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Factors Affecting Customer Satisfaction of the Wi-Fi Services

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Abstract

Measuring the quality of service and customer satisfaction is ultimately important for ISPs to remain in business. In order to achieve a good quality of service, understanding the two-way relationship among customers in a variety of patterns of quality of service is crucial. Three methods of analysis namely; Penalty Rewards Contrast Analysis (PRCA), Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) were used in the analysis to identify the causes of the main problems that affect the level of customer satisfaction. For the PRCA analysis, factors that were categorized as one-dimensional are service quality, promotion, as well as payment of bills of paid Wi-Fi services and the promotional factor of free Wi-Fi services. Based on the IPA results, there were eight attributes for paid Wi-Fi services and four attributes of free Wi-Fi services in the first quadrant. These attributes are important but their performance are low. Therefore, these attributes need to be emphasized further to increase their level of performance. Meanwile, the CSI analysis showed that all five factors are found to be at a good level and being categorized in the indifferent zone.

Keywords: Wi-Fi; customer satisfaction Index; penalty reward contrast analysis; important performance analysis

Abstrak

Pengukuran kualiti perkhidmatan dan kepuasan pelanggan adalah sangat penting bagi ISP untuk kekal dalam perniagaan. Bagi mencapai kualiti perkhidmatan yang baik, memahami hubungan dua hala di kalangan pelanggan di pelbagai corak kualiti perkhidmatan adalah penting. Tiga kaedah analisis iaitu Analisis Kontras Hukuman Ganjaran (PRCA), Analisis Kepentingan Prestasi (IPA) dan Indeks Kepuasan Pelanggan (CSI) telah digunakan dalam analisis bagi mengukur kepuasan pelanggan untuk mengenal pasti punca masalah utama yang memberi kesan kepada tahap kepuasan pelanggan. Untuk analisis PRCA, faktor-faktor yang telah dikategorikan sebagai satu dimensi adalah faktor kualiti perkhidmatan, kenaikan pangkat, serta pembayaran bil-bil perkhidmatan Wi-Fi berbayar dan faktor promosi perkhidmatan Wi-Fi percuma. Berdasarkan keputusan IPA, terdapat lapan atribut untuk perkhidmatan Wi-Fi berbayar dan empat atribut bagi perkhidmatan Wi-Fi percuma berada dalam kuadran pertama. Atribut-atribut ini didapati penting tetapi prestasi mereka adalah rendah. Oleh itu, atribut-atribut ini perlu diberi penekanan untuk meningkatkan lagi tahap prestasi mereka. Manakala, analisis CSI pula menunjukkan bahawa kesemua lima faktor didapati berada pada tahap yang baik dan yang dikategorikan dalam zon acuh tak acuh.

Kata kunci: Wi-Fi; indeks kepuasan pelanggan; analisis kontras penalti ganjaran; analisis kepentingan prestasi

1.0 INTRODUCTION

In recent years, wireless technology often get the attention around the world. In Malaysia, this technology is expected to be the answer to the problem of very low broadband access. In addition to the 3G technology for high speed data network based on mobile phones, there is also Wireless Fidelity (Wi-Fi) or Wireless Local Area Network (WLAN) which is a wireless technology based on computer network using the IEEE 802.11 standard, used to connect people and machines. The latest wireless technology WiMax is said to beat the technology of 3G because of its wider network coverage and greater speed.

In Malaysia, free Wi-Fi services highly attract users to access the Internet at hotspot places. With the free access, many shopping complexes have successfully attracted customers to their places. Basically, the management of the complex will pay the Internet Service Provider (ISP) to open an access point to the public without charging them on login/entry pass. With the access paid by the management of the complex to the ISP, customers are able to access the Internet within the access point area freely.

In this study, Broadband Wireless Wi-Fi has been chosen as the scope to examine the satisfaction of the Wi-Fi service. A plethora of research on customer satisfaction can be found in the literature. Among them are Svein (2002), Patterson, Johnson and Spreng (1997) and Joseph, Brady and Hult (2000). The purpose of the research reported here is to measure customer satisfaction on the quality of Wi-fi services, and to identify the factors that would enhanced the quality of Wi-Fi services in Klang Valley, Malaysia by using the Importance-Performance Analysis, the Penalty Reward Contrast Analysis and Customer Satisfaction Index.

2.0 METHODOLOGY

400 respondents were randomly selected at hotspots around Klang Valley, Kuala Lumpur. The respondents, all of whom are Wi-Fi service users, are between 15 and above of age, and each possessed a laptop/notebook or personal digital aid (PDA).

In this study, the collected data were analyzed using three methods namely the Penalty-Reward Contrast Analysis (PRCA), Importance Performance Analysis, and Customer Satisfaction Index (CSI).

2.1 Penalty-Reward Contrast Analysis (PRCA)

The Penalty-Reward Contrast Analysis (PRCA) was introduced by Brandt (1987). This analysis is used to study the impact of the low or high performance of an attribute towards customer satisfaction. Two concerns that need to be present prior to performing this analysis are the performance level of each attribute and the overall satisfaction level. PRCA uses the multiple regression analysis. The dependent variable is the overall satisfaction level while the independent variables are the factors being studied. The results from PRCA show the influence of performance of each attribute on the level of customer satisfaction.

There are four classifications of factors being studied; attractive, must-be, one-dimensional, and indifferent. These factors are classified using the comparison between customers' overall satisfaction and its performance as stated below:

Must-be: Significant for low-medium performance, not significant for high-medium performance.
One-dimensional: Significant for both low-medium and high medium performances.
Attractive: Not significant for low-medium performance, significant for high-medium performance.
Indifferent: Not significant for both low-medium and high-medium performances.

2.2 Importance-Performance Analysis (IPA)

The Importance-Performance Analysis first introduced by Martilla and James (1977), consists of two components, namely, the quadrant analysis and gap analysis. Using the quadrant analysis, the respondent's feedback on the plotted levels of importance and satisfaction attributes is obtained. Meanwhile, the gap analysis is used to identify the gap between an attribute's satisfaction and its importance to customers.

For the purpose of this study, the quadrant analysis were used in identifying the factors that need to be observed in order to improve a performance so that they can increase the level of customer satisfaction. The IPA has four quadrants as shown in Fig. 1, that determine the actions that need to be taken after the graph of importance and satisfaction mean (Hudson & Shephard, 1998) is plotted. The quadrant are divided into four quadrant by dividing it with overall mean score of importance and overall mean score of satisfaction. The mean score for each factor being studied can be identified to be either in the quadrant that has low importance and performance, or high importance and performance. Each quadrant explains the level of importance and satisfaction of each attribute (Brandt, 1988). This method is able to identify the strengths and weaknesses of a particular service (Ahmad Mahir et al. 2007).

Quadrant I: High importance and low performance. Emphasis is needed in the effort to increase the attribute's performance.
Quadrant II: High importance and performance. The attribute needs to be maintained at this good state.
Quadrant III: Low importance and performance. The attribute needs no priority for improvement.
Quadrant IV: Low importance and high performance. Emphasis needed in the effort to enhance the attribute's importance.

Importance		
	Quadrant I Result: Not good but attribute very important Action: Emphasized	**Quadrant II** Result: Very good & very important Action: Maintain performance
	Quadrant III Result: Not good & not important Action: Low priority	**Quadrant IV** Result: Very good although attribute less important Action: Waste
	Performance	

Figure 1 Importance-Performance Analysis

2.3 Customer Satisfaction Index (CSI)

Customer satisfaction is a total measurement of the conditions set by customers on the merit that is delivered by an enterprise. In order to identify the level of customer satisfaction, a survey was conducted and the collected data were analyzed using the Customer Satisfaction Index (CSI). The quality of service of a particular company can be enhanced or maintained based on the results of the CSI analysis. Moreover, CSI can also determine the overall level of Wi-Fi user satisfaction by combining all performance factors that are achieved by Internet service providers. The calculation for obtaining the Customer Satisfaction Index (CSI) are as follow:

1. Obtain the weighted importance score, $W_{ij} = \frac{K_{ij}}{\sum_{i=1}^{n} K_{ij}}$ with K_{ij} being the importance score for attribute *j* for respondent *i*.

2. Then, obtain a weighted satisfaction score for each attribute, $P_{ij} = W_{ij} \times \text{satisfaction score}_{ij}$, where P_{ij} is the weighted satisfaction score for attribute *j* for respondent *i*.

3. Calculate the total weighted satisfaction score for each respondent with $X_i = \sum_{i=1}^{n} P_i$ in which X_i is the total weighted satisfaction score for respondent *i*.

4. Obtain Customer Satisfaction Index of each respondent with $CSI_i = \frac{x_i}{7} \times 100$.

3.0 RESULTS AND DISCUSSION

In Table 1, it is found that the registration service and customer service factors show significant value for low-medium performance and non-significant for high-medium performance. Thus, both factors are categorized as must-be. A must-be factor is a factor that is necessary. Its absence will lead to customer dissatisfaction but it does not show any impact on customer satisfaction when it is fulfilled.

Table 1 ANOVA test on each factor of paid services

Factor	Low-medium performance		High-medium performance		Factor category
	p-value	Coefficient	*p*-value	Coefficient	
Registration service	0.005	-0.584	0.204	0.361	Must-be
Customer service	0.000	-0.734	0.123	0.411	Must-be
Quality of service	0.000	-1.075	0.032	0.466	One-dimensional
Promotion	0.002	-0.619	0.002	0.685	One-dimensional
Payment of bill	0.004	-0.600	0.040	0.494	One-dimensional

Table 2 ANOVA test on each factor of free services

Factor	Low-medium performance		High-medium performance		Factor category
	p-value	Coefficient	*p*-value	Coefficient	
Registration service	0.706	-0.137	0.002	0.677	Attractive
Customer service	0.041	-0.427	0.401	0.265	Must-be
Quality of service	0.060	-0.391	0.004	0.610	Attractive
Promotion	0.032	-0.443	0.035	0.467	One-dimensional

For the quality of service, promotion, and payment of bill factors, the *p*-value is significant for both low-medium and high-medium performance. These factors are categorized as one-dimensional. One-dimensional factors have a linear relationship with the level of customer satisfaction where the increase in performance will increase the level of customer satisfaction and vice versa.

The results from the analysis shown in Table 2 show that registration service and quality of service of free services are categorized as attractive since the *p*-value is not significant for low-medium performance but significant for high-medium performance. An attractive factor is a factor that gives impact on customer satisfaction when it is not fulfilled. Meanwhile, the service factor is categorized as must-be and promotion factor is categorized as one-dimensional.

Figure 2 shows the results of the Importance-Performance Analysis (IPA) of each factor of paid Wi-Fi service. It is found that factor 3, which is the quality of service, is located in quadrant I. This signifies that customer perceived this factor as of a high importance but the performance is low. Thus, this factor needs to be emphasized in the effort to enhance its performance. Factor 5, which is payment of bill, is in quadrant II. This shows that the factor is deemed very important and has high performance level. Therefore, this factor needs to be maintained in good condition. On the other hand, factor 2, which is customer service, is found to be in quadrant 3. This shows that it is not an important factor and has a low performance level. The results of the analysis also show that factors 1 and 4 are in quadrant 4, representing that they are less important but at a high performance level. Emphasis is needed to increase their importance.

As the IPA results for paid services indicate, the IPA for free services show similar results for factors 2, 3, and 4 that are in quadrant III, I and IV respectively (see Figure 3). Factor 1, which is registration service, falls under the category of quadrant II that has high level of importance and performance. Therefore, this factor is categorized as very important and with satisfactory performance, and it needs to be maintained.

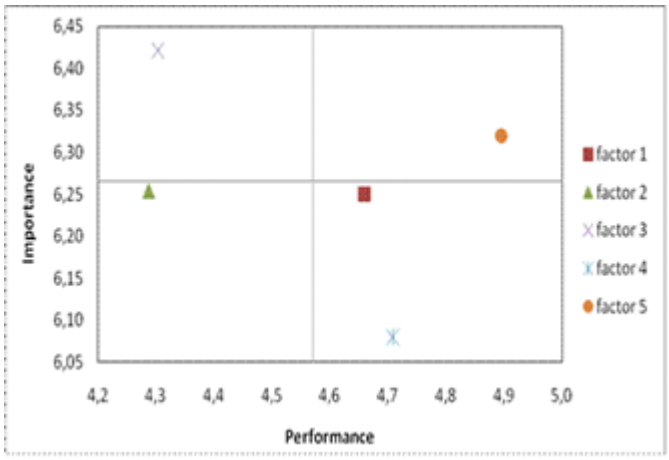

Figure 2 Importance-Performance Analysis of each factor for paid services

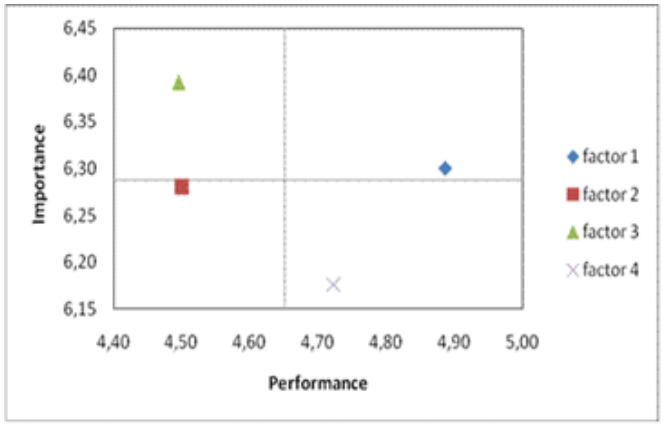

Figure 3 Importance-Performance Analysis of each factor for free service

The summary of the IPA results of each factor for paid Wi-Fi and free Wi-Fi services are shown in Table 3.

Table 3. Importance-performance analysis of each factor for paid and free services

	Factors	Quadrant	
		Paid service	Free service
1.	Registration service	IV	II
2.	Customer service	III	III
3.	Quality of service	I	I
4.	Promotion	IV	IV
5.	Payment of bill	II	-

Figure 4 illustrate the Importance-Performance Analysis (IPA) of each attribute for paid Wi-Fi services. It is found that attributes 2, 8, 9, 10, 11, 12, 13, and 14 are in quadrant I. These attributes need to be emphasized to increase their performance. Apart from that, the results of the analysis also indicated that attributes 4, 16, 17, 21, 22, 23, 24, and 25 are in quadrant II. This shows that these attributes are very important to the customers/respondents and have high performance level. Thus, these attributes' good performances need to be maintained.

Quadrant III has four attributes namely 5, 6, 7, and 15. These four attributes are deemed not important and have low performance level. Priority for improvement is not necessary for these attributes. Five attributes in quadrant IV namely attributes 1, 3, 18, 19, and 20, are less important but have high performance level. However, emphasis is needed to increase their level of importance.

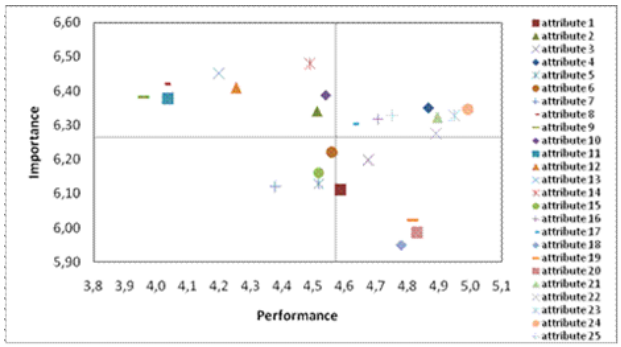

Figure 4. Importance-Performance Analysis of each attribute for paid services

From Figure 5, there are four attributes in quadrant I namely 11, 12, 13, and 14. Meanwhile, quadrant II has seven attributes; 1, 2, 5, 6, 10, 15, and 16. Both quadrants III and IV have attributes 6 and 3. The attributes that are in quadrant III are 7, 8, 9, 18, 19, and 20 while those in quadrant IV are 3, 4, and 17.

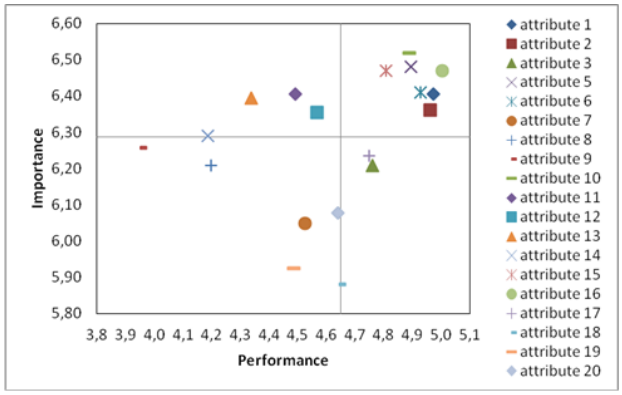

Figure 5 Importance-Performance Analysis of each attribute for free services

Table 4 provides the comparisons of the results obtained from the Importance-Performance Analysis of each attribute for paid and free services. There are 13 attributes that are located differently while seven attributes are at the same position. For attribute 3, which is latest information about services, both paid and free services indicate similar IPA results. It is found to be at quadrant IV that has low importance level and high performance. For user-friendly phone service attribute, respondents categorized this attribute in quadrant III, which has low importance and performance level. Attributes 11 and 14 are found to have high importance level by low performance. Thus, emphasis has to be given in the effort to increase its performance. Meanwhile, respondents for both services

categorized the free registration attribute in quadrant II, reflecting that this attribute is very important and has very satisfactory performance. Thus, it needs to be maintained in good condition.

Table 4 Importance-Performance Analysis of each attribute for paid and free services

	Attributes	Quadrant	
		Paid service	Free service
1.	Easy registration process	IV	II
2.	Fast registration process	I	II
3.	Latest information on service	IV	IV
4.	Easy to understand information on service	II	IV
5.	User-friendly counter service	III	II
6.	User-friendly online service	III	II
7.	User-friendly phone service	III	III
8.	Fast feedback on complaints	I	III
9.	Effectiveness in solving complaints/issues	I	III
10.	Easy login	I	II
11.	Access speed during peak hours (8.00 a.m. to 4.00 p.m.)	I	I
12.	Connection efficiency	I	I
13.	Connection stability	I	I
14.	Good network coverage	I	I
15.	Price promotion	III	II
16.	Free registration	II	II
17.	Free login	II	IV
18.	Wide promotion or advertisement	IV	III
19.	Variety of packages	IV	III
20.	Sufficient promotion period	IV	III
21.	Accurate billing information	II	-
22.	Accurate period of receiving bill	II	-
23.	Easy payment process	II	-
24.	Fast payment process	II	-
25.	Affordable monthly payment	II	-

Table 5 and 6 show the Customer Satisfaction Index for paid Wi-Fi services and free Wi-Fi services respectively. It is found that the Customer Satisfaction Index (CSI) for paid Wi-Fi services states an overall percentage of 65.3% while the CSI for free Wi-Fi services states an overall of 66.36%. The CSI for free Wi-Fi is higher than the one for paid services. However, both percentages are categorized in the indifferent zone and are at a good level. This shows that most users of Wi-Fi services are satisfied with the free Wi-Fi services.

Customer Satisfaction Index, (CSI) paid service

$$= \frac{4.5709}{7} \times 100\% = 65.30\%$$

Customer Satisfaction Index , (CSI) free service

$$= \frac{4.6455}{7} \times 100\% = 66.36\%$$

Table 7 summarizes the results from the analysis for paid and free Wi-Fi services. The first factor, which is the registration service, the results of the analysis for paid services is categorized as must-be using the PRCA method, and in quadrant IV using the IPA analysis. It also shows that this factor does not require emphasis to increase its performance as there is no impact on customer satisfaction when it is fulfilled. Meanwhile for free services, this factor is categorized as attractive and belongs to quadrant II. This factor needs to be regularly fulfilled so that customer satisfaction can be maintained in good condition. The CSI analysis indicates that users who use free Wi-Fi services are more satisfied compared to those who use paid Wi-Fi services.

Table 5 Customer satisfaction index for paid Wi-Fi services

Attributes	Importance mean, μ_1	Weighted mean $W = \frac{\mu_1}{\sum \mu_1}$	Satisfaction mean, μ_2	Weighted score, $P = \mu_1 \times \mu_2$
1	6.1106	0.0390	4.5853	0.1788
2	6.3410	0.0405	4.5115	0.1825
3	6.1982	0.0395	4.6728	0.1848
4	6.3502	0.0405	4.8664	0.1972
5	6.1290	0.0391	4.5161	0.1766
6	6.2212	0.0397	4.5576	0.1809
7	6.1198	0.0390	4.3779	0.1710
8	6.4194	0.0410	4.0276	0.1650
9	6.3825	0.0407	3.9585	0.1612
10	6.3871	0.0408	4.5392	0.1850
11	6.3779	0.0407	4.0369	0.1643
12	6.4101	0.0409	4.2535	0.1740
13	6.4516	0.0412	4.1982	0.1728
14	6.4793	0.0413	4.4885	0.1856
15	6.1613	0.0393	4.5161	0.1775
16	6.3180	0.0403	4.7051	0.1897
17	6.3041	0.0402	4.6267	0.1861
18	5.9493	0.0380	4.7788	0.1814
19	6.0230	0.0384	4.8157	0.1851
20	5.9862	0.0382	4.8295	0.1845
21	6.3226	0.0403	4.8940	0.1974
22	6.2765	0.0400	4.8894	0.1958
23	6.3272	0.0404	4.9493	0.1998
24	6.3456	0.0405	4.9908	0.2021
25	6.3272	0.0404	4.7512	0.1918
Total	156.7189		Total	4.5709

Table 6 Customer satisfaction index for free Wi-Fi services

Attributes	Importance mean, μ_1	Weight mean, $W = \frac{\mu_1}{\sum \mu_1}$	Satisfaction mean, μ_2	Weighted score, $P = \mu_1 \times \mu_2$
1	6.4044	0.0510	4.9727	0.2535
2	6.3607	0.0506	4.9617	0.2512
3	6.2077	0.0494	4.7596	0.2352
4	6.2295	0.0496	4.8525	0.2406
5	6.4809	0.0516	4.8962	0.2526
6	6.4098	0.0510	4.9290	0.2515
7	6.0492	0.0482	4.5246	0.2179
8	6.2077	0.0494	4.1967	0.2074
9	6.2568	0.0498	3.9508	0.1968
10	6.5191	0.0519	4.8907	0.2538
11	6.4044	0.0510	4.4918	0.2290
12	6.3552	0.0506	4.5683	0.2311
13	6.3934	0.0509	4.3388	0.2208
14	6.2896	0.0501	4.1858	0.2096
15	6.4699	0.0515	4.8087	0.2477
16	6.4699	0.0515	5.0055	0.2578
17	6.2350	0.0496	4.7486	0.2357
18	5.8798	0.0468	4.6448	0.2174
19	5.9235	0.0472	4.4863	0.2115
20	6.0765	0.0484	4.6393	0.2244
Total	125.623		**Total**	4.6455

The second factor is customer service. The results of the PRCA analysis indicated that this factor can be categorized as must-be while it belongs to quadrant II using the IPA analysis. The results of these analyses are similar for both paid and free services. Therefore, it can be concluded that the level of

importance and performance of this factor is low. Thus, this factor needs no emphasis for performance improvement for both Wi-Fi services as it will not give an impact if it is fulfilled. The CSI analysis shows a higher percentage for free services compared to paid services and both are at a good level as well as categorized in the indifferent zone.

The third factor, quality of service, is categorized as one-dimensional for paid services while the attractive factor for free services using the PRCA analysis. Both services fall into quadrant I using the IPA analysis. Thus, this factor needs to be emphasized for performance improvement. The results from the analysis show that attribute 10 for paid services and attributes 11 to 14 fall into quadrant I and need to be emphasized for performance improvement. Both services for this factor is at a good level and are categorized in the indifferent zone using the CSI analysis. Furthermore, the results of the PRCA analysis show the fourth factor, which is promotion, being categorized as one-dimensional and fall into quadrant IV using the IPA analysis for both paid and free services. This indicates that promotion has high performance level but with low importance level. Thus, the need to be emphasized for importance improvement. The customer satisfaction index for paid and free services shows almost similar percentages namely 67.29% and 67.54% respectively. The fifth factor, payment of bill that is only asked to users who use paid Wi-Fi services, is categorized as one-dimensional in the PRCA analysis. Also the IPA analysis shows that this factor is very important compared to other factors. Thus, this factor's good condition has to be maintained. The CSI for this factor also states the highest percentage of 69.95% among the five factors.

Table 7 Summary of analysis results for paid and free Wi-Fi services

	Paid services			Free services		
	PRCA	**IPA**	**CSI**	**PRCA**	**IPA**	**CSI**
Factor 1	**Must-be factor**	**Quadrant IV**	66.57%	**Attractive factor**	**Quadrant II**	69.82%
Attribute 1		Quadrant IV			Quadrant II	
Attribute 2		Quadrant I			Quadrant II	
Attribute 3		Quadrant IV			Quadrant IV	
Attribute 4		Quadrant II			Quadrant IV	
Factor 2	**Must-be factor**	**Quadrant III**	61.19%	**Must-be factor**	**Quadrant III**	64.35%
Attribute 5		Quadrant III			Quadrant II	
Attribute 6		Quadrant II			Quadrant II	
Attribute 7		Quadrant III			Quadrant III	
Attribute 8		Quadrant I			Quadrant III	
Attribute 9		Quadrant I			Quadrant III	
Factor 3	**One-dimensional factor**	**Quadrant I**	63.46%	**One-dimensional factor**	**Quadrant I**	64.25%
Attribute 10		Quadrant I			Quadrant II	
Attribute 11		Quadrant I			Quadrant I	
Attribute 12		Quadrant I			Quadrant I	
Attribute 13		Quadrant I			Quadrant I	
Attribute 14		Quadrant I			Quadrant I	
Factor 4	**One-dimensional factor**	**Quadrant IV**	67.29%	**One-dimensional factor**	**Quadrant IV**	67.54%
Attribute 15		Quadrant III			Quadrant II	
Attribute 16		Quadrant II			Quadrant II	
Attribute 17		Quadrant II			Quadrant IV	
Attribute 18		Quadrant IV			Quadrant III	
Attribute 19		Quadrant IV			Quadrant III	
Attribute 20		Quadrant IV			Quadrant III	
Factor 5	**One-dimensional factor**	**Quadrant II**	69.93%	-	-	-
Attribute 21		Quadrant II			-	
Attribute 22		Quadrant II			-	
Attribute 23		Quadrant II			-	
Attribute 24		Quadrant II			-	
Attribute 25		Quadrant II			-	
Overall	-	-	65.30%	-	-	66.36%

4.0 CONCLUSION

In short, although users are mostly satisfied with the Wi-Fi services improvements have to be made to increase the level of customer satisfaction and importance on the factors being studied. Therefore, it is hoped that these can be a guide to Internet Service Providers (ISPs) and can help them improve their services as well as for them to increase customer satisfaction level towards the services.

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