The relationship investigation between factors affecting demand for broadband and the level of satisfaction among broadband customers in the South East Coast of Sabah, Malaysia

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Abstract. This paper aims to investigate the relationship between factors that affecting the demand for broadband and the level of satisfaction. Previous researchers have found that the adoption of broadband is greatly influenced by many factors. Thus, in this study, a self-administered questionnaire was developed to obtain the factors affecting demand for broadband among broadband customers as well as their level of satisfaction. Pearson correlation, one-way analysis of variance (ANOVA) and t-test were used for statistical interpretation of the relationship. This study shows that there are better relationships between several factors over demand for broadband and satisfaction level.

1. Introduction

Broadband is the high-speed Internet access technology. It is the medium connecting in high-capacity communications contrary to narrowband. Both of these terms refer to the width of the frequency spectrum for communication use. In 2006, Choudrie and Dwivedi have forethought that broadband could be benefit countries as it delivers economic value, public value, credit to the private sectors and enhance people’s lives [1]. Malaysia’s broadband contributes in many aspects [2]. Currently, there are two types of broadband, which is the fixed line broadband and mobile broadband. The mobile broadband is offered by the private telecommunication companies (also known as Telco) such as Celcom, Maxis, Digi, U Mobile and others. However, the fixed line broadband is usually provided by Streamyx [3] or Unifi, which is a product of TM (Telekom Malaysia Berhad).

In Malaysia, National Broadband Implementation (NBI) is built to expand the adoption of broadband to the whole nation. This implementation is under Malaysian Communication and Multimedia (MCMC). Malaysian government expected 50% broadband penetration rate per household in the end of 2010. Therefore many efforts have been done include covering both the supply side and the demand of broadband. For example, High Speed Broadband (HSB) Project for the high economic impact areas which is also a partnerships project with TM. Otherwise, in order to increase the demand of broadband
for single supply which is insufficient, Malaysian government was emphasized the strategy on Awareness, Attractiveness and Affordability [2].

However, in spite of the wide usage of broadband in Malaysia, there are still lacks of satisfaction among Malaysian, especially for those who are the broadband customers [4]. Therefore, in this study, we explore some factors that affect the demand for broadband and their satisfaction level. This study will be useful for the industry player either the broadband services provider (Telcos) or the policy makers to understand which factors that related in order to encourage and satisfy consumers to adopt broadband technology. The sample of this study is kept in the simplest form by not taking into account other aspects (e.g., age, gender, etc) as influences of the acquisition, except that the participants are mainly located in the South East Coast of Sabah. Thus, further research can be done after identifying probable causal factors that instigates stronger relationship between broadband demand factors and the level of satisfaction. Therefore, as the beginning of this study, we identify the affects of broadband demand factors. Then, determine the relationship between each factors and level of satisfaction. Finally, we identify the relationship between overall factors affecting demand for broadband and level of satisfaction.

2. Previous study
Research of broadband and the other aspects that are related to it have always been paid attention by many researchers around the world [1,5,6]. In fact, in Malaysia a few researches have been conducted [3,4,7,8]. However, research of broadband is still limited in Malaysia. Nowadays, the broadband penetration rate is regarded as a key economic indicator. Based on statistics in Quarter 1, 2015, has shown that the penetration rate of broadband in Malaysia is 70.4% per 100 household [9]. Thus, the target before of 50% penetration rate is achieved. Therefore, this study is as an extension to increase the penetration rate of broadband so that more Malaysian realize the importance of broadband use in developing country. Following that, we consider their factors affecting demand for broadband and find out their level of satisfaction.

Ooi et al. [7] had done a study of broadband in Malaysia in 2011 about the factors influencing consumers’ intention to adopt broadband. By using Behavioral Intention (BI) as the dependent variables, factors of Primary Influence, Secondary Influence and Relative Advantage were the key determinants in influencing consumers’ broadband intention. This study is based on the past research models used (TPB, DOI and Maths). TPB (Theory of Planned Behaviour) is a base theory that has been widely used and adopted by many researchers to study the adoption and implementation of information technology (IT). Model of Adoption of Technology in Households (MATH) has been employed, believing that this model is more appropriate and useful to study broadband adoption while DOI (Rogers’ Diffusion of Innovation) is a theory that explains the pattern of adoption in predicting the success of new technology invention.

Conversely, Sim et al. [3] have investigated the factors that affect the users’ intention to adopt broadband by incorporating individual characteristics with the conventional Technology Acceptance Model (TAM). The research was conducted in Malaysia using a self-administered questionnaire and analyzed by multiple regression. Individual characteristics such as individual innovativeness, age, gender and qualification were found to have significant relationship with Perceived Usefulness (PU). However, only individual innovativeness, age and gender were related to Perceived Ease of Use (PEOU). The results also support a positive relationship between PU and BI and the mediating effect of PEOU and PU.

Latest research in Sri Lanka by Gunasekara [6] explores the analysis and mathematical modelling of consumer behaviour in mobile telecommunications industry. There are twelve independent variables divided by four groups. From all the variables tested, only variables of Previous Experience and Retailer Recommendations are not statistically significant relationship to the Level of Preference for mobile operators (as dependent variables). There were 60-85% of variance explained (R square result) from the variables used. Therefore, this study is based on these variables used due to the direct term of variables and suitable in the context of this study of broadband. Besides, Junoh and Yaacob [4] have used variables
of price, speed and stability to determine customer satisfaction towards broadband in Malaysia. However, these variables have no statistically significant relationship to the customer satisfaction level. Thus, it was contradicted with our study where the price variable is significant relationship to the level of satisfaction.

3. Material and methods
By using random sampling method, one hundred and eighty of broadband customers (59 males, 121 females) in the South East Coast of Sabah fulfills as participants in this study, included five non-citizens customers. The questionnaires distributed manually by hand, via email, telegram and whatsapp applications. The data collection was estimated around two months from January to March 2017. They are 30.6% Malays, 3.9% Chinese, 0.6% Indian and 64.9% other races. Most of the respondents are between 20-29 years old and 31.1% ages below 20 years old. About 33.3% of the respondents’ monthly income is below RM1000 and 55% used the internet for more than five years. 27.8% of them known about the broadband services through family members, 27.2% from friends and 20.6% from television. In addition, 38.9% of the respondents paid below RM 40 per month. From this research, 12.8% are the fixed line customers and 87.2% are the mobile broadband customers. They are Digi customers (34.4%), Celcom (27.8%), 21.7% (Maxis), 2.8% (U Mobile), 11.7% (Telekom) and 1.8% other operators. Most of them using only one name on their broadband subscription and excellent coverage with high-speed data package was the reason for choosing the operators.

3.1. Factors affecting demand for broadband
There are 10 factors in this research and divided into 10 sections. There are the factors of technology preference (6 items), previous experience (5 items), price (5 items) service quality (8 items), social influence (4 items), peer influence (5 items), perceived brand equity (4 items), awareness of promotions and advertising (2 items), retailer recommendations (4 items) and ethnocentricity (2 items). There are 45 items on the questionnaire and respondents are to answer each item using 5-point Likert scale. Responses are in the form of agreement with 1 being “Strongly Disagree” to 5 being “Strongly Agree”. The questionnaire was prepared in both English and Malay.

3.2 Level of satisfaction
In this study, level of satisfaction is the dependent variable. This section consisted with 7 items. Responses were in the form of satisfaction with 1 being “Strongly Dissatisfied” to 5 being “Strongly Satisfied”. The questionnaire was prepared in both English and Malay.

3.3 Background questionnaire
The background component of the questionnaire requires the research subjects to provide the following informations: location, citizenships, gender, race, age, religion, marital status, occupation, level of education, type head of household, gross monthly household income, duration used, monthly payment, percentage budget, type of broadband, service operators, total broadband registered under respondent’s name and reason for operator selection. This part of questionnaire was constructed to understand the background of the participants and to specify the selection criteria of samples.

3.4 Statistical analysis
The analysis of the data is mainly descriptive and inferential. By using SPSS statistical software, the analysis started by computing the means and standard deviations of each factors and the mean of satisfaction level. Then, to determine the overall affected factors, Independent-sample T Test is used to find the significance of the variation in mean factors affected cross the level of satisfaction according to the three different levels (low, moderate and high). Next, Correlation matrix was computed by using Pearson Correlation Coefficient to examine the relationship between factors and level of satisfaction. Finally, the relationship between overall factors affecting demand for broadband and level of satisfaction was analyzed by using Pearson Correlation Coefficient and analysis of variance (ANOVA).
4. Results and discussion

4.1. The overall of factors affecting demand for broadband

Table 1 shows that the mean of each factors roughly from 3.2 to 4.2. These means, \( \bar{X} \) from Table 1 indicated that these customers are influenced by the factors. The mean of satisfaction level is 3.4849 with standard deviation 0.65986. The minimum scale is 2.00 and maximum of 5.00. Therefore, given this range of satisfaction calculation, we fairly determined that the level of satisfaction as low (2.00-2.99), moderate (3.00-4.00) and high (4.01-5.00).

Table 1. Descriptive statistic for the factors affecting demand for broadband overall.

| Factors                                    | n  | \( \bar{X} \) | s       |
|--------------------------------------------|----|--------------|---------|
| Technology Preference (TP)                 | 180| 4.2204       | 0.49065 |
| Previous Experience (PE)                   | 180| 3.9211       | 0.54496 |
| Service Quality (SQ)                       | 180| 3.6568       | 0.54310 |
| Price (P)                                  | 180| 4.0444       | 0.52917 |
| Social Influence (SI)                      | 180| 3.5306       | 0.69196 |
| Peer Influence (PI)                        | 180| 3.5722       | 0.77292 |
| Perceived Brand Equity (PBE)               | 180| 3.2611       | 0.76170 |
| Awareness of Promotions and Advertising (APA)| 180| 3.8417     | 0.64832 |
| Retailer Recommendation (RR)               | 180| 3.6014       | 0.67771 |
| Ethnocentricity (E)                        | 180| 3.6306       | 0.86095 |

Table 2 describes the mean and standard deviations of each factor and the overall factors according to their level of satisfaction. The hypothesis tested here to see whether the true difference in means are equal (\( H_0: \bar{X}_1 = \bar{X}_2 \)) versus the true difference in means are less than zero (\( H_1: \bar{X}_1 < \bar{X}_2 \)). In other words, is it true that the customers with higher level of satisfaction influence more factors than those of low satisfaction? Significant increment of means indicates that they are affected of more factors. By using the independent t-test, the results show that there is significant difference between customers with low level and moderate level (\( t = -5.146, p < 0.001 \)), low level and high level (\( t = -8.900, p < 0.001 \)), and moderate level and high level (\( t = -5.973, p < 0.001 \)).

4.2. The relationship between factors affecting demand for broadband and level of satisfaction

According to table 1, regardless of customer’s satisfaction level, factor of technology preference (TP) seems to be the most preferred factors by customers, followed by price (P), previous experience (PE), awareness of promotions and advertising (APA), service quality (SQ), ethnocentricity (E), retailer recommendation (RR), peer influence (PR), social influence (SI), and perceived brand equity (PBE) being the least preferred factors. The correlation matrix calculated in Table 3 has resulted in high correlation factors (values near 1).
Table 2. Descriptive statistics for the factors affecting demand for broadband and level of satisfaction.

| Level of Satisfaction (LS) | n  | TP  | PE  | SQ  | P   | SI  | PI  |
|----------------------------|----|---|---|---|---|---|---|
|                            |    | $\bar{x}$ | $s$ | $\bar{x}$ | $s$ | $\bar{x}$ | $s$ | $\bar{x}$ | $s$ |
| Low                       | 37 | 4.15 | 0.60 | 3.68 | 0.57 | 3.16 | 0.42 | 3.87 | 0.60 | 3.18 | 0.54 | 3.27 | 0.84 |
| Moderate                   | 115 | 4.19 | 0.46 | 3.93 | 0.53 | 3.68 | 0.43 | 4.02 | 0.48 | 3.51 | 0.67 | 3.55 | 0.70 |
| High                      | 28 | 4.42 | 0.42 | 4.19 | 0.45 | 4.24 | 0.49 | 4.36 | 0.51 | 4.10 | 0.64 | 4.05 | 0.76 |

| Level of Satisfaction (LS) | n  | PBE | APA | RR  | E   | Overall |
|----------------------------|----|----|----|----|----|--------|
|                            |    | $\bar{x}$ | $s$ | $\bar{x}$ | $s$ | $\bar{x}$ | $s$ | $\bar{x}$ | $s$ | $\bar{x}$ | $s$ |
| Low                       | 37 | 2.84 | 0.74 | 3.49 | 0.83 | 3.05 | 0.69 | 3.18 | 1.04 | 3.39 | 0.37 |
| Moderate                   | 115 | 3.29 | 0.66 | 3.82 | 0.52 | 3.63 | 0.55 | 3.69 | 0.76 | 3.73 | 0.35 |
| High                      | 28 | 3.69 | 0.91 | 4.41 | 0.45 | 4.21 | 0.59 | 4.00 | 0.78 | 4.17 | 0.32 |

Particularly, the correlation between SQ and LS in Table 3 shows the highest value with $r=0.596$ with $p$-value less than 0.001. The correlation obtain between each factors and level of satisfaction shows significant relationship ($p<0.001$) with strengths of low (0.1-0.29), moderate (0.3-0.49) and substantial (0.5-0.69) [4]. In this study, there are significant relationships among all the factors except for the relationship between SI, PR, PBE, APA and RR towards TP. Besides, the P factor shows significant relationship with LS and it contradicts with the study of Junoh and Yaacob [4].

Table 3. Correlation matrix.

| TP  | PE  | SQ  | P   | SI  | PI  | PBE | APA | RR  | E   | LS  |
|----|----|----|----|----|----|----|----|----|----|----|
| TP | 1.000 |    |    |    |    |    |    |    |    |    |
| PE | 0.432 | 1.000 |    |    |    |    |    |    |    |    |
| SQ | 0.362 | 0.465 | 1.000 |    |    |    |    |    |    |    |
| P  | 0.248 | 0.405 | 0.464 | 1.000 |    |    |    |    |    |    |
| SI | 0.143 | 0.474 | 0.350 | 0.369 | 1.000 |    |    |    |    |    |
| PI | 0.083 | 0.278 | 0.323 | 0.166 | 0.376 | 1.000 |    |    |    |    |
| PBE| 0.021 | 0.325 | 0.415 | 0.354 | 0.441 | 0.471 | 1.000 |    |    |    |
| APA| 0.129 | 0.346 | 0.442 | 0.452 | 0.386 | 0.297 | 0.448 | 1.000 |    |    |
| RR | 0.138 | 0.381 | 0.528 | 0.394 | 0.399 | 0.348 | 0.442 | 0.582 | 1.000 |    |
| E  | 0.170 | 0.310 | 0.376 | 0.293 | 0.223 | 0.221 | 0.348 | 0.393 | 0.473 | 1.000 |
| LS | 0.158 | 0.285 | 0.596 | 0.267 | 0.384 | 0.297 | 0.337 | 0.417 | 0.514 | 0.294 | 1.000 |

4.3. The relationship between overall factors affecting demand for broadband and level of satisfaction

Table 4 shows the correlation between the overall factors affecting demand for broadband and level of satisfaction. With $p$ value less than 0.001, the relationship appears to be significant. Also, the result from the analysis (Table 5) indicates that the intensity of the overall factors affecting demand for broadband has a significant effect on the level of satisfaction, $F(2,177) = 39.529, p < 0.001$. 
Table 4. Overall relationship between factors affecting demand for broadband and level of satisfaction.

| Pearson’s $r$ | $p$ |
|---------------|-----|
| 0.553         | 0.000 |

Table 5. ANOVA.

| Sums of Squares | df  | Mean Square | F      | Sig. |
|-----------------|-----|-------------|--------|------|
| Between Groups  | 9.722 | 2        | 4.861  | 39.529 | 0.000 |
| Within Groups   | 21.766 | 177     | 0.123  |       |
| Total           | 31.488 | 179     |        |       |

5. Conclusion
The findings of this study leads to four conclusions. First, the broadband customers of South East Coast of Sabah, Malaysia are indeed influenced by the factors affecting demand for broadband, with technology preference (TP) factors being the most preferred. Second, frequent affect of broadband demand factors does result in better customer’s satisfaction. Significant increments were found between all the levels of customer satisfaction. Third, the highest correlation was found between service quality (SQ) and level of satisfaction (LS). Besides, there are significant relationships among all the factors except between four factors and technology preference (TP) factor as mentioned in 4.2. Finally, there is significant relationship between overall factors affecting demand for broadband and level of satisfaction (LS).

These results clearly show that all the factors affecting demand for broadband have significantly relationship to the level of satisfaction. It suggests that further research needs to continue in order to construct the best mathematical model.

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