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The illustrated image at the front cover of JCIS is a diwani's caligraphic art of Qur'anic verse: وَقُل رَّبِّ زِدْنِي عِلْمًا *which means "..and say, "my Lord! increase me in knowledge" (Thoha: 114). The verse is indeed, implies our prayer to call for the enhancement of our knowledge. The true knowledge that can lead to the absolute truth and prosperity; combination of revealed and contemporary knowledge. Therefore, JCIS is one of the medium for disseminating these knowledge.*

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CONTENTS

Application of Rasch Measurement Model in Quality Evaluation of Shariah Compliant Gold Investment (SCGI) Instrument

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ABSTRACT

This paper describes the process of assessing the validity and reliability of a new instrument namely Shariah Compliant Gold Investment (SCGI). The instrument consists of 33 items that are embedded in three dimensions and was administered to 27 Malaysian investors and investment institutions. Rasch model was used to examine the validity of items by two criteria (1) point measure correlation (PTMEA CORR) and (2) fit statistics (infit/outfit MNSQ and z-std). The findings indicated that the reliability value for the respondents and items are high with r = 0.91 and r = 0.81 respectively with Cronbach alpha 0.93. At the same time, the item separation is 2.07 while the person separation is 3.15. As for the items polarity, most of the items contributed to the measurement as all of the PTMEA CORR values are positive (+0.44 logit to +1.66 logit) except for the A03 item (0.17 logit). The fit item testing indicated that the value of the sum of the mean of infit MNSQ and SD was between +0.68 logit to +1.30 logit. Only one item (A03) falls in the range of elimination due to negative value of PTMEA CORR and z-std > 2.0. The results suggested the item to be removed, retaining the balance of 32 items.

Keywords: Gold Investment, Rasch Model, Shariah Compliant

1. Introduction

A shariah-compliant gold transaction has been authentically justified in a few hadith, among them narrated by 'Ubadah ibn al-Samit in which the Prophet Muhammad SAW said: "Gold (exchanged) with gold, silver for silver, wheat for wheat, barley for barley, salt for salt, and they should be

of equal weight, and hand to hand. If the types of goods exchanged are different, then sell without delay and submit the goods directly." (Muslim, 2010). The hadith pointed two conditions for a shariah-compliant gold investment; equal and on-the-spot transaction (al-Sharbini, 1978; al-Saddam, 2006).

In Malaysia, both criteria have been gazetted as Gold Investment Parameter, endorsed by the National Fatwa Council. It functions as guidance for investors as well as investment institutions. However, the parameters are too general. This has urged the Shariah Advisory Council of Malaysia to call for the parameters to be reviewed (Jakim, 2012). Recently, Najahudin et al. (2014) propose Shariah Compliant Gold Investment (SCGI) as a new guideline. Thus, this research aims to evaluate the validity and reliability of the SCGI using Rasch Measurement Model. The Rasch analyses will be focused on the interpretation of data reliability, item polarity, fit statistics and the persons-items distribution map.

2. Shariah Compliant Gold Investment (SCGI)

The SCGI has been developed meticulously through systematic procedures involving relevant experts (Najahudin et al., 2014). It is more specific and consists of three dimensions; (i) investor and investment institutions; (ii) products and prices; and (iii) the contracts offered. These three dimensions and a total of 33 items have been unanimously agreed by 13 experts via two rounds of Delphi technique. Each round was implemented using a questionnaire with 4-Point Likert Scale; (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree. Data collected from each round were analyzed using Statistical Package for Social Science (SPSS) in order to attain the agreed dimensions and items. In the second round, the expert consensus had successfully obtained. All items indicated that the consensus were in the interquartile range of (IQR) = 0 to 1, median = 4 and mode = 4, above the 95 percentage. The median frequency distribution of this study is consistent with Green's (1981) value of 3.8. The items which have been agreed upon are shown in Table 1.

Table 1. Dimension and Items of SCGI

Dimensions	Number of Items	Total
Investor and investment institutions	A01, A02, A03, A04, A05	5 items
Product and prices	B01, B02, B03, B04, B05, B06, B07, B08, B09, B10, B11, B12, B13, B14, B15, B16, B17	17 items
Contract deal	C01, C02, C03, C04, C05, C06, C07, C08, C09, C10, C11	11 items

3. Methodology

Source of Data

For the purpose of validating 33 items of SCGI, the researcher organized a special seminar on 4 April 2015. The seminar attracted 27 participants who were of gold investors. Prior to administering the SCGI, the researcher thoroughly explained the dimensions and items to ensure the respondents' understanding correspond to the questions. At the end of the seminar, 27 valid responses were collected.

3.1 Rasch Measurement Model

The Rasch model is a measurement on the probability of interaction between the person and the item. Each person will be categorized based on their temporary skills whereas the items are categorized based on their difficulty. The Rasch model was formed by taking into consideration the ability of the person answering the questionnaire or the instrument and the difficulty posed by each of the question or the item. The ability of the person and the difficulty of the item were shown in the form of logit through the transformation of ordinal data into ratio measurements. This model would be able to predict the pattern of the response based on the different ability of each person and the difficulty of each item (Rasch, 1980). The probability to succeed would depend on the difference of the ability of the respondent and the difficulty of the item. According to Rasch, (i) a smarter person would have a bigger probability to agree with the items; and (ii) items that are less difficult would have a higher probability to be agreed by all of the respondents (Bond & Fox, 2015).

The Rasch model is able to provide the accuracy of the validity and reliability as it focuses on the person and the item. Moreover, this model

would be able to show which of the item or construct would fit, misfit, requires further research or eliminated (Azrilah, 2010) based on the established rating scale. This study utilised the acceptable ranges of the Rasch model as shown in Table 2.

Table 2. Rating Scale Instrument Quality Evaluation Criteria using Rasch Model

Criteria	Statistical Info	Results
Item Validity	a. Item Polarity	PTMEA CORR > 0.4 – 0.8 (Linacre, 2011; Azrilah, 2010)
Item	b. Item Fit	Total MNSQ infit and outfit of 0.5 - 1.5 (Linacre, 2011; Linacre, 2002)
Item Misfit	c. Separation	All items show ≥ 2.0 (Linacre, 2011;
	d. Person Reliability	Fisher, 2007) Value > 0.8 (Bond & Fox, 2015)
	e. Item Reliability	Value> 0.8 (Bond & Fox, 2015)

Source: Bond & Fox (2015); Linacre (2011); Azrilah (2010); Fisher (2007); Linacre (2002); Wright & Stone (1979)

4. Data analysis

Data were analyzed using the Rasch analysis software, the WINSTEPS 3.72.3. Rasch predicts the probability of a person to evaluate item, and the probability for each item to be evaluated by a person. In Rasch Measurement Model, the validity of the instrument could be identified through several major analysis such as the item polarity, person-item fit, person-item misfit, the person-items distribution map, person-item separation, unidimensionality and scale calibration (Rasch, 1980; Bond & Fox, 2015; Linacre, 2011). This study only reports on the reliability value, item polarity, fit statistics and person-items distribution map (PIDM). Figure 1 summarises the types of analysis performed.

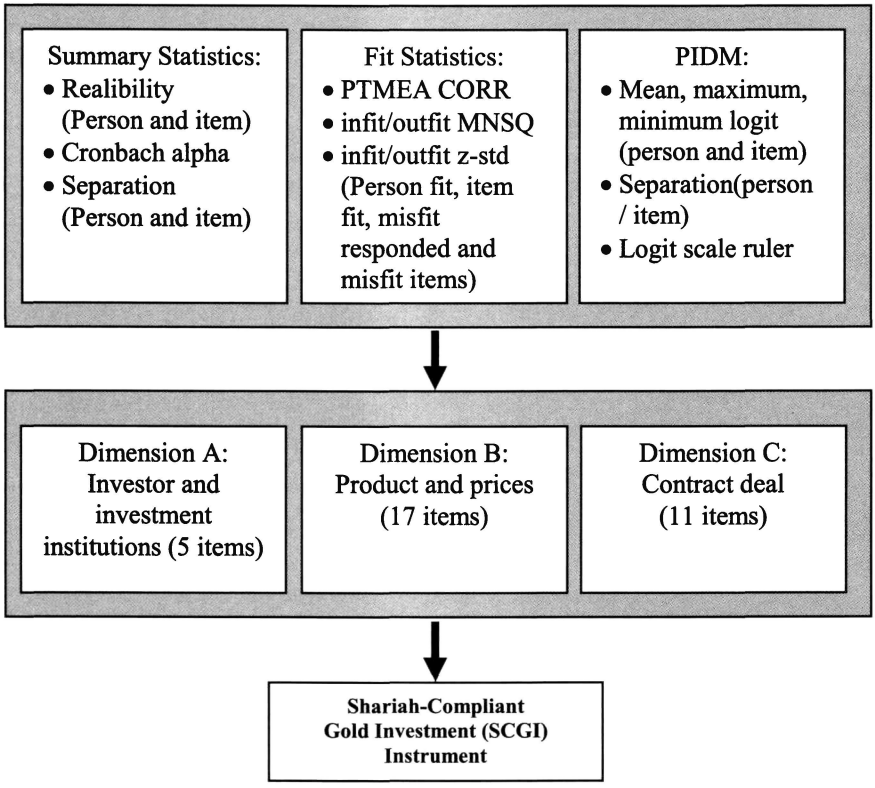

Figure 1. Analysis and validation process

5. Results and discussion

5.1 Reliability

Reliability is the value that indicates the consistency of the position of the person and item in the logit scale. The person reliability value shows the consistency of the position of the respondent when given another set of items that measures the same construct. The item reliability value shows the consistency of the set of items when answered by different respondents who have similar abilities. The coefficient value that is closest to 1.00 denotes a high reliability (Nunnally & Bernstein, 1994).

According to Bond and Fox (2015) and Linarce (2011), the reliability of a person which exceeds 0.80 values indicates a strong acceptance towards the respondent or the item. On the other hand, Fisher (2007) divided the rating scale for the reliability of a person and item into poor (< 0.67), fair (0.67 - 0.80), good (0.81 - 0.90), very good (0.91 - 0.94) and excellent (> 0.94). The accepted separation value for a person and item must be at least 2.0 (Linarce, 2011; Fisher, 2007).

Based on Figure 2, the summary statistic displays acceptable person and item reliability values. On top of that, the Cronbach-α of 0.93 is good, indicating the instrument is a valid measurement and capable of identifying the level of shariah-compliance of gold investment products. The reliability of the item recorded a value of 0.81, which indicates that there are sufficient items to measure what need to be measured (Nunnally & Bernstein, 1994).

The respondent reliability value is 0.91, indicating a strong probability of the items to measure the same result when given to another similar respondent (Azrilah, 2010). In addition, the separation value for respondent and item were 3.15 and 2.07, respectively. A value of ≥ 2.0 is good, indicating the SCGI ability to segregate respondent ability and item difficulty.

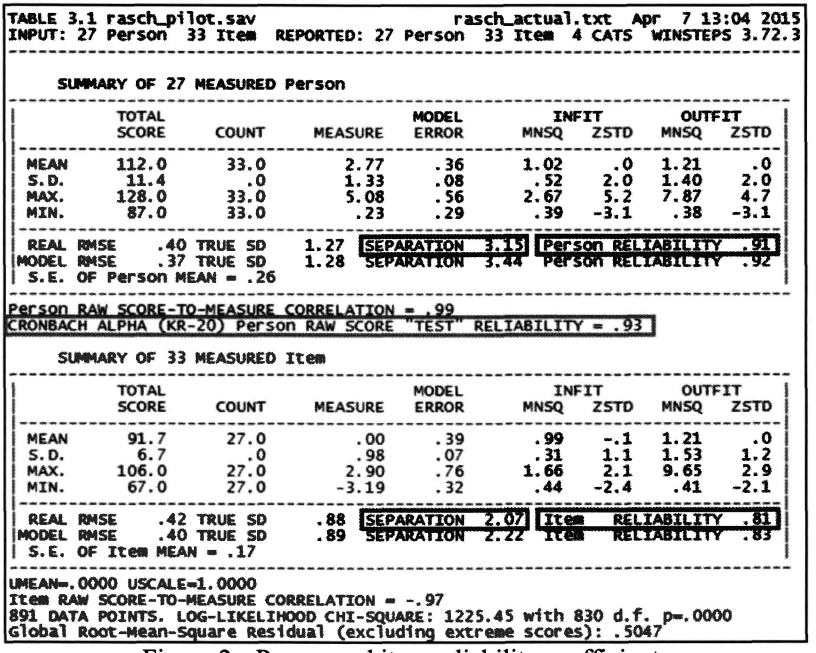

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TABLE 3.1 rasch_pilot.sav                    rasch_actual.txt  Apr  7 13:04 2015
INPUT: 27 Person  33 Item  REPORTED: 27 Person  33 Item  4 CATS  WINSTEPS 3.72.3

    SUMMARY OF 27 MEASURED Person

|          TOTAL                          MODEL          INFIT        OUTFIT    |
|          SCORE      COUNT     MEASURE   ERROR      MNSQ   ZSTD    MNSQ   ZSTD |
| MEAN     112.0       33.0        2.77     .36      1.02     .0    1.21     .0 |
| S.D.      11.4         .0        1.33     .08       .52    2.0    1.40    2.0 |
| MAX.     128.0       33.0        5.08     .56      2.67    5.2    7.87    4.7 |
| MIN.      87.0       33.0         .23     .29       .39   -3.1     .38   -3.1 |
| REAL RMSE    .40 TRUE SD   1.27  SEPARATION  3.15  Person RELIABILITY  .91     |
|MODEL RMSE    .37 TRUE SD   1.28  SEPARATION  3.44  Person RELIABILITY  .92     |
| S.E. OF Person MEAN = .26                                                      |

Person RAW SCORE-TO-MEASURE CORRELATION = .99
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .93

    SUMMARY OF 33 MEASURED Item

|          TOTAL                          MODEL          INFIT        OUTFIT    |
|          SCORE      COUNT     MEASURE   ERROR      MNSQ   ZSTD    MNSQ   ZSTD |
| MEAN      91.7       27.0         .00     .39       .99    -.1    1.21     .0 |
| S.D.       6.7         .0         .98     .07       .31    1.1    1.53    1.2 |
| MAX.     106.0       27.0        2.90     .76      1.66    2.1    9.65    2.9 |
| MIN.      67.0       27.0       -3.19     .32       .44   -2.4     .41   -2.1 |
| REAL RMSE    .42 TRUE SD    .88  SEPARATION  2.07  Item   RELIABILITY  .81     |
|MODEL RMSE    .40 TRUE SD    .89  SEPARATION  2.22  Item   RELIABILITY  .83     |
| S.E. OF Item MEAN = .17                                                        |

UMEAN=.0000 USCALE=1.0000
Item RAW SCORE-TO-MEASURE CORRELATION = -.97
891 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 1225.45 with 830 d.f. p=.0000
Global Root-Mean-Square Residual (excluding extreme scores): .5047
```

Figure 2. Person and item reliability coefficients

5.2 Polarity of the Item

The item polarity is a precondition that must be referred to by reviewing the point measure correlation (PTMEA CORR) coefficient. Items are assumed to be able to differentiate the ability of the respondents when the PTMEA CORR values are high. The value must be positive to indicate the item is moving in parallel (Bond & Fox, 2015). The negative or zero PTMEA CORR values indicates that the response of a person or item conflicts with the variables constructed (Linacre, 2011), an inverse direction of measurement and an uncommon decision making variable (Azrilah, 2010). Nunnally and Bernstein (1994) and Finlayson (2009) believed that the PTMEA CORR item value of at least +0.30 logit would be able to measure a construct systematically, whereas a value of +0.32 logit would be able to merely measure in an average manner. However, this study uses the value between +0.4 logit and +0.8 logit ($0.4 < x < 0.8$) to prove that the constructed items would be measureable and able to differentiate the respondents (Linacre, 2011; Fisher, 2007; Azrilah, 2010).

Figure 3 shows that all the items have positive PTMEA CORR values and small mean error measurement of SE (+0.39 logit), except item A03, which reported a negative value of -0.17 logit (SE = +0.76 logit). This particular item was eliminated, as it did not measure what should be measured (Azrilah, 2010). Most of the values of the other items are between the values of +0.42 logit to +0.77 logit, except for 2 items that are outside the specified range that is A01 (+0.77 logit) and A02 (+0.15 logit). However, both items were retained, based on their acceptable infit MNSQ (+1.49 logit and +1.48 logit respectively) and z-std (1.7 and 0.6 respectively).

TABLE 10.1 rasch_pilot.sav rasch_actual.txt Apr 7 13:04 2015
INPUT: 27 Person 33 Item REPORTED: 27 Person 33 Item 4 CATS WINSTEPS 3.72.3

Item STATISTICS: MISFIT ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
3	106	27	-3.19	.76	1.27	.6	9.65	2.	A -.17	.27	92.6	92.6	A03_redaP
19	91	27	.19	.37	1.66	2.1	1.60	1.	B .42	.58	55.6	67.7	B14_laniH
1	79	27	1.66	.33	1.49	1.7	1.55	1.	C .07	.61	63.0	59.7	A01_umurP
28	82	27	1.32	.34	1.51	1.8	1.46	1.	D .56	.60	70.4	60.9	C06_Xsewa
14	90	27	.33	.37	1.51	1.7	1.42	1.	E .55	.58	55.6	66.6	B09_laniE
2	91	27	.19	.37	1.14	.6	1.48	1.	F .15	.58	55.6	67.7	A02_umurC
27	89	27	.47	.36	1.44	1.5	1.34	1.	G .56	.58	66.7	65.8	C05_Xbyback
21	91	27	.19	.37	1.24	.9	1.19	.	H .53	.58	74.1	67.7	B16_tunaiH
25	91	27	.19	.37	1.14	.6	1.23	.	I .56	.58	63.0	67.7	C03_selangi
29	85	27	.97	.35	1.20	.8	1.19	.	J .53	.60	59.3	63.4	C07_Xhibah
33	92	27	.05	.38	1.20	.8	1.18	.	K .47	.57	66.7	68.3	C11_Xtrade
24	89	27	.47	.36	1.11	.5	1.17	.	L .53	.58	63.0	65.8	C02_bertemu
31	94	27	-.24	.39	1.12	.5	1.07	.	M .55	.56	70.4	69.7	C09_Xloan
7	98	27	-.91	.43	1.02	.2	.73	-.	N .67	.51	77.8	73.0	B02_milikE
15	88	27	.60	.36	1.01	.1	.98	.	O .64	.59	74.1	65.5	B10_QEblaku
32	95	27	-.40	.40	1.01	.1	.85	-.	P .65	.55	85.2	70.4	C10_Xjudi
4	92	27	.05	.38	.90	-.3	.96	.	Q .61	.57	66.7	68.3	A04_daftarC
5	67	27	2.90	.32	.95	-.1	.94	-.	p .46	.63	63.0	58.8	A05_apsC
16	91	27	.19	.37	.94	-.1	.85	-.	o .69	.58	70.4	67.7	B11_dapatE
30	90	27	.33	.37	.94	-.1	.88	-.	n .58	.58	74.1	66.6	C08_Xsalaf
17	94	27	-.24	.39	.93	-.1	.87	-.	m .58	.56	77.8	69.7	B12_tasarruf
22	86	27	.85	.35	.87	-.4	.84	-.	l .72	.59	74.1	64.1	B17_kunciH
6	99	27	-1.10	.44	.85	-.4	.68	-.	k .64	.49	81.5	74.0	B01_wujudE
26	93	27	-.09	.39	.82	-.6	.70	-.	j .78	.56	81.5	69.0	C04_Xmilikan
8	95	27	-.40	.40	.67	-1.2	.73	-.	i .61	.55	81.5	70.4	B03_pindahE
11	97	27	-.73	.42	.71	-1.0	.68	-.	h .61	.52	74.1	71.6	B06_tautulen
10	97	27	-.73	.42	.67	-1.2	.58	-1.	g .64	.52	81.5	71.6	B05_bentukE
18	97	27	-.73	.42	.64	-1.4	.58	-1.	f .66	.52	81.5	71.6	B13_tahuH
12	95	27	-.40	.40	.60	-1.6	.59	-1.	e .67	.55	74.1	70.4	B07_tmbangE
9	95	27	-.40	.40	.59	-1.6	.58	-1.	d .67	.55	81.5	70.4	B04_tahuE
13	98	27	-.91	.43	.59	-1.6	.52	-1.	c .68	.51	85.2	73.0	B08_beratE
20	93	27	-.09	.39	.51	-2.0	.57	-1.	b .69	.56	88.9	69.0	B15_QHfull
23	95	27	-.40	.40	.44	-2.4	.41	-2.	a .77	.55	88.9	70.4	C01_kontrak
MEAN	91.7	27.0	.00	.39	.99	-.1	1.21	.0			73.3	68.8	
S.D.	6.7	.0	.98	.07	.31	1.1	1.53	1.2			10.0	5.5	

Figure 3. Item Point Measure Correlation.

5.3 Fit Statistics

The Rasch model provides fit statistics to detect item or person misfit. The fit statistics refer to (i) infit and outfit mean square (MNSQ); and (ii) infit and outfit standardized (z-std); for both person and items. MNSQ is the ratio of an observation compared to the expectation. The ideal value for MNSQ is 1, when the observation corresponds with the expectation. The MNSQ value is excluded from the expectation when the total mean value of the MNSQ infit and the SD (mean iMNSQ +/- SD) is out of the specified range.

According to Bond and Fox (2015), the values of the MNSQ infit and outfit for each person and items for the likert scale must be between +0.6 logit to +1.4 logit. Fisher (2007) established that the fit item has a fair scale of within +0.34 logit to +2.9 logit, whereas a good scale has a value of within +0.50 logit to +2.0 logit. However, this study utilised the range of values recognised by Linacre (2002) in which the values between +0.5 logit to +1.5 logit in order to verify the fit and misfit for a person or an item. Usually the outfit would be more sensitive to the response compared to the infit (Linacre, 2002). The detection of the items that are misfit or outlier can be further confirmed with the z-std values that must be between the ranges of -2.0 to 2.00. The ideal value for z-std is 1.0 (Azrilah, 2010). The person or item that does not fulfil the criteria range will be considered to be eliminated, except if the PTMEA CORR values for the person and item is between +0.4 logit and +0.8 logit.

This study focused on the fit item compared to the fit person. The fit item here means that the given value has an item function and is able to measure the latent trait required. Misfit occurs when (i) the item does not measure the desired traits; (ii) the items are too difficult or too simple for the person; (iii) or there was an unstable response from the person. Figure 3 shows the sum of the MNSQ infit mean and (+/-) SD (0.99 logit + (-) 0.31 logit) are among the values between +0.68 logit to +1.30 logit, which is acceptable.

All the items were accepted. However, item A03 was eliminated as it was outside the acceptable range of z-std (outfit 2.90) and has a negative PTMEA CORR value (-0.17 logit). Even though the infit MNSQ of item B14 (+1.66 logit), C06 (+1.51 logit) and B09 (+1.51 logit) were beyond the acceptable range ($0.5 < y < 1.5$), all of them were accepted as their z-std outfit were within the acceptable range (B14 = 1.8; C06 = 1.7; B09 = 1.4). They were also measuring in the right direction as the PTMEA CORR values were positive (B14 = +0.42; C06 = +0.56; B09 =

+0.55). Therefore, all of the items (n = 33) were retained except item A03.

5.4 Persons-Items Distribution Map (PIDM)

PIDM is the heart of the Rasch model analysis, which shows the hierarchical relationship of the ability of the person and the difficulty of the item (Bond & Fox, 2015). The person with a higher ability and a more difficult item is placed at the top, whereas a person with a lower ability and an easy item is placed at the bottom. Based on Figure 2, the mean value for the evaluation of a person is +2.77 logit and for the item is 0.00 logit. The minimum value for a person is +0.23 logit whereas the maximum value is +5.08 logit. The minimum value for the item is -3.19 logit whereas its maximum value is +2.90 logit. This makes the total ruler length of a person to be 5.31 logit against the item value of 6.09 logit. The gap that is lacking between the scale of the person compared to the measured item is 0.78 logit (6.09 - 5.31). This hierarchical value is shown in Figure 4.

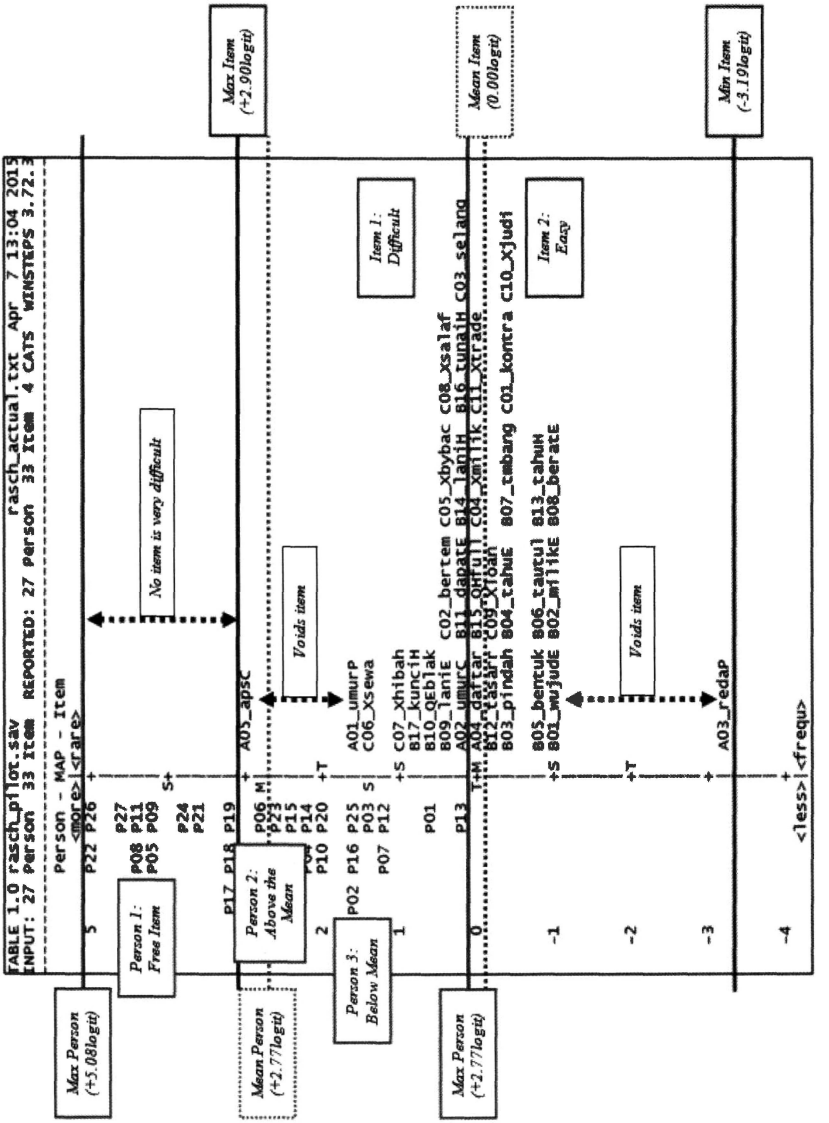

Figure 4. Hierarchy of relationship

The PIDM above shows the ability of the item to separate the respondents into three categories namely the person free item, the person above the mean and the person below the mean. The items were divided into difficult and easy, with the item mean (0.00 logit) as the separation line. This division is aligned with the data separation of the person (3.15) and the item (2.07) as shown in Table 3. Out of the 27 respondents, Group 1 (excellent) contains 12 people which were located within the maximum item location at a range of values between +2.90 logit to +5.08 logit. Group 2 (good) consisting of 7 people were located within +2.90 logit to +2.07 logit. The rest of the respondents were in Group 3 (mediocre) as they were within the range of +2.07 logit to item mean (0.00 logit).

The map proves most of the respondents were person free item. More items are required to measure them. The respondents have high evaluation ratings, and they had no problem to agree with most of the items in the instrument. The items only measure the person in Group 2 and 3, whereas there was no complicated item to measure the people in Group 1. Most of the items are easy and below the respondent mean (+2.77 logit). There were no respondents under the mean item (0.00 logit). This is aligned with the view of Bond and Fox (2015) in which, an easier item is more likely to be agreed upon by all of the respondents.

The easiest item to be agreed by most of the respondents was the A03 (-3.19 logit) and the most difficult item to be agreed together was the A05 (+2.90 logit). There are also large gaps in two places namely between the items A01 and A05, and also the items B01 and A03. This made the item reliability to be at a value of 0.81.

5.5 Summary Statistic after Removal of Misfit Item

The value for the statistics analysis after the elimination of A03 item is shown in Table 3. Overall, the findings showed that the instrument has a fair item reliability (+0.75 logit), mean infit MNSQ (+1.02 logit) and mean outfit z-std (0.00).

Table 3. Summary statistic after removal of misfit item

Statistics		Measures (logits)	
		Before Item Removal	After Item Removal
Mean measure	Person	+2.77	+2.70
	Item	0.00	0.00
Separation	Person	+3.15	3.19
	Item	+2.07	1.75
Realibility	Person	+0.91	+0.91
	Item	+0.81	+0.75
Mean infit MNSQ	Person	+1.02	+1.02
	Item	+0.99	+0.99
Mean outfit MNSQ	Person	+1.21	+0.96
	Item	+1.21	+0.96
Mean infit z-std	Person	0.00	0.00
	Item	0.00	0.00
Mean outfit z-std	Person	-0.10	-0.10
	Item	0.00	0.00

6. Conclusion

The analysis of the Rasch model has proven that SCGI can be accepted and has a high reliability (person = 91; item = 81). Out of the original 33 items, 1 of them was a misfit and was required to be eliminated in order to obtain a valid instrument under the Rasch model. Therefore, the final instrument contained only 32 items. SCGI instrument can be used as guidance to the public and adopted by Islamic financial institutions to create new products or audit of the existing Shariah gold investment. Further studies can be carried out by extending the scope of management, public understanding, product selection factors and fraud in a gold investment. The study can also be made on the correlation and significant differences between the parties involved in gold investment such as investors and investment institutions or between banks and investment companies. The researchers then are able to use or modify the approach and the methodology of this study to develop other shariah-compliant muamalat instruments such as real estate investments or forex. In addition, the increase in dimension of shariah-compliant can also be done from the *maqasid al-shariah*, legal documents, financial reports or corporate governance.

7. References

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