

Hu, H. Y., Lee, Y. C., Yen, T. M. and Tsai, C. H. (2009) 'Using BPNN and DEMATEL to modify importance-performance analysis model - A study of computer industry', *Expert System with Application*, 36, pp. 9969-9979.

Lewis, R. (2004) 'Importance-performance analysis', *Australasian Journal of Engineering Education*, 02.

Lo, C. C., Wang, C. H., Chien, P. Y. and Hung, C. W. (2012) 'An empirical study of commercialization performance on nano products', *Technovation*, 32, pp. 168-178.

Martilla, J. A. and Carvey, D. W. (1975) 'Four subtle sins in marketing research', *Journal of Marketing*, 39(1), pp. 8-15.

Martilla, J. A. and James, J. C. (1977) 'Importance-Performance Analysis', *The Journal of Marketing*, 41(1), pp. 77-79.

Matzler, K., Bailom, F. and Hinterhuber, H. H. (2004) 'The asymetric relationship between attribute-level performance and overall customer satisfaction: a reconsideration of the importance-performance analysis', *Industrial Marketing Management*, 33, pp. 271-277.

Oh, H. (2001) 'Revisiting importance-performance analysis', *Tourism Management*, 22, pp. 617-627.

Sorensson, A. and Friedrichs, Y. v. (2013) 'An importance-performance analysis of sustainabie tourism: A comparison between international and national tourists', *Journal of destination marketing and management*, 2, pp. 14-21.

Tonge, J. and Moore, S. A. (2007) 'Importance-satisfaction analysis for marine-park hinterlands: A Western Australian case study', *Tourism Management*, 28, pp. 768-776.

Wang, R. and Tseng, M. L. (2011) 'Evaluation of international student satisfaction using fuzzy importance-performance analysis', *Procedia: Social and Behavioural Sciences*, 25, pp. 438-446.

Yahya, N. and Bell, M. C. (2010) 'Assessment of service quality and satisfaction from passengers' perspective to inform bus operator decision making', *UTSG 42nd Annual Conference*. University of Plymouth, January 5-7, 2010.