Preliminary Study on Strength Identification Measurement for World Cup Soccer Players in Whoscored.com using Rasch Measurement Model

N.S. Khusaini, N. Aziz, K.I Sainan, A.R Hemdi, Z.Mohamed

Abstract: Malaysia soccer team is facing a declining trend of performance in recent years. There are a lot of corrective actions that have been taken by the related authorities, but to no avail. One of the actions that had been taken is related to improving the player's strength. However, the significant strength attributes that could be the winning factor in a game is yet to be determined. Hence, the study aims to identify the sequences of strength attributes for 2018 World Cup soccer players using a probabilistic model known as Rasch Measurement Model (RMM); which can act as a guidance for the Malaysia football team to improve the player's performances. Nineteen (19) strength attributes were obtained from Whoscored.com and converted into a 4-Likert rating data. A total of fifty (50) players participated in the 2018 FIFA World Cup were taken as population sample. The result from the Person-Item Distribution Map (PIDM) shows that, in order for the Malaysia soccer team to improve, they should start with the skill to intercept the ball (- 2.70 logit), dribble (-2.33 logit) and taking set-pieces (-2.03 logit). On the other hand, the result from Summary Statistics proves that the strength attributes used by Whoscored.com is sufficient to gauge the players' strength since it yields a reliability value of 0.90, and Cronbach Alpha value of 0.96.

Index Terms: FIFA World Cup; Football; Rasch Model; Strength Attributes; Soccer

I. INTRODUCTION

It is a known fact that soccer teams with dexterous players have a higher chance of winning a game. As skillful as a soccer player may be, it is almost impossible for each of them to acquire all the strength attributes needed in soccer. The strength attributes refer to significant skills that a player has developed through training and experiences related to their position on the field, as well as being able to perform under pressure during a soccer match. Moreover, different position in the soccer game requires different strength attributes. A combination of players with different set of strength attributes determines the uniqueness of a soccer team.

To determine how well a team has performed, various parties whom normally known as soccer analysts have observed and conducted relevant analysis with respect to a team's performance. The analysis is normally related to each player's performance in a team, and it includes the strength attributes. One of the importances of doing the said analysis is clearly, for the purpose of continuous improvement. Analysis related to continuous improvement does not only benefit the team, which is being analyzed, but it also provides meaningful guidelines for any team which is not up to world class standard to progress and can be said as a means of benchmarking. For a successful benchmarking effort, the analysis should be conducted on a better performing soccer team (e.g World Cup soccer teams).

There are a lot of issues lingering the Malaysia soccer team due to declining trend of performance. Even though a lot of corrective actions have been taken into action, but the performance of the team is still upsetting. To date, Malaysia stands at a distressing rank of 171 as of September 2018 [1]; and to rub salt to the wound, it is the lowest point in the national soccer performance history. Hence, there is a need to do a thorough analysis to rectify the root cause of this problem. This paper aims to identify the sequences of strength attributes for 2018 World Cup soccer players using a probabilistic model known as Rasch Measurement Model (RMM); which can act as a guidance for the Malaysia football team to improve the player's performances. This is the first study intended to analyze the aim as stated above, using RMM. It is expected that RMM has the ability to measure the level of strength attributes, hence demonstrating a strong hierarchical level as aimed in the objective.

II. METHODOLOGY

This study extracts qualitative data from a website named Whoscored.com; a website which provides a detailed and comprehensive soccer data; conducted by a dedicated team of sports' analysts. A total of nineteen (19) strength attributes have been identified from the website and are converted and ranked into a 4-Likert rating type (4- Very Strong, 3- Strong, 2-Weak,

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1-Very Weak) according to the details provided by website are shown in Table 1 as below.

No.	Attributes	Item Coding	Attributes' Description
1	Holding to Ball	ST1	The ability to keep the ball under opponent's pressure.
2	Key Passes	ST2	The ability to pass the ball either to break opponent's defending structure, or to create goal chances.
3	Dribbling	ST3	The ability to control the ball while running through opponent's players.
4	Finishing	ST4	The ability of to score goal each time; at any given chance.
5	Through Balls	ST5	The ability to pass the ball accurately from deep in between opponent's defenders.
6	Aerial Duels	ST6	The ability of player to win the ball aerially.
7	Defensive Contribution	ST7	The willingness to contribute during defensive phase.
8	Passing	ST8	The ability to pass the ball accurately to the intended target.
9	Tackling	ST9	The ability to gain possession of the ball from an opponent's player without committing a foul.
10	Long Shots	ST10	The ability to shoot the ball from outside penalty area towards the target goal area.
11	Taking Set-pieces	ST11	The ability to take indirect free kicks or corner kicks towards intended target.
12	Crossing	ST12	The ability to deliver the ball from wide area to the intended target.
13	Direct Free Kicks	ST13	The ability to deliver a free kick directly to the target area of the goal.
14	Concentration	ST14	The ability to perform and make decision without losing focus at any time during soccer match.
15	Discipline	ST15	The ability develops by a player to refrain himself from doing any foul or silly mistakes; as well as to follow tactical strategies.
16	Headed Attempts	ST16	The ability to head the ball accurately to the intended target.
17	Offside Awareness	ST17	The ability to create offside trap (as defenders); or avoid from being caught in it (as attackers).
18	Ball interception	ST18	The ability to intercept the ball from opponent passing lane
19	Blocking the Ball	ST19	The ability to block the ball from reaching dangerous area or to break opponent passes.

Whoscored.com. The strength attributes identified from the

Table 1 Strength Attributes from Whoscored.com

A. Participants

The targeted populations are the soccer players who have represented their respective countries in the 2018 FIFA World Cup which was held in Russia. A total of fifty (50) 2018 World Cup players have been selected based on the rating given by Whoscored.com. In terms of sample size of a preliminary study, Johanson has conducted a study related to sample size and has conclude that a minimum number of 30 respondents is considered reasonable [2]. Hence, having fifty (50) 2018 World Cup players as respondent is considered more than enough.

B. Analysis Method

The Rasch Measurement Model (RMM) is a probabilistic model that has been used widely to analyze and to predict the designated psychometric attributes. RMM offers a new paradigm on how a set of data can be interpreted. Unlike any other models, RMM measures and shows the relationship between a person and an item based on mutual latent trait. Both person and item will be measured hand-in-hand in terms of the likelihood of a person to answer an item with given difficulty, correctly. According to Bond, the probability of success is highly dependent on the difference be-tween a person's ability, and an item's difficulty [3]. RMM is constructed based on two theorems [4]:

- A person with high ability has a greater likelihood to answer all given items correctly.
- An easy item has a greater likelihood to be answered correctly by all person.

To relate those two theorems with this study, it can be said that;

- A World Cup player with an excellent ability has a greater likelihood to acquire all strength attributes listed.
- An easy strength attribute has a greater likelihood to be acquired by all World Cup players.

RMM has been used widely in all around the world. For instance, RMM has been used in medical studies related to cancer [5], depression [6], pain and fatigue [7], treatment of injuries [8], stroke [9] and diabetes [10]. In education, RMM is used to produce accurate student's ability grade [11], and to measure students' performance in Mechanical Engineering final examination [12]. In sports, RMM is used mainly for training procedures and rehabilitation of pain or fatigue [13][14]. Interestingly, no study has been performed related to identifying the sequences of strength attributes acquired by the soccer players in 2018 FIFA World Cup using RMM.

Additionally, RMM bids a valid and reliable analysis since it converts nominal and ordinal data into ratio data. This is consistent with the findings provided by Stevens, where any raw data should be converted to interval or ratio data, before it can be used for statistical analysis [15]. Hence, it is believed that RMM fulfils the needs of this study. To analyze the data (nineteen (19) strength attributes) from Whoscored.com, a RMM software named Winstep is used.

Table 2 Summary statistics: Item reliability

	Total score	Count	Measure	Model error	Infit		Outfit	
					MnSq	ZStd	MnSq	ZStd
Mean	47.2	15.8	0.00	0.56	0.88	-0.3	0.87	-0.3
SD	26.9	8.2	1.92	0.18	0.48	1.5	0.47	1.4
Max	116.0	36.0	4.66	0.89	2.01	3.0	1.98	2.9
Min	13.0	5.0	-2.7	0.31	0.10	-2.5	0.10	-2.5
Real RMSE	0.61	True SD	1.83	Separation	3.02			
Item Reliability	**0.90**	S.E of Item Mean	0.45					
Cronbach Alpha (KR-20) Person Raw Score "Test" Reliability = 0.96								

III. RESULTS

A. Summary Statistics

Summary statistics offers an insight related to item reliability, which means, summary statistics provide empirical evidence whether the instrument has sufficient items to measure what it is supposed to measure or not. As shown in Table 2, the item reliability is at an excellent value of 0.90 [16]. This indicates that, even though Whoscored.com developed only nineteen (19) items to measure the player's strength, it is indeed sufficient enough to achieve what was intended. Furthermore, the Cronbach Alpha (KR-20) Person Raw Score "Test" Reliability is also at an impressive value of +0.96. A high value of Cronbach Alpha signifies that; if a comparable instrument is given to the same group to measure their strength, the chances of obtaining a similar pattern of player's ability in the Person-Item Distribution Map (PIDM) is quite high (similar). Additionally, it also proves that the instrument is capable to distinguish the level of strength attributes for each player [17].

B. Person-Item Distribution Map (PIDM)

The Person-Item Distribution Map (PIDM) or also known as the Wright Map is the unique feature of RMM. RMM sees an event as a probability of success; which means it involves the analysis of the relationship between the person (respondent) and the items (questions asked). It is a normal practice for anyone to describe possibilities or chances in percentage form. For instance, what are the chances of raining today? The response will most likely be in percentage form (50% chance of raining). However, RMM de-scribed it as 50:50; hence a ratio data. Thus, it can be said that, the PIDM fulfils the criteria of measurement.

As stated by Saidfudin, a measurement should have these three (3) criteria [18]:

- Must have a unit of measurement (e.g minutes, kilogram)
- Must be equal interval (e.g clock)
- Must have numbers and ordered

In PIDM, the measurement for both person's ability and item's difficulty is measured using the same scale, named Logit. In other words, the PIDM is capable to measure both person and items concurrently, by using the measurement ruler generated by the RMM software, Winstep. Winstep has the capability to chart both person and item position along a continuum (range).

As seen in Fig. 1, there are two sections on the left and right, where both sections are separated by a vertical-dashed line. The vertical dashed-line acts like a ruler, which shows the ordering from poor to excellent (bottom to top). On the left side, the ordering of position is developed to measure the person's ability. The least able person is situated at the bottom of the range, while the ablest person is at the top of the continuum. As for the right side, the ordering position is developed to measure the item's difficulty. The easiest item is located at the bottom of the range, while the toughest item is located at the topmost position [19]. Also, from Fig.1, the letter 'M' at the centre of the vertical-dashed line represents the mean for both person and item. Meanwhile, the letter 'S' and 'T' reflects one standard deviation away and two standard deviations away from the mean value, respectively. The item mean is zero set at 0.00 logit, where the likelihood of a person to respond correctly to an item is at 50:50 [20].

It can be deduced that the chances of a person to correctly answer an item is high if the item's difficulty is lower than the person's ability, and the same goes vice versa. From the PIDM, it can be seen that the Person's Mean is at +1.95 Logit. This signifies that averagely; the 2018 FIFA World Cup players have acquired the necessary skills needed to perform during the game. The spread of item is as wide as 7.36 logit. However, there is a notable gap be-tween item ST9, ST17 and item ST15, which can be filled in with relevant items.

Overall, it can be said that, out of 19 items being evaluated, most of the 2018 FIFA World Cup players need to improve the skills to avoid offside trap, as well as maintaining good discipline.

C. Sequence of Strength Attributes for Malaysia Team Development

From Fig.1, a sequence of strength attributes can be tabulated as shown in Table 3. As seen in Table 3, the sequence of the strength attributes is arranged from the easiest to the hardest. This piece of information can do wonders to the development of Malaysia soccer player, where it can assist the players to be one of the world class players in the future.
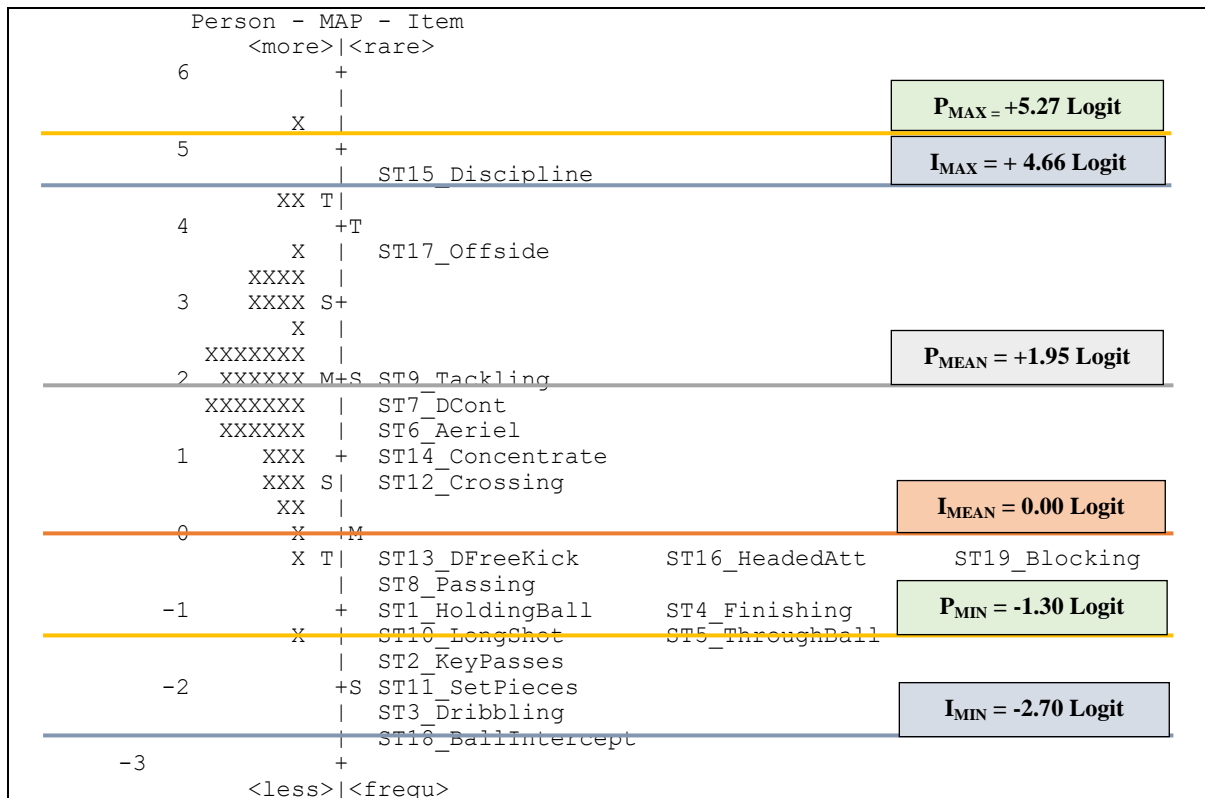
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        Person - MAP - Item
            <more>|<rare>
    6         +
              |                                    ┌────────────────────────┐
              |                                    │ P_MAX = +5.27 Logit     │
            X |                                    └────────────────────────┘
    5         +
              |    ST15_Discipline                 ┌────────────────────────┐
                                                   │ I_MAX = + 4.66 Logit    │
         XX T|                                     └────────────────────────┘
    4        +T
          X  |    ST17_Offside
        XXXX |
    3   XXXX S+
          X  |
      XXXXXXX |                                    ┌────────────────────────┐
    2  XXXXXX M+S ST9_Tackling                     │ P_MEAN = +1.95 Logit    │
                                                   └────────────────────────┘
      XXXXXXX |    ST7_DCont
       XXXXXX |    ST6_Aeriel
    1     XXX + ST14_Concentrate
          XXX S| ST12_Crossing
           XX |                                    ┌────────────────────────┐
    0      X +M                                    │ I_MEAN = 0.00 Logit     │
                                                   └────────────────────────┘
          X T| ST13_DFreeKick   ST16_HeadedAtt        ST19_Blocking
             |    ST8_Passing
   -1        + ST1_HoldingBall  ST4_Finishing      ┌────────────────────────┐
          X  | ST10_LongShot    ST5_ThroughBall    │ P_MIN = -1.30 Logit     │
             |    ST2_KeyPasses                     └────────────────────────┘
   -2        +S ST11_SetPieces                     ┌────────────────────────┐
             |    ST3_Dribbling                     │ I_MIN = -2.70 Logit     │
             |    ST18_BallIntercept                └────────────────────────┘
   -3        +
            <less>|<frequ>
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Fig.1 : Person-Item Distribution Map (PIDM)

Table 3 Sequence of strength attributes (from easiest to hardest)

Attributes	Item Coding	Measure (Logit)
Ball Interception	ST18	-2.70
Dribbling	ST3	-2.33
Taking Set-pieces	ST11	-2.03
Key Passes	ST2	-1.61
Through Ball	ST5	-1.34
Long Shot	ST10	-1.33
Holding Ball	ST1	-0.95
Finishing	ST4	-0.95
Passing	ST8	-0.76
Direct Free Kick	ST13	-0.47
Headed Attempt	ST16	-0.36
Blocking the ball	ST19	-0.21
Crossing	ST12	+0.68
Concentration	ST14	+1.14
Aerial Duel	ST6	+1.46
Defensive Contribution	ST7	+1.66
Tackling	ST9	+1.84
Offside Awareness	ST17	+3.59
Discipline	ST15	+4.66

Based on Table 3, a few inferences can be made. The examples of inference are shown as below.

1) For soccer players to develop the strength needed for them to be one of the world class players, strengthening their skills to intercept the ball could be a good starting point, since it is evident that ball interception is the easiest skill to master.
2) For soccer players to know how to dribble, they need to master the skills to intercept the ball first.
3) To have high chance in scoring a goal (excellent finishing), the soccer players should master seven out of nineteen items namely ball interception, dribbling, taking set-pieces, key passes, through ball, long shot, and holding ball.
4) For soccer players to be able to make a successful passing, they need to be able to master the skill to hold the ball under opponent's pressure.

IV. CONCLUSION

The objective of this study is to determine the order of 2018 FIFA World Cup soccer players' strength attributes based on the data provided by Whoscored.com. A total of nineteen (19)

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items of strength attributes have been identified, and those items are arranged according to their level of difficulty (from the easiest to the hardest).

Based on the results, the easiest strength attribute is ball interception (ST18); while the hardest strength attribute is maintaining discipline (ST15). Furthermore, the items used by Whoscored.com had been proven to be sufficient to gauge the players' strength with a reliability of 0.90, and Cronbach Alpha value of 0.96.

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