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# Assessing factors influencing internet banking adoption by using rasch model measurement

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**ABSTRACT**

The purpose of this paper is to use the Rasch model software in analyzing the identified influencing factors of internet banking towards improving adoption usage and to find the validity and reliability of the instrument. An initial conceptual model was developed based on the previous of literature review. About 17 factors have been identified from the previous models and frameworks and they have been improved as influencing factors. Those factors are the website design (WD), the ease of use (EOU), the security, the quality system, the social influence, the trust, the electronic word of mouth (eWOM), the rewards, the perceived usefulness (PU), the perceived ease of use (PEOU), the intention to use (IU), the sustainability, the commitment, the user experience/generation, the knowledge, the profession, and the income. The questionnaire survey was successfully conducted with 51 respondents and pilot data verification of 30 respondents. The results showed that person reliability was 0.93 spread of person respondent was 54.06 and person separation was 3.66. However, item reliability result was 0.88, spread of item was 45.98 and item separation equal to 2.70 was fair. This paper was proven to be a significant contribution to the validity and reliability of using the Rasch model.



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## 1. INTRODUCTION

Internet banking in Malaysia has become a key platform especially during the COVID-19 pandemic which compelled customers to stay at home and limit their hybrid needs. By using internet banking applications, customers could manage their finances wisely and there was also an increase in customer satisfaction by improving adoption usage. Through the technologies' advanced platform, internet banking was more effective in influencing customers towards usage of this service. By increasing the degree of convenience to customers, it will also increase the level of customer satisfaction [1]. In the Malaysian banking platforms, customer concerns have always been a priority and it sometimes compels banks to expend their budget towards conducting loyalty programs. Due to fraudulent activities by the fraudsters, customers feel insecure in terms of satisfaction and loyalty to the services [1]. To maintain customer sustainability, banks in Malaysia must improvise their performance in areas such as website design, campaign programs, and increasing their trust and security approaches. Over the past decade, internet banking has been pivotal in spurring the growth of conventional banking, as observed most convincingly in emerging markets [2].

In Malaysia, there are almost 19 million internet banking users, however traditional banking methods still hold a high demand amongst users [3]. Internet banking of the banks is compulsory to improve convenience

among customer, minimizes of cost transactions and the most important is time saving [4]. Besides, the emerging techniques uses of the information system type as world wide web (WWW) as known as internet banking. This approach describes the way customers perform on their financial transaction in the virtual platform. According to the earlier researchers, Californian bank wells fargo is the first bank that offers internet banking. Besides, in USA as knows as security first network bank (SFNB) was mentioned that internet banking has a good potential for the bank platform [5]. Internet banking technologies updates now days was rapidly growth to contributes to the country. With these new technologies, the daily working becomes easily and efficiency. It allows customers to carry out banking transactions over the Internet anywhere and anytime [6]. Banks are starting to deliver a quality online experience for customers, and, as a result, online banking adoption continues to grow. It has become an increasingly competitive agent for banks in attracting and retaining customers. Internet banking can conduct transactions such as checking balances, transferring money, and paying utility bills without physically visiting a branch [7]. Internet banking provides a breakthrough in revolutionizing how banks operate, primarily in terms of services to increase customer volume [8]. Internet banking has been used as an innovative strategy to improve bank service quality while leveraging the growth of the customer base [9]. History records the first internet banking service in the United Kingdom in 1983, offered by the bank of Scotland to one of its customers, the Nottingham building society (NBS) [10]. However, internet banking reduces staff resources and physical facilities in the banks [11]. Internet banking has enabled busy people to complete their economic activities cost-effectively and efficiently at any time of the day [12]. With the Internet's growth, it is anticipated that banks will move toward providing online banking for their customers [13]. The purpose of this paper is to use the Rasch model software in analyzing the identified influencing factors of internet banking towards improving adoption usage and to find the validity and reliability of the instrument.

## 2. LITERATURE RIVIEW

Researchers [14] reveals that internet banking is a known platform accepted around the world. In Malaysia, internet banking was introduced in 1996 and around June 2001, Maybank Berhad was the first bank to implement internet banking in Malaysia [15]. Year by year, every bank developed their own internet banking to enhance their customer's experience [16]. Soon internet banking became more renowned amongst banking customers. Time constraints and convenience made customers demand immediate service of internet banking instead of the conventional application over the banking counters. Essentially, customers used internet banking to pay their monthly commitments such as bill payments, loans payment, transfer funds to other banks and transfer funds to the between accounts [4]. However, there are factors to influence internet banking adoption such as efficiency, flexibility, security, convenience, access, performance and trust [17]. Researchers have conducted systematic literature review and new factors have been identified from the previous models and frameworks. Over the decade, few models and frameworks have been hypothesized and synthesized to explore the new factors of influencing internet banking adoption. Researchers often combine the models and frameworks from the perspective of information technology, information system, business and social. From this paper, about 17 factors have been identified from the previous models and have been improved as influencing factors. The factors are the website design (WD), the ease of use (EOU), the security, the quality system, the social influence, the trust, the electronic word of mouth (eWOM), the rewards, the perceived usefulness (PU), the perceived ease of use (PEOU), the intention to use (IU), the Sustainability, the commitment, the user experience/generation, the knowledge, the profession, and the income. Previously, these proposed factors were yet to be measured and analyzed. Hence, the researchers have taken an approach to measure, evaluate and analyze the identified factors by using Rasch model. The academic necessity of this paper is to try and explore the potential of Rasch by empowering intelligences among researchers.

## 3. RESEARCH METHOD

The questionnaire surveys have been conducted with 51 respondents. During the survey, most of the respondents have their internet banking application and pilot data verification by 30 respondents. The questionnaire surveys consist of 85 items comprising of the identified 17 factors. The 17 factors have been identified from the previous research. The factors were identified since it was evident from previous research with regards to the internet banking adoption. The study was conducted on random samples from Malaysian states to those who have internet banking application. This instrument contains 85 items in the form of 5-point Likert scale (1–Strongly disagree, 2–Disagree, 3–Natural, 4–Agree and 5–Strongly agree). The items analysis is analyzed using the Winsteps Rasch software version 5.1.7.0.

## 4. RESULTS AND DISCUSSION

As seen in the Table 1, about 51% of the respondents (26 respondents) were male and 49% about (25 respondents) of the respondents were female. Table 2 summarized the ages of the respondents. Table 3 summarized the education levels of the respondents. Table 4 summarized the professions of the respondents. Table 5 summarized the working experience of the respondents. An analysis of the summary statistics was done to determine the item-person reliability and item person separation index of the Likert scale items.

Table 1. Summary of respondents' gender

| Gender | Total Respondents | Percentage (%) |
|---|---|---|
| Male | 26 | 5 |
| Female | 25 | 49% |

Table 2. Summary of respondents' age

| Age | Total Respondents | Percentage (%) |
|---|---|---|
| 18 to 25 | 10 | 19.6 |
| 26 to 30 | 3 | 5.9 |
| 31 to 40 | 36 | 70.6 |
| 41 to 50 | 1 | 2 |
| 51 to 60 | 1 | 2 |

Table 3. Summary of respondents' education

| Education | Total Respondents | Percentage (%) |
|---|---|---|
| Secondary School | 2 | 3.9 |
| Diploma | 5 | 9.8 |
| Bachelor's Degree | 26 | 51 |
| Master | 5 | 9.8 |
| Professional | 1 | 2 |
| Other | 5 | 9.8 |

Table 4. Summary of respondents' professions

| Profession | Total Respondents | Percentage (%) |
|---|---|---|
| Government employee | 16 | 31.4 |
| Private employee | 22 | 43.1 |
| Business | 2 | 3.9 |
| Self-employed | 2 | 3.9 |
| Student | 8 | 15.7 |
| Homemaker | 1 | 2 |

Table 5. Summary of respondents' working experiences

| Working Experience | Total Respondents | Percentage (%) |
|---|---|---|
| Less than 5 years | 17 | 33.3 |
| 5 to 10 years | 18 | 35.3 |
| 11 to 15 years | 11 | 21.6 |
| 16 to 20 years | 3 | 5.9 |
| 21 to 25 years | 1 | 2 |
| 26 to 30 years | 1 | 2 |

### 4.1. An overview of the proposed model

The previous research discussed the factors influencing customers in internet banking adoption. The model was developed since it was evident from the past research wherein few studies were undertaken with regards to the internet banking adoption initiatives to enhance the existing model and innovation. Referring to an overview of the proposed model, the author has found some gaps and emerging factors that needs to be addressed by developing an enhanced continuity model to improve internet banking usage. This proposed factors for the model have been identified through the limitation of the existing model. Nevertheless, the identified factors have been summarized as the WD, the EOU, the Security, quality system, the social influence, the trust, the eWOM, the rewards, the PU, PEOU, the IU, the sustainability, the commitment, the user

experience/generation, the knowledge, the profession, and the income. Table 6 unveils the way 17 factors has been identified. Most of the studies have the limitation of factors which needs to be enhanced accordingly based on the current requirement of success factors. However, this study has attempted to fill the gaps by diversifying proposed factors on internet banking adoption usage. An overview of the conceptual model is shown in Figure 1.

Table 6. Identified 17 factors

| Factors | Author |
|---|---|
| Website design (WD) | [17], [18] |
| Ease of use (EOU) | [17], [19], [20] |
| Security | Expert Review suggestion |
| Quality System | [21] |
| Social Influence | [22] |
| Trust | Expert Review suggestion |
| Electronic word of mouth (eWOM) | Expert Review suggestion |
| Rewards | Expert Review suggestion |
| Perceived usefulness (PU) | [19], [22], [23] |
| Perceived ease of use (PEOU) | [22], [23] |
| Intention to use (IU) | [22] |
| Sustainability | Expert Review suggestion |
| Commitment | Expert Review suggestion |
| User Experience/Generation | Expert Review suggestion |
| Knowledge | Expert Review suggestion |
| Profession | Expert Review suggestion |
| Income | Expert Review suggestion |

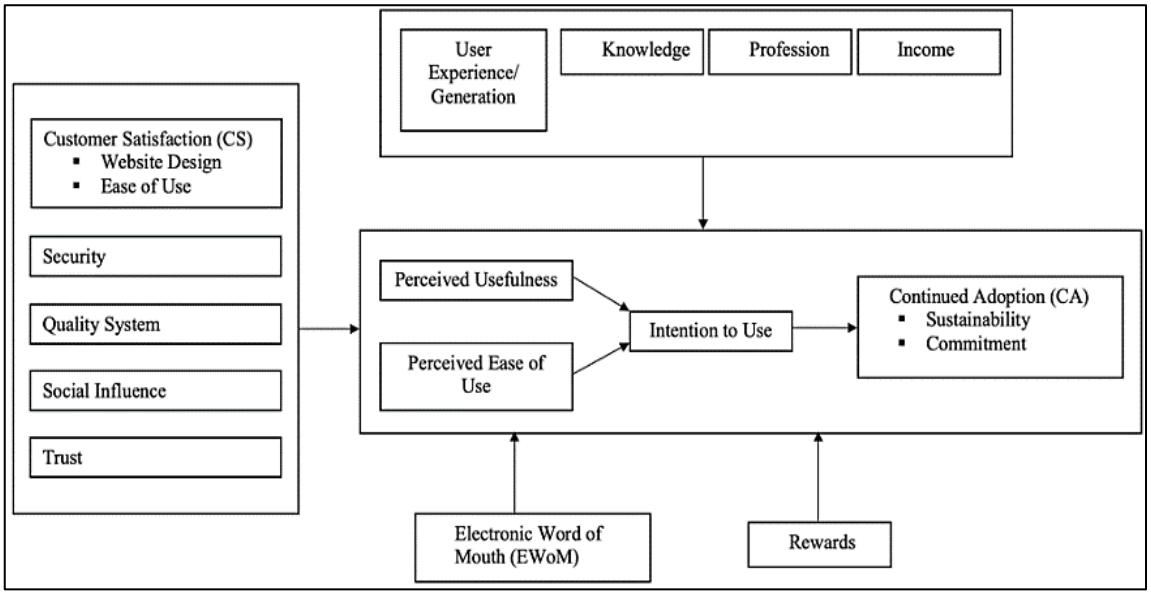


Figure 1. An overview of conceptual model

### 4.2. Validity and reliability using rasch measurement

Results as seen in Table 7, shows that person reliability is at 0.93 which indicates that the responses are reliable for analysis. Individual Mean is 73.84 logit, and the logit showed that the respondents endorse most items. The spread of person respondent is 97.81 to (43.75) =54.06. This is due to one erratic respondent. The person separation at 3.66 is quite good. In Rasch analysis, person separation is used in classifying persons. In measurement, low person separation (<2, person reliability <0.8) with the relevant person sample, it implies that the instrument may not be not sensitive enough to distinguish between high and low performers [24]. Subsequently, Table 8 shows that the statistic summary for item reliability score is 0.88 which means it is reliable to be analysed. The spread of item is 81.95 to (35.97)=45.98. The item separation = 2.70 is fair.

Table 7. Summary statistics of likert scale person

| | TOTAL | | MODEL | | INFIT | | OUTFIT | |
|---|---|---|---|---|---|---|---|---|
| | SCORE | COUNT | MEASURE | S.E. | MNSQ | ZSTD | MNSQ | ZSTD |
| MEAN | 100.5 | 25.0 | 73.84 | 3.40 | 1.04 | -0.18 | 1.04 | -0.30 |
| SEM | 3.0 | 0.0 | 2.86 | 0.10 | 0.11 | 0.41 | 0.14 | .39 |
| P.SD | 15.4 | 0.0 | 14.88 | 0.54 | 0.59 | 2.14 | 0.74 | 2.02 |
| S.SD | 15.7 | 0.0 | 15.15 | .55 | 0.60 | 2.18 | 0.75 | 2.06 |
| MAX. | 120.0 | 25.0 | **97.81** | 5.19 | 2. 84 | 5.00 | 3.74 | 4.32 |
| MIN. | 69.0 | 25.0 | **43.75** | 2.86 | 0.15 | -5.35 | 0.15 | -5.07 |
| REAL | RMSE | 3.92 | TRUE SD | 14.35 | **SEPARATION** | 3.66 | **Person RELIABILITY** | 0.93 |
| MODEL | RMSE | 3.44 | TRUE SD | 14.48 | SEPARATION | 4.20 | Person RELIABILITY | 0.95 |
| S.E. of Person MEAN = 2.86 | | | | | | | | |

Table 8. Statistic summary for item

| | TOTAL | | MODEL | | INFIT | | OUTFIT | |
|---|---|---|---|---|---|---|---|---|
| | SCORE | COUNT | MEASURE | S.E. | MNSQ | ZSTD | MNSQ | ZSTD |
| MEAN | 122.6 | 30.0 | 50.00 | 3.14 | 0.96 | -0.32 | 1.04 | 0.00 |
| SEM | 2.3 | .0 | 1.98 | 0.05 | 0.12 | 0.34 | 0.13 | 0.32 |
| P.SD | 11.1 | .0 | 9.72 | 0.23 | 0.59 | 1.68 | 0.62 | 1.55 |
| S.SD | 11.4 | .0 | 9.92 | 0.23 | 0.60 | 1.72 | 0.63 | 1.58 |
| MAX. | 136.0 | 30.0 | **81.95** | 3.68 | 3.34 | 5.27 | 3.61 | 5.44 |
| MIN. | 84.0 | 30.0 | **35.97** | 2.78 | 0.43 | -2.22 | 0.46 | -1.89 |
| REAL | RMSE | 3.38 | TRUE SD | 9.11 | **SEPARATION** | 2.70 | **Person RELIABILITY** | 0.88 |
| MODEL | RMSE | 3.15 | TRUE SD | 9.20 | SEPARATION | 2.91 | Person RELIABILITY | 0.89 |
| S.E. of Person MEAN = 1.98 | | | | | | | | |

### 4.3. Analysis on wright map

Based on the result as Figure 2, the person map illustrates that the person at the top is most agreeable whilst the person at the bottom is the most disagreeable to endorse. This indicates tendency to endorse higher importance for the questionnaire items [24]. Person P13 and P17 being the highest in wright map, have the tendency to easily endorse most of the items, whilst P24 tends to rate lower which mean they hardly agree with all items.

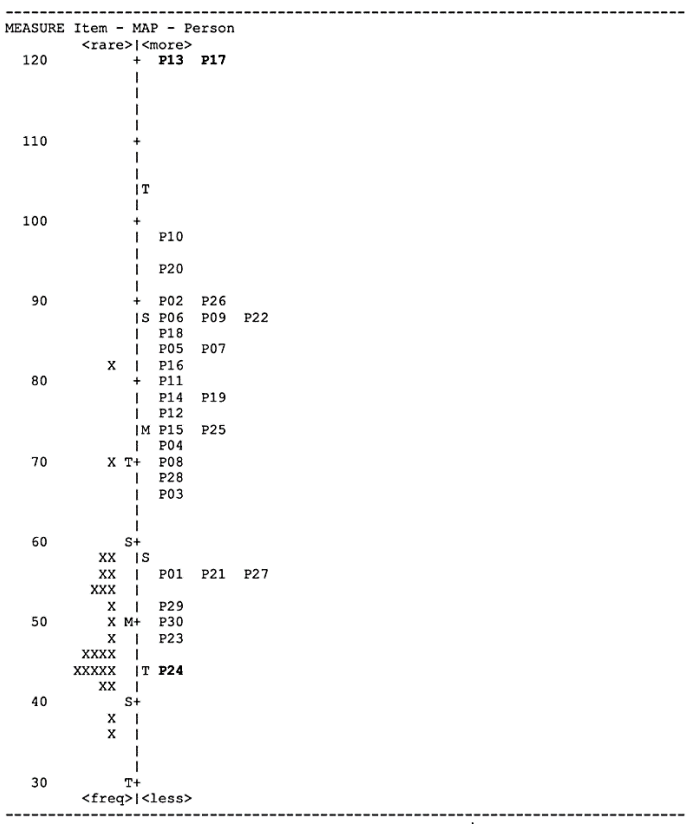


Figure 2. Result of item map of person

As shown in result as Figure 3, the item at the top is the most difficult question (item) and at the bottom is the easiest item. The distribution is quite closely bunched together. This may be due to the respondents not understanding the term "structured format" used in the item. Therefore, this question will be revised for easier understanding. Almost all items are below person mean, except E1 and E2. This indicates an overall agreeableness on the high importance of these factors [24].

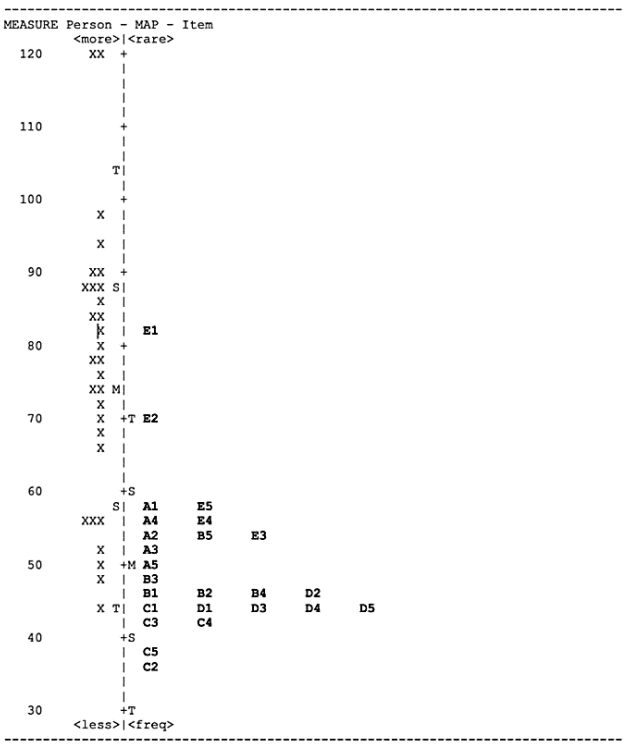


Figure 3. Result of item map of item

### 4.4. Analysis to determine misfit items/person

According to [25], the means square (MNSQ) infit and outfit for each item and respondent must be within the range 0.5 to 1.5 and Z-Standard within in range -2.0 to 2.0. However, if items or person do not fall within the range, then it is possibly eliminated. According to the range, item E1 and E4 were identified as overly misfitting in Figure 4. However, supported by [26], correlation coefficient between 0.36 to 0.67 are still accepted as modest or moderate correlations. Hence, according to the experts, values of correlation are unacceptable and item E1 and E4 to be eliminated as Figure 4.

### 4.5. Evaluating unidimensionality

Unidimensionality is one of the necessary requirements in the Rasch measurement. The proof of unidimensionality will be supported by using items to determine where the respondents fall amongst the factors. Researchers revealed that unidimensionality using Fit statistic, principal component analysis of residuals (PCAR) and point-measure correlations (PMC) data are determined to "fit" the Rasch measurement which means there is proof of unidimensionality [21]. To prove the fit, researchers used the Rasch measurement statistic infit mean-square (MNSQ) and Outfit MNSQ as Figure 4 above. According to [24] unidimensionality is used as the key component of valid content. In dimensionality analysis, variance have been explained by the first factor in the residuals to indicate whether another dimension exists. Focus on unexplained variances, first to fifth contrast and the value more than 15% is poor, 10 to 15% is fair, 5 to 10% is good, 3 to 5% is very good and less than is excellent. Figure 5 reveals that variance explained by measure as 59.6% is fair. Eigenvalue of 1st contrast has the strength of 5.5686=6 items. Figure 5 also indicated the items with high and low contrasts do not belong to any group. Therefore, researchers may conclude that there is no secondary dimension for this instrument as Figure 5.

| ENTRY NUMBER | TOTAL SCORE | TOTAL COUNT | JMLE MEASURE | MODEL S.E. | INFIT MNSQ | INFIT ZSTD | OUTFIT MNSQ | OUTFIT ZSTD | PTMEASUR-AL CORR. | PTMEASUR-AL EXP. | EXACT MATCH OBS% | EXACT MATCH EXP% | Item |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 84 | 30 | 81.95 | 2.95 | **3.34** | **5.27** | **3.61** | **5.44** | **.53** | .81 | 35.7 | 58.7 | **E1** |
| 22 | 99 | 30 | 69.71 | 2.78 | 1.39 | 1.46 | 1.45 | 1.58 | .67 | .75 | 39.3 | 52.7 | E2 |
| 25 | 114 | 30 | 58.06 | 2.84 | 1.19 | .80 | 1.17 | .71 | .68 | .70 | 50.0 | 52.1 | E5 |
| 1 | 115 | 30 | 57.25 | 2.86 | 1.40 | 1.50 | 1.29 | 1.09 | .60 | .70 | 42.9 | 52.0 | A1 |
| 24 | 116 | 30 | 56.43 | 2.88 | 1.80 | **2.65** | **1.74** | **2.36** | **.63** | .70 | 50.0 | 53.5 | **E4** |
| 4 | 117 | 30 | 55.60 | 2.89 | .97 | -.05 | 1.00 | .07 | .70 | .70 | 53.6 | 53.7 | A4 |
| 2 | 119 | 30 | 53.90 | 2.94 | .78 | -.84 | .72 | -1.04 | .74 | .69 | 57.1 | 56.2 | A2 |
| 23 | 119 | 30 | 53.90 | 2.94 | .78 | -.84 | .77 | -.79 | .72 | .69 | 67.9 | 56.2 | E3 |
| 10 | 120 | 30 | 53.03 | 2.96 | .72 | -1.12 | .68 | -1.22 | .73 | .69 | 60.7 | 56.6 | B5 |
| 3 | 121 | 30 | 52.14 | 2.99 | .80 | -.72 | .77 | -.77 | .71 | .69 | 67.9 | 57.2 | A3 |
| 5 | 124 | 30 | 49.39 | 3.08 | .85 | -.48 | .86 | -.39 | .70 | .68 | 67.9 | 60.9 | A5 |
| 8 | 126 | 30 | 47.45 | 3.15 | .93 | -.15 | .83 | -.48 | .72 | .67 | 67.9 | 62.4 | B3 |
| 7 | 127 | 30 | 46.45 | 3.19 | .98 | .02 | .92 | -.15 | .68 | .67 | 67.9 | 62.8 | B2 |
| 6 | 128 | 30 | 45.42 | 3.23 | 1.13 | .53 | .99 | .08 | .66 | .66 | 60.7 | 62.9 | B1 |
| 9 | 128 | 30 | 45.42 | 3.23 | 1.10 | .43 | 1.18 | .64 | .62 | .66 | 57.1 | 62.9 | B4 |
| 17 | 128 | 30 | 45.42 | 3.23 | .48 | -2.19 | .47 | -1.89 | .77 | .66 | 75.0 | 62.9 | D2 |
| 11 | 129 | 30 | 44.36 | 3.27 | .70 | -1.06 | .88 | -.24 | .71 | .66 | 71.4 | 63.4 | C1 |
| 16 | 129 | 30 | 44.36 | 3.27 | .54 | -1.81 | .53 | -1.57 | .75 | .66 | 78.6 | 63.4 | D1 |
| 20 | 129 | 30 | 44.36 | 3.27 | .53 | -1.89 | .51 | -1.67 | .76 | .66 | 78.6 | 63.4 | D5 |
| 18 | 130 | 30 | 43.28 | 3.32 | .52 | -1.89 | .46 | -1.81 | .76 | .65 | 85.7 | 63.5 | D3 |
| 19 | 130 | 30 | 43.28 | 3.32 | .58 | -1.59 | .52 | -1.55 | .75 | .65 | 78.6 | 63.5 | D4 |
| 13 | 131 | 30 | 42.16 | 3.37 | .82 | -.55 | 1.34 | .96 | .66 | .65 | 75.0 | 64.9 | C3 |
| 14 | 131 | 30 | 42.16 | 3.37 | .52 | -1.87 | .88 | -.22 | .72 | .65 | 71.4 | 64.9 | C4 |
| 15 | 134 | 30 | 38.57 | 3.54 | .43 | -2.22 | 1.01 | .17 | .71 | .62 | 92.9 | 69.4 | C5 |
| 12 | 136 | 30 | 35.97 | 3.68 | .61 | -1.32 | 1.29 | .73 | .66 | .60 | 82.1 | 71.2 | C2 |
| MEAN | 122.6 | 30.0 | 50.00 | 3.14 | .96 | -.3 | 1.04 | .0 | | | 65.4 | 60.5 | |
| P.SD | 11.1 | .0 | 9.72 | .23 | .59 | 1.7 | .62 | 1.6 | | | 14.3 | 5.2 | |

Figure 4. Result of person/item measurement

| | Eigenvalue | Observed | | Expected |
|---|---|---|---|---|
| Total raw variance in observations = | 61.8776 | 100.0% | | 100.0% |
| Raw variance explained by measures = | 36.8775 | **59.6%** | | 59.6% |
| Raw variance explained by persons = | 19.5206 | 31.5% | | 31.6% |
| Raw Variance explained by items = | 17.3570 | 28.1% | | 28.1% |
| Raw unexplained variance (total) = | 25.0000 | 40.4% | 100.0% | 40.4% |
| Unexplned variance in 1st contrast = | **5.5686** | 9.0% | 22.3% | |
| Unexplned variance in 2nd contrast = | **4.1595** | 6.7% | 16.6% | |
| Unexplned variance in 3rd contrast = | **3.6480** | 5.9% | 14.6% | |
| Unexplned variance in 4th contrast = | **2.1773** | 3.5% | 8.7% | |
| Unexplned variance in 5th contrast = | **1.9739** | 3.2% | 7.9% | |

Figure 5. Unidimensionality

## 5. LIMITATIONS AND FUTURE DIRECTIONS

This study made use of the Rasch model, which is considered an attractive mathematical tool to evaluate success factors. However, this paper shows that item E1 and E4 were considerably removed due to the misfit items. Therefore, this questionnaire survey shall be distributed again as real/actual data research. These recommendations should be tested in new datasets survey gathered with the similar scale. In the most studies of social and IT, researchers often encounter theoretical factors that they are unable to observed directly. However, SmartPLS-SEM analysis is to be used to cater to factor loading for each factor by using SmartPLS-SEM software and continuously using the initial conceptual model.

## 6. RESULTS AND DISCUSSION

Its limit notwithstanding, this paper contributed a total of 17 factors which were found to show good factors based on the Rasch model analysis. It is appropriate to evaluate internet banking adoption and it is a reliable and valid research instrument. Thus, the persons and items gave good validity and reliability by using the Rasch model. These findings imply that the factors used could influence internet banking adoption. In summary, the person reliability shows that 0.93 and item reliability shows 0.88 and separation equal is 2.70 which is fair. Thus, this paper is a significant contribution to validity and reliability factors to influence internet banking adoption by using the Rasch analysis.

## REFERENCES

[1] K. I. Hadid, N. K. Soon, and A. A. E. Amreeghah, "The Effect of Digital Banking Service Quality on Customer Satisfaction: A Case Study on the Malaysian Banks," *Asian J. Appl. Sci. Technol.*, vol. 04, no. 01, pp. 06–29, 2020, doi: 10.38177/ajast.2020.4102.

[2] A. P. Khan, S. Khan, and I. A. R. Xiang, "Factors Influencing Consumer Intentions to Adopt Online Banking in Malaysia," *Bus. Econ. Rev.*, vol. 9, no. 2, pp. 101–134, 2017, doi: 10.22547/BER/9.2.5.

[3] M. Selvanathan, U. Devi Krisnan, and G. Kar Jun, "Acceptance of internet banking among consumers in Kota Damansara, Selangor, Malaysia," *Int. J. Bus. Manag.*, vol. 12, no. 2, p. 103, 2017, doi: 10.5539/ijbm.v12n2p103.

[4] A. Sundara and A. Perera, "The factors influencing on the customer adoption of internet banking system special reference to the Sampath Bank in Colombo district," vol. 8, no. 2, 2018.

[5] I. Santouridis and M. Kyritsi, "Investigating the determinants of internet banking adoption in Greece," *Procedia Econ. Financ.*, vol. 9, no. Ebeec 2013, pp. 501–510, 2014, doi: 10.1016/S2212-5671(14)00051-3.
[6] S. N and S. S, "E-banking service qualities, e-customer satisfaction and e-loyalty: A conceptual model," *Int. J. Soc. Sci. Humanit. Invent.*, vol. 5, no. 6, pp. 4808–4819, 2018, doi: 10.18535/ijsshi/v5i6.08.
[7] C. R. Thinamano and S. Mokwena, "Factors influencing internet banking adoption in African rural areas," *South African J. Inf. Manag.*, vol. 18, no. 2, pp. 1–14, 2016.
[8] R. S. Johar and D. Suhartanto, "The Adoption of Online Internet Banking in Islamic Banking Industry," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 662, no. 3, 2019, doi: 10.1088/1757-899X/662/3/032032.
[9] A. H. O. Khater, M. S. Omer, A. A. A. Khatarna, M. E. M. I. Osman, and I. Y. I. Osman, "Customers intention to use internet banking: Age as a moderator variable," *Int. J. Sci. Technol. Res.*, vol. 9, no. 3, pp. 6541–6548, 2020.
[10] Yendra, N. Brasit, and I. Nursyamsi, "An Analysis on Factors that Influence Customers' Intention to Use Internet Banking in Jayapura City," *Sci. Res. J.*, vol. V, no. Viii, p. 29, 2017, [Online]. Available: www.scirj.org
[11] S. Daneshgadeh and S. Ö. Yıldırım, "Empirical Investigation of Internet Banking Usage: The Case of Turkey," *Procedia Technol.*, vol. 16, pp. 322–331, 2014, doi: 10.1016/j.protcy.2014.10.098.
[12] P. Hanafizadeh, B. W. Keating, and H. R. Khedmatgozar, "A systematic review of Internet banking adoption," *Telemat. Informatics*, vol. 31, no. 3, pp. 492–510, 2014, doi: 10.1016/j.tele.2013.04.003.
[13] H. Boateng, D. R. Adam, A. F. Okoe, and T. Anning-Dorson, "Assessing the determinants of internet banking adoption intentions: A social cognitive theory perspective," *Comput. Human Behav.*, vol. 65, pp. 468–478, 2016, doi: 10.1016/j.chb.2016.09.017.
[14] C. H. Ling, M. A. Islam, A. H. A. Manaf, and W. M. Wan Mustafa, "Users satisfaction towards online banking in Malaysia," *Int. Bus. Manag.*, vol. 9, no. 1, pp. 15–27, 2015, doi: 10.3923/ibm.2015.15.27.
[15] W.-S. Ho and S. Yahya, "Consumers' perception towards the extent of internet banking usage in Malaysia," *Probl. Perspect. Manag.*, vol. 13, no. 2, pp. 288–295, 2015.
[16] T. S. Ong, Y. H. Hong, B. H. Teh, P. C. H. Soh, and C. P. Tan, "Factors that affect the adoption of internet banking in Malaysia," *Int. Bus. Manag.*, vol. 8, no. 2, pp. 55–63, 2014.
[17] S. I. S. Al-Hawary and W. F. Al-Smeran, "Impact of Electronic Service Quality on Customers Satisfaction of Islamic Banks in Jordan," *Int. J. Acad. Res. Accounting, Financ. Manag. Sci.*, vol. 7, no. 1, pp. 170–188, 2017, doi: 10.6007/ijarafms/v7-i1/2613.
[18] D. Bouketir and A. Hassani, "Impact of banking service quality on customer satisfaction: Sample study," *J. Internet Bank. Commer.*, vol. 22, no. 1, pp. 61–78, 2017, doi: 10.37136/1003-000-046-141.
[19] H. Rawwash *et al.*, "Factors affecting Jordanian electronic banking services," *Manag. Sci. Lett.*, vol. 10, no. 4, pp. 915–922, 2020, doi: 10.5267/j.msl.2019.10.004.
[20] V. Tharanikaran, S. Sritharan, and V. Thusyanthy, "Service quality and customer satisfaction in the electronic banking," *Int. J. Bus. Manag.*, vol. 12, no. 4, p. 67, 2017, doi: 10.5539/ijbm.v12n4p67.
[21] W. Usino and W. Metri, "Factors influencing customers' intention to use internet banking: MAYBANK2U in Indonesia," *3rd Int. Conf. Comput. Eng. Des. ICCED 2017*, vol. 2018-March, pp. 1–4, 2018, doi: 10.1109/CED.2017.8308133.
[22] A. K. Nag and B. Gilitwala, "E-Wallet- Factors affecting it's intention to use," no. 4, pp. 3411–3415, 2019, doi: 10.35940/ijrte.D6756.118419.
[23] A. Kaur and G. Malik, "Examining factors influencing Indian customers ' intentions and adoption of internet banking : Extending TAM with electronic service quality," 2019, doi: 10.21511/im.15(2).2019.04.
[24] N. Ilyana, I. Tajuddin, R. Abdullah, M. A. Jabar, Y. Y. Jusoh, and N. Arbaiy, "Rasch Model application in validating instrument for knowledge integration in small medium enterprises," *Acta Informatica Malaysia*, vol. 1, pp. 15–16, 2017.
[25] F. W. P. Jr, "Rating scale instrument quality criteria," *Rasch Meas. Trans.*, vol. 21, no. 1, 2007.
[26] N. Othman, S. M. Salleh, H. Hussin, and H. A. Wahid, "Assessing Construct Validity and Reliability of Competitiveness Scale Using Rasch Model Approach," *2014 WEI Int. Acad. Conf. Proc.*, pp. 113–120, 2014.

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