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스포츠 매니지먼트 석사 학위논문

Exploring the sports players and coaches' perception of the national rating system:

In the case of Mongolian table tennis

국내 랭킹 제도에 대한 스포츠 선수와 감독의 인식
탐색적 연구: 몽골 탁구 사례

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Abstract

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While studying in the Dream Together Master program at SNU, I learned that the most successful sports have at least one rating system at the national, league and club level. For the international level, International Federations use the ranking method based on the ranking point system. For the International

Table Tennis Federation (ITTF), “World Ranking” points are generally awarded on the basis of the final positions in knockout singles events. The current ranking method of the Mongolian Table Tennis Association (MTTA) and most other national federations are similar to other international federations. But it is accurate to rate individual players and teams through a proper rating system at the national level. It is important to distinguish these rating systems from the international ranking for the national federations. See the following description of the rating system: “Being competitive is a core element of human nature and a rating system is a great tool for satisfying the need of ranking players for the skills they demonstrate” (Visti, Joelsson, and Smed 2017). Sport rating systems are mathematical models that provide ratings to players that indicate their strength relative to each other. The difference of the rating is the player or team gain different points depending on the weighted strength of competitors and most international ranking points are allocated based on the results of the event.

Based on interviewee responses, it is not hard to name important issues facing developing sports federations such as coach/athlete development programs, policy, number of facilities, human resources, government support, etc. It could be argued that having a rating system might come second in priority to a number of the issues above, but when seeing the current issues depending on us, it should be held as the top priority. A proper rating system will help the

federation, league or clubs to enhance player competitiveness. Players want to have the rating as a constant measurement that motivates them to continually improve themselves toward the top ranking. This is not about creating a raw framework, but rather it is about developing a proper rating system based on one of the computing models.

The primary purpose of this study is to generate the optimal rating system for Mongolian table tennis by exploring the coaches' and player's perception of the national rating system. Through the process we confirmed that the national rating system an important issue based on coaches' and players' perceptions.

Keywords: Sports Rankings; Sports ratings; Table-tennis; Rating System

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Chapter 1. Introduction

1.1. Introduction of Mongolian table tennis

Table tennis was first introduced in Mongolia by a teacher named S. Choivon in 1955. He was a member of the Mongolian cyclist team that traveled to Beijing, China. For him, it was the first time seeing an interesting game to play on the table with a small ball and rackets. He brought a few rackets and balls on his bicycle and some of the teachers and students came to play on the tables in the school. Later on, the first national championship was hosted in 1957 and the Mongolian Table Tennis Association (MTTA) was founded in 1959. At that time, the Mongolian government supported table tennis as a public sport and founded the Mongolian National Team with seven members. After being trained by a high-level Chinese coach, the Mongolian National Team participated in its first event at the 26th World Championship in Beijing, China. Also, Mongolia became a member of the International Table Tennis Federation (ITTF). A Mongolian mixed double team placed 4th in the first Asian Games in 1966. The Mongolian Revolution of 1990 (1990 Democratic Revolution) was a democratic peaceful revolution that started with demonstrations and hunger strikes to overthrow the

Mongolian People's Republic, and eventually moved towards democratic present-day Mongolia after the writing of the new constitution. After the Revolution, society changed and many people left sports and many clubs closed. It was a hard time for the development of sports. However, for the last fifteen to twenty years, Mongolian table tennis sport development has resisted this trend. Many private table tennis clubs opened in the districts and provinces, with the number of players and students increasing year by year. We held around 30 official events of MTTA per year with three levels of league events, National Cup, juniors, veterans, adult's national championships, Mongolia Cup international event, etc. Mongolia hosted the first Asian Students of Universities Championship in 2008, East Asian Juniors & Cadet Championships in 2017, 2018 and the 'Mongolia Cup' international tournament in 2017, 2018 in the capital Ulaanbaatar. Mongolian Para Table Tennis Federation was founded in 2011 under MTTA and participated in international para table tennis tournaments as well as The Asian Games. More than ten Mongolian referees qualified as the international referees to judge Asian and World level tournaments. We hosted one of the biggest tournaments 'Asian Juniors & Cadet Championship 2019' in Ulaanbaatar, Mongolia. Now, Mongolia is positioned among dominant table tennis countries like China, Korea and Japan. It is challenging to succeed on

the Asian continent, but I've seen great opportunities, too. Because the best athletes are born from the challenges of hard competitions. Also, we have the opportunity to learn from the closest countries and it is important to bring their experiences to our own ground. Table tennis is developing more likely as an amateur rather than a professional sport. Because there is no single paid athlete, it is quite difficult to follow full time training programs. Yet still, we have a national team by age groups and a good number of training clubs with many experienced coaches. To achieve in the international arena, we have to discover and improve the necessary things and weaknesses. I can easily mention our needs and what we have to do immediately, such as coaches development, sponsorship, proper management, new facilities, the athlete development policy, etc. We have a 60 year history which is the same as other Asian countries, but some experts have said Mongolian table tennis development is behind 15 years compared to the dominate countries. The most effective approach is to support athlete development as a main priority and then seek the possibilities of what we can do system-wide.

1.2. Background

Many people ask why the Mongolian table tennis sport development goes so slowly. Our ready-made answer is always “it is all about money.” We like to complain there is no support from the government. One of the things I best learned from the Dream Together Master program at SNU is the development of the sport really depends on us, not 100% about money. We may actually solve our financial issues through the sport. Also, it is important to discover and improve the issues that are possible to solve based on our resources. So, the first thing we should be improving is what we can improve based on our own resources by finding out what factors really depend on us. In my view, we need to introduce a national ranking and rating system to Mongolian table tennis following the lead of table tennis in developed countries. This is one thing that we can establish based on our resources. It could be an important issue and one major step to drive progress for Mongolian table tennis development, in my view. My research focuses on the importance of establishing a national rating system based on the perception of coaches and players. How do we know who are the top athletes in the world in different sports? How we measure the athlete's strength and performance, and which metrics do we track to achieve this? The world ranking is proof of

the athletes' performance and how they become stronger athletes. This is possible when we can clarify the ranking based on the rating calculations.

1.3. Problem Statement

In sixty years of history, we never had a national rating system and the current ranking method is not accurate, which is not the case for table tennis in developed countries. The National Federation hosts 30 official events for all age groups and the average player participates in around 10-15 official competitions per year. Without a rating system, those tournaments have no connection to each other, and to advice, only the names of athletes who placed highly in single events can be recognized. For other players, there is no benefit to have played in the tournament as there is nothing left for them to analyze about their general performance.

The problem statement is therefore focuses on the crucial fact that there is currently no rating system, and further explores the important task of identifying the optimal calculation model for Mongolian table tennis.

1.4. Research Purpose

Based on my learning, a national rating system is the essential indicator of a player's ability in the countries that have been successful in table tennis. In my view, the proper rating system affects players' competitiveness and motivation, yet for the sixty-year history of the sport, there has been no rating system for table tennis in Mongolia. The primary reason for not having a rating system is a lack of understanding of the importance of the rating system.. For this reason, my research is poses a study of different levels of players' and coaches' perception of the national rating system in the case of Mongolian table tennis. It is necessary to know the importance to players and coaches in Mongolia. It is only possible to establish something newer based on research findings.

1.5. Research Hypothesis and Research Questions

There will be three hypotheses shown below:

H1: We didn't initiate the establishment because there has been a lack of understanding of the importance, advantages and requirements of the national rating system.

H2: We understand the importance and want to have a national rating system, but don't know how to establish it.

H3: We state that the perception of the rating system is not very important compared to other urgent issues in the sport.

The three research questions described below will aid in uncovering the importance of the rating system according to the stated hypotheses:

RQ1: How to measure Mongolian players' and coaches' perception of the importance and requirement of having a table tennis rating system?

RQ2: Do Mongolian table tennis players and coaches want to have a national rating system?

RQ3: How are Mongolian table tennis players' and coaches' positioned for introducing a national rating system, and how important is it to them?

Chapter 2. Literature Review

2.1. What is a sport ranking and rating system

Many sports have rankings and rating systems. We need to distinguish ratings from ranking as there are a variety of theories on the subject. Doctor Stefani said, “A rating is a numerical value assigned to a competitor, based on results and other factors while a ranking is an ordinal placement based on the ratings” (R. T. Stefani 2018). Also, we use the rankings list only for players who are eligible to play for their country. The Rating system includes all players who compete in this country, regardless of their nationality (England 2019). A rating system estimates the playing strength of each player while in contrast, a ranking system only produces an ordinal list of players ranked by playing strength. If the values are going to be updated as new results come in, then ratings are preferable since they maintain more information about a player’s level. An obvious way to produce rankings from ratings is to sort the players by rating. (Marcus 2001). Being competitive is a core element of human nature and rating systems are a great tool for satisfying the need of ranking players for the skills they demonstrate. But the games of today have left rating systems behind in their evolution, making it more and more unlikely that individual players are evaluated fairly for their

performance (Visti, Joelsson, and Smed 2017). Wikipedia describes sport rating systems as follows:

A sports rating system is a system that analyzes the results of sports competitions to provide objective ratings for each team or player. Rankings are then derived by sorting each team's ratings and assigning an ordinal rank to each team starting with the highest rated team earning the #1 rank. (Wikipedia 2019b) Sport rating systems are mathematical models that provide ratings to teams that indicate their strength relative to each other. Ratings are different from rankings, as described by (Hand 2012) :

- A ranking of items is a rank-ordered list of the items. Thus, a ranking vector is a permutation of the integers 1 through x (any number of participants).
- A rating of items assigns a numerical score to each item. A rating list, when sorted, creates a ranking list.

Sport rating systems are perhaps most notably used by many sports organizations that arrange competitions in their respective sports. A motivation for constructing a proper rating system is to be able to describe the differences in strength amongst competitors. This system can then be used for various purposes (Tenkanen 2019). Rating systems are commonly used

by international sports federations and other competition organizers in different sports and mind games. They are automated systems developed with the intention to rank, or rate competitors based on their performance (R. Stefani 2011b).

2.2. Usage of the rating system in sports

Most are relatively simple, involving only weighting and averaging. Stefani (1997) and Bennett (1998), section 12.3, have surveyed the systems used by various sports. The chess rating system is the best-known method and even some sports federations have adopted this system. Even the current USATT national rating system is similar to chess. It uses a probability model, but it does not use conditioning to process new results. See (Elo 1978), (Glickman 1995), and (Regan and Haworth 2011) for more information and related systems. Glickman used an approximate Bayesian updating algorithm. Section 11 compares an algorithm similar to Glickman's to the approximate algorithm that is the US current system. Farmers and Tutz's algorithm is a state-space smoothing algorithm. The algorithm of US current table tennis rating is neither a state-space algorithm, nor a smoothing algorithm. As mentioned in the research paper 'A Comparative Survey of Officially Recognized International Sports Rating Systems' (R. Stefani 2011a) 59 sports

have no rating system of the 156 sports, two combat sports have a subjective rating system, 82 sports have an accumulative system in which points accrue non-decreasingly over some window of time, and 13 sports have an adjusted system in which a rating self-adjusts based on the difference between some observed result and a prediction of that result based on past performance (R. Stefani 2011b). Sports ratings have many connections to non-sports statistical problems. See the references in (Batchelder, Bershad, and Simpson 1992), (Fahrmeir and Tutz 1994), (Glickman 1999), (Joe 2006) and (Stob 2006). (Stob 2006) An excellent introduction to some of the mathematics behind sports ratings. (Marcus 2001).

A true Skill Rating system

The True Skill ranking methods were constructed to be suited for football. It worked on tennis and ice hockey as well, but performed best for football, taking the different conditions of the sports into account, e.g. the possibility of a draw in football. This performance superiority could be due to a few reasons, e.g. that the parameters have been optimized while testing on Premier League data, that home team advantage is a more prevalent phenomenon, and that the score difference has a higher correlation to the skill within football (Ibstedt and Voorde 2019).

2.3. The Elo Model (US National Rating System)

A famous algorithm that provides ratings for different teams in a competition is the Elo rating system. The Elo rating system was created by Hungarian-born physicist and chess master Arpad Elo (1903-1992). Initially, Elo designed the system to rate chess players, but this system soon proved to be applicable to the other two team or two player sports as well. It is currently regarded among the most prominent systems for rating competitors in this category. The advantage of the Elo system is that it ensures that a player can play somewhat better or somewhat worse than usual without it having major consequences on the player's rating. Additionally, the Elo system rewards a weaker player more for defeating a stronger opponent than it rewards a stronger player for defeating a weaker opponent (Joost, Marysia, and Christian 2014). According to different types of rating systems (R. Stefani 2011b) can be categorized into three groups: subjective, accumulative and self-adjusting systems. Subjective systems are rare and only used in a few combat sports where a panel of judges rate competitors. In accumulative rating systems, ratings are based on the sum of the past results. These past results are often weighted and aged over time in numerous ways. Other factors such as additional statistics can also be added to accumulative models. Adjusted rating systems, such as Elo-based rating systems, adjust the previous

ratings of competitors after their encounter based on the difference between actual, and predicted results. The size of rating adjustment can be modified, and this adjustment varies in many sports. Based on Stefani's research, both accumulative and adjectives systems can identify the strength of teams and players when they are properly constructed. Most rating systems that were in use at the time of Stefani's research were accumulative systems. The Elo rating system was the most commonly used amongst adjective rating systems (R. Stefani 2011b).

USA Table Tennis (USATT), the national governing body for table tennis in the USA, has had a rating system since the 1970s. The system is similar to the chess rating system, which is undoubtedly the best-known sports rating system. However, the formulae are different and have changed several times over the years. Table-tennis in the USA has a large changing population of tournament players that compete on an irregular schedule. Some players play a dozen tournaments a year, whereas others play less than one tournament a year. Only matches in USATT-sanctioned tournaments count for ratings. There is an average of 243 tournaments per year. (Marcus 2001)

USATT has a membership policy, and anyone can become a member of the online system. The players have to create an account on the teamusa.org web

page on their own and need to pay membership fees using online payment. After that, the player can participate in the official USATT tournaments and can be evaluated according to the national rating system. The USATT rating system has four steps:

Step 1: Find players that should be adjusted.

Based on results against other rated players in the tournament, a determination will be made as to whether that player should have their rating adjusted upwards. There are two tiers of rating adjustments that are used to derive a player's adjusted rating. The first tier is for players with a net "rating point" gain between 50 and 74 points. The player's adjusted rating will be equal to their pre-tournament rating plus the net rating gain. For example, if a player has a rating of 1440 and has a net rating gain of 54 points, their adjusted rating will be 1494. The first tier is referred to as PASS1.

The second tier is used only for those rated players who have experienced a rating change of at least 75 for a particular tournament. The second tier is referred to as PASS2, and works as follows:

- If a player has either all wins, or all losses, the Adjusted Rating is derived by taking the *median implied rating* for all of the player's

games. The implied rating is calculated using each of the opponents' Pre-Tournament Ratings, and the rating chart above.

- In both cases, the player's adjusted rating will never be lower than the player's pre-tournament rating. In the event the PASS2 adjusted rating results in a lower rating than the player's pre-tournament rating, the adjustment will then revert to the PASS1 adjusted rating, which is derived solely on the basis of the net rating point gain plus the player's pre-tournament rating. (Ratings Central 2019)

Step 2: Find unrated player initial ratings.

Based on results against rated players in the tournament (including the adjusted ratings calculated in step 1), initial ratings are calculated for all unrated players. The Adjusted Rating (Initial Rating) for unrated players is derived by either a mathematical calculation, or a fixed rating assigned by either the Tournament Director, or USATT office. The mathematical calculation for unrated players works as follows:

- If the player has either, all wins, or all losses, the Adjusted Rating is derived by taking the median implied rating for all of the player's games. The implied rating is calculated using each of the opponents' Pre-Tournament Ratings, and the rating chart

above. For players with all losses, the Adjusted Rating cannot be higher than the player's worst loss.

- If the player wins and losses, the adjusted rating will be derived by an average of the player's best win and worst loss.
- In both cases, the Adjusted Ratings for unrated players are subject to a 75 minimum value. (Ratings Central 2019)

Step 3: Find the final adjusted ratings.

Similar to step 1 except that player adjustments are based both on results against previously rated players, as well as unrated players (using the ratings set in step 2). The adjusted ratings found in this step are used for the final calculation of points won/lost for the tournament. (Ratings Central 2019)

Step 4: Final ratings.

Total points won/lost will be calculated for each player based on the rating chart. Players with adjusted ratings from step 3 will start step 4 with this rating and will gain/lose points based on this new rating.

When a late reporting tournament is processed, all the subsequent tournament results are recalculated as well, so that a player's rating history is always correct to that point.

Complete records of all tournament results are stored in the database, and therefore allows for match corrections to be made. Sometimes players incorrectly indicate the winner/loser of a match in their paperwork to the Tournament Director. Sometimes a Tournament Director will incorrectly report a result to USA Table Tennis. Sometimes there will be a data entry error that shows an incorrect result. If we believe an incorrect result has processed for one of the matches, we can report it on this page. If an error is verified, the results are corrected and reprocessed for rating. No changes will be made in tournaments that are more than 60 days old. (Ratings Central 2019)

Rating calculations: Points are gained and lost according to the rating difference between two players in the following chart.

Table 1. US Current Rating System

| Rating Chart | | |
|------------------------------------|---|---|
| Point Spread Between Players | Expected Result (Higher Rated Player Wins: number of points exchanged) | Upset Result (Lower Rated Player Wins: number of points exchanged) |
| 0 – 12 | 8 | 8 |
| 13 – 37 | 7 | 10 |
| 38 – 62 | 6 | 13 |
| 63 – 87 | 5 | 16 |
| 88 – 112 | 4 | 20 |
| 113 – 137 | 3 | 25 |
| 138 – 162 | 2 | 30 |
| 163 – 187 | 2 | 35 |
| 188 – 212 | 1 | 40 |

| | | |
|------------|---|----|
| 213 – 237 | 1 | 45 |
| 238 and up | 0 | 50 |

The system is similar to chess wherein each match, there is an “exchange” in rating points, with the winner going up, the loser going down. (If the players are more than 237 points apart, there is no exchange for the higher level player)

If a higher rated player beats a lower-rated player, there is only a small exchange of points. If a lower-rated player upsets a stronger player, there is a more significant exchange of points. (USATT 2013)

If a player has a good tournament, he/she may be adjusted upwards. The goal, of course, is to get a rating as high as possible!

Consider an example: suppose that a player, *Derrick*, rated 2040 plays a player, *Peter*, rated 2140. Subtract 2040 from 2140 to obtain 100. An excellent is the rating difference between the two players. Find the row of the table that corresponds to this difference, i.e., the row ‘88-112’

Table 2. Expected Rating Chart of the Example

| Rating Chart | | |
|-----------------|--|---|
| Point Spread | Expected Result | Upset Result |
| Between Players | (Higher Rated Player Wins: number of points exchanged) | (Lower Rated Player Wins: number of points exchanged) |
| 88 – 112 | 4 | 20 |

According to the expectation, Peter (2140) beat Derrick (2040) and gain +4 points. Because he is the higher-rated player, and so his rating would be

adjusted upward to 2144. The defeated player, Derrick, will lose -4 points and his rating would be adjusted downward to 2036. Sometimes, the lower-rated player beats the higher-rated player. If the player, Derrick (rated 2040), won the match, then use the value in the 'upset' column instead. In this case, Peter's new rating would be 2120, and Derrick's new rating would be 2060. The USATT Ratings are a numerical system, similar to chess ratings. The higher, the better! By playing in the USATT Sanctioned Tournament, they will achieve a USATT Rating and have the opportunity to move upward in the rating system.

Here is a chart showing how the system works. USATT Ratings based on the well-established tournament ratings for tournament players in USATT tournaments. (Tabletennischicago 2019)

Table 3. Player's level by Rating

| | |
|------------|--|
| Under 1000 | Beginners |
| 1000-1700 | Intermediate |
| 1400-1700 | The average member of the USA Table Tennis |
| 1700-1800 | Average tournament player |
| 1800-2000 | An "Expert" player |
| 2000-2200 | A "Master" player |
| 2350-2650 | Members of the USA Women's National Team (5 players) |
| 2550-2800 | Members of the USA Men's National Team (5 players) |

2.4. Bayesian Skill Rating System (Rating Central)

The Bayesian skill rating system is the new system that can be viewed as a generalization of the Elo system used in Chess. The new system tracks the uncertainty around a player's skills, and explicit models drawn can deal with any number of competing entities and can infer individual skills from team results. The inference is performed by approximate message passing on a factor graph representation of the model. (Herbrich, Minka, and Graepel 2007). Since the point change values are rounded to the nearest integer for displaying, occasionally the sum of the per-match point changes will not equal the total point change for the player for the event. If there is a discrepancy, it will usually be only a point. The Bayesian skill rating algorithm is based on approximate message passing in factor graphs. It has many theoretical and practical advantages over the Elo system, and has been demonstrated to work well in practice (Herbrich, Minka, and Graepel 2007). The model was developed using statistical analysis of data from the Elo Model (US rating system), experimentation and testing of various candidate models on historical data, and subjective input from tournament directors and players with many years of experience in the sport.

2.5. Korean Table Tennis Rating System

The Republic of Korea is one of the highly developed countries in table tennis and is ranked fourth in the world. There are four levels of national teams such as University National Team, High School National Team, Middle and Elementary school teams with boys and girls groups. Those national team athletes represent the Republic of Korea to the International level. Talented kids are selected as a national team athlete from elementary schools and are then developed to become a professional athlete through specialized training. For the Korean table tennis rating, there are two systems in effect. The rating system works only for the national team athletes and includes fewer players. For the remaining players there is an interesting and attractive system used that might be the reason for heavy participation in the league events every weekend. All of the players (professional, amateurs, retired, etc.) have been included in only seven groupings, and the playing system is very simple to understand for anyone. New and weaker players start from the lowest level (level 7) and step up to the next level by winning their league. According to the rules of the league system, each match will have three to five sets of games, and each set will have eleven scores. At the beginning of the set game, the weaker player will get 1 to 5 bonus points from the higher player after equating the players' level differences for each game. (Level 5 and Level 4

players' match start at score of 2:0). For the same level of players the match will start at score of 0:0. Giving a number of the points are depending on their level difference. A one-level difference of each player is to give 2 points, the difference between the two stages is 3 points, and the difference between the three levels is 4 points. Example:

Han (Level 5), Rahul (Level 5), Zohid (Level 4) and Bony (Level 2) are playing in the same group as a round-robin system. Han and Rahul are the same level so their game will start as a score 0:0, and the first player to reach 11 points will win. For the match Zohid (Level 4) against Han or Rahul (Level 5), each game will start at a score of 0:2. As for the match of Bony (Level 2) against Level 5 players, they will give 4 points so the game will start with a score of 0:4 (because a 3 level difference is 4 points). Lastly, there will be 2 points given for the game against Level 4 player Zohid (0:2). This rule ensures an equal chance for everyone to compete, and anyone has a path to potentially win the tournament. After winning the league tournament, he or she will receive a prize and move to the upper level after winning twice. The official table tennis clubs (탁구클럽) hold the tournament at the same time and with the same rules as above. There is no specific rating value for each player, but this friendship game could develop table tennis as a tool of sport for all programs in Korea.

2.6. Comparison of the rating systems

The Rating Central (Bayesian model) developed using data and statistics from the US current rating system (Elo Model). This is the new rating system and official ratings of the Austrian Table Tennis Association, the Lower Austrian Table Tennis Association, the Salzburg Table Tennis Association, the Table Tennis Queensland, Table Tennis South Australia, the Tasmanian Table Tennis Association, and some US table tennis clubs, etc. The difference in this system is shown below:

- Each player has an initial rating
- The results of the tournament are the data used for updating the model
- Bayes Theorem is used to update the ratings
- Computationally intense - hundreds of players and hundreds of possible ratings per player

The comparison of the rating systems is based on ten indicators:

Table 4. The Comparison of the rating systems

| Indicators | Rating Systems | | | |
|--------------------------------|----------------|----------------|--------------|----------------|
| | USATT | Rating Central | England TT | Russian TT TTW |
| Understandable | | | | |
| Fully automated | | | | |
| Counting double & team results | | | | |
| Trouble to rate unrated player | | | | |
| Indicating tournament weight | | | | |
| Linked to tournament program | | | | |
| Accurate | | | | |
| Manage the inactive players | | | | |
| Playing history & audit trail | | | | |
| Publishing the rating on time | | | | |
| Total rating (100%) | 55% | 70% | 57.5% | 75% |



The indicators are based on previous research and components of the rating systems. See below a graphical comparison of the system weightings:

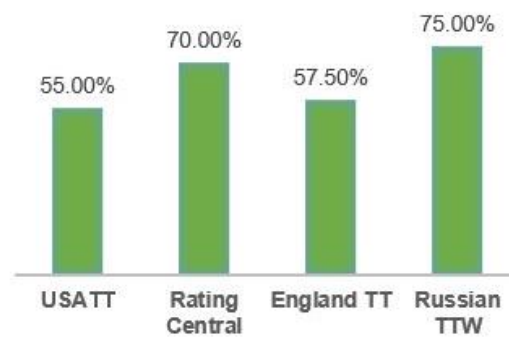


Figure 1. The comparison results of the rating systems

The graphic shows different results by each rating, but we are not concluding that one of them is good/bad or right/wrong. Because each of the rating systems has its own strengths and weaknesses. The essential consideration is to choose a rating system that fits best for the characteristics of Mongolian table tennis.

2.7. Table tennis rating systems

We presume that each player has a playing strength, i.e., a number that quantifies how active the player is. The playing strength of a player does not change during a single event but may change over time, as the player gets better or worse. The rating system is therefore an evaluation of the players' ability over time. International Table Tennis Federation (ITTF 2019) changed their ranking calculation method to the objective merit-based method used for determining to seed in all tournaments for both singles and doubles, and for selecting players at certain competitions (Table and Federation 2019). The ITTF World Rankings are run 12 times per year. Every player who has earned ITTF Ranking points in an eligible tournament during the ranking period is included in the ITTF World Rankings. The ITTF World Rankings is calculated on a rolling 12 month base. However, there is an exception for

ITTF World Table Tennis Championships, ITTF World Junior Table Tennis Championships, ITTF World Cups, ITTF World Tour Grand Finals, Continental Championships, and Continental Cups which stay in the ITTF World Rankings until the next edition. (Table and Federation 2019).

Mathematics David J. Marcus Ph.D. published his research “New table-tennis rating system” to the Journal of the Royal Statistical Society: Series D (The Statistician), in 2001 (Marcus 2001). He proposed a new system for rating the playing strength of table-tennis players. The system is based on Bayesian principles and is designed to handle a large changing population of players, where some players play frequently whereas others play infrequently. The system takes into account the length of time since a player last played a tournament. When processing matches in a single tournament, the system takes into account how a player’s opponents did in the same tournament. The system has been tested by processing data from 5½ years of tournaments (15,549 players and 330,079 matches), and could be adapted to other sports that involve head-to-head competition. (Marcus 2001). Most are relatively simple, involving only weighting and averaging. (R. T. Stefani 1997) Also, (Bennett 1998) has surveyed the systems used by various sports. The chess rating system is the best-known rating system. It uses a probability model, but it does not use conditioning to process new results.

Some of the calculation methods of the table tennis rating system are similar to the chess rating system. Every player has a rating which their relative strength among the competition. If a player improves their rating will go up, and if they experience a drop in performance, their rating will fall. The number of points gained or lost depends on the difference in ratings between the two competitors and the weighting of the tournament they are playing in (Ratings Central 2019). Even if we knew the playing strengths of two players, we would not know for sure which player would win, since a weaker player will sometimes beat a stronger player. A match is classified as an “upset” if the player with the lower playing strength wins. We presume that the probability that a match will be an upset is determined solely by the difference in playing strengths of the two players. The more significant the difference in the playing strengths, the more likely it is that the stronger player will win. The probability-of-upset function quantifies this. (Ratings Central 2019). If the values are going to be updated as new results come in, then ratings are preferable, since they maintain more information about the player’s level. An obvious way to produce rankings from ratings is to sort the players by rating. (Marcus 2001). For example, The US and UK rating system work on the odds of whether a player should win or lose based on the difference between the players’ ratings. The publication “Survey of the major world sports rating

systems” (Journal of Quantitative Analysis in Sports, Vol. 7, 2011), by R.T. Stefani, presents a list of all the different rating (ranking) systems used by internationally-recognized sports federations. For accumulative rating systems, features include converting results to points, aging results more than one-year-old and adjusting points for performance quality. (R. T. Stefani 2018). ELO model (Elo 1978) and Bayesian model (Marcus 2011) are the best models used in many sports including table tennis. This study focuses on two rating systems created by the models as mentioned above. Also, it attempts to describe the strength and weaknesses of the two systems, by including some explanations of how the rating systems work. *The Elo rating system* (Wikipedia 2018) is a method for calculating the relative skill levels of players in zero-sum games such as chess. It is named after its creator Arpad Elo, a Hungarian-American physics professor. The Elo system was originally invented as an improved chess rating system over the previously used Harkness_system but is also used as a rating system for multiplayer competitive on in a number of video games, American football, baseball, tennis, board games, table tennis such as diplomacy and other games. (Wikipedia 2018) United States Table Tennis USATT uses the Elo model, (Elo 1978) and improved it several times. Another system is the Bayesian model (Marcus 2011). “The Rating Central” rating system which is created

by Dr. David J. Marcus fully used the Bayesian Model (Marcus 2011) and is relatively straight-forward. New players are assigned a normal prior. Players who have competed before have a random walk added to their playing strength to reflect the passage of time. The probability that one player defeats another is a function of the difference in their playing strengths, and match results are processed by conditioning of the result (win or loss). Because of the large dimensionality of the problem, some approximations must be made to produce a workable algorithm.

2.8. The rating system in Mongolian sport

Mongolian traditional sports have a long history, and are still developing successfully. Mongolian popular sporting competitions are held in the three "manly sports" of horse racing, archery and wrestling, held around the time of their main national festival of Naadam (Wikipedia 2019a). Mongolia has participated in the Olympic Games since 1964, for the 55 years Mongolia has won 26 Olympic medals in the Summer Olympic Games. Those medalists succeed in individual sports such as judo, boxing, wrestling and shooting (Wikipedia 2019a). There is limited research related to the rating system of Mongolian sports, but based on observation, most successful sports

have a ranking and rating system based on their experiences. Those sports federations rate their athletes based on the performance of the international and national competitions similar to other international federations. (Judo Association 2019). The Associations hold official qualification tournaments among national athletes and then select the athletes who will represent Mongolia in the international arena. Also, the performance of the international, world-level tournaments influences the athletes' ranking. This is the method to rate through tournament performance. For the new developing sports such as fencing, basketball, football and modern sports it is not a good way to rate based on tournament results only. The problem is that the rating system is not always simple to understand. While experts will understand the ratings, most times players will not. For instance, a player might ask why a team that has lost a game has a higher rating and is ranked above a team that has won all their games. The goal of the graphical representation will be to show a team/player why their rating is what it is (Joost, Marysia, and Christian 2014). One of the best developing sports in the recent past is the Mongolian Fencing Association, which was founded in 2009.. When the association was founded, they had established a rating system that began to rate players since the first year. The rating system and proper management system raised the development of their sport. (Fencing

Associaont 2019). This is a good example of using the rating system based on players playing strength and performance.

The need for a rating system comes from the desire to evaluate the strength of competitors in competitive matches. However, there is very little use for a system that can only give a conclusion that player A is better than player B. Furthermore, the rating system should also be able to describe the relative strength between competitors.

Chapter 3. Research Method

This chapter outlines the qualitative framework for the project and verifies, methods for data collection and analysis. The first part of this chapter explains the underlying research tradition and justifies the case study approach used to explore the research questions. The second section discusses the sampling techniques and professional samples used in the study. This is followed by a description of the various stages of the research process, which includes an overview of the observation and interview strategies employed. The next section of this chapter classifies the methods used for analyzing the data and acknowledges some of the limitations related to the project. The final part of the chapter highlights examples from the pilot study and concludes with a discussion of the ethical considerations for the current research. This study investigates coach's and player's perceptions of a national rating system and its impact on athletes and sports development and the state that is representing the coaches and players. The study aims to clearly understand why we are not introducing a national rating system, and what obstacles we faced based on the qualitative research method. While quantitative research emphasizes the measurement and analysis of causal relationships between variables, qualitative research attempts to capture the individual's point of

view, and examines the constraints of everyday life to secure rich descriptions of the social world (Denzin and Lincoln 2000).

3.1. Research Design

“Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore the social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting.” (Creswell 2007). More specifically this study will focus on the analysis of coaches' and players' perception, state and thoughts. When selecting methods of data collection, it is important to consider the particular aspects of coaches, along with professional and amateur players. That makes the target sample unique while also ensuring the data is collected in a manner that truly represents real opinions on the issues that are being discussed. For these reasons, the collection of interview data would be a better way to conclude the issues at hand. This research style should be measured using words, statements, and other non-numerical channels that generate the data from the viewpoint of the participant. Detailed and personalized responses where the participants create their own definitions of effectiveness are

required, rather than research which focuses on pre-determined definitions that request participants to rate their beliefs on a scale. As such, a qualitative paradigm guided the research framework, in order to address the research question and focus areas outlined in Chapter 1.

3.2. Research Method

Qualitative research is a broad term encompassing different data collection and analytical approaches with the aim of providing a cultural and contextual description and interpretation of a social phenomena. While there are variations between these research approaches in terms of data analysis and presentation of findings, they all contribute to both description and interpretation of phenomena (Holloway and Galvin 2017). According to (Walsh, Domegan, and Fleming 2012), “Qualitative research aims to explore and to discover issues about the problem on hand because very little is known about the problem. There is usually uncertainty about the dimensions and characteristics of the problem. It uses ‘soft’ data and gets ‘rich’ data.’ Qualitative research is designed to help researchers understand people, and the social and cultural contexts within which they live. Such studies allow the complexities and differences of worlds-under-study to be explored and represented” (Myers 1997). The current study employs a multidimensional

case study method based on the methodological framework outlined by Robert K. Yin (1994, 2003). Cohen et al. (2000) indicates that the paradigm most suited to case study research is that which emphasizes the interpretive and subjective dimensions of phenomena – two key features of this research. According to previous research, the case study approach is a comprehensive research strategy that provides methodological strategies for design, analysis, and reporting (see 99 Freebody, 2003; Silverman, 2006; and Yin, 1994, 2003). Case studies present situations in ways that are not always prevalent in numerical analysis by investigating complex, dynamic and unfolding interactions of events, human relationships and other factors unique to specific situations (Cohen et al., 2000). The case study methodology enables the researcher to uncover contextual conditions and meaningful characteristics that are pertinent to the phenomenon under investigation. This is because case study research examines the dynamics of situations and people with the focus on the significance of events and meaning rather than frequency, as in quantitative traditions (Yin, 1994, 2003). In the case of qualitative studies, researchers strive to portray what it is like to be in a particular situation, providing participants' lived experiences, thoughts and feelings in a real situation. Furthermore, the case study methodology engenders a holistic understanding of life events and relationships with a

particular group, organization, sports team or individual (Gratton & Jones, 2004; Yin, 1994, 2003).

Multidimensional case study research is useful for assessing a coach's knowledge and their practical application of coaching skills. Studying the components of effective coaching based on a case-by-case scenario provides great clarity regarding the similarities and differences exhibited across different professional sports teams and codes. In fact, Yin (1994, 2003) claims that case study research allows perceptions of important events and situations to speak for themselves. This is an important feature of this research and is the reason why observation techniques are included. To sum up this section, qualitative research is a systematic inquiry into the nature or qualities of complex social group behaviors by employing interpretive and naturalistic approaches. The qualitative study lends itself to a thick narrative description of the group behaviors in the group's natural environment. It attempts to be non-manipulative, and takes into account the unperturbed views of the participants as the purpose is generally to aim for objectivity (Lougen 2009). Qualitative research is most appropriate when the researcher wants to become more familiar with the phenomenon of interest, to achieve a deep understanding of how people think about a topic and to describe in great detail the perspectives of the research participants (MOHAJAN 2018).

3.3. Data Collection

Data collection occurred in November 2019. At the onset of interviews, participants will have provided an overview of the study, procedures for confidentiality, and the voluntary nature of participation. All participants provided detailed information about research purposes and findings.

3.3.1. The Participants

The national rating system includes all age level groups, national teams, other professionals and amateurs who participate in national-level tournaments held by National Federation. Therefore, the research considers participants from the different target groups shown below:

Table 5. Participants by group

| Groups | Representing | Number-10 |
|---------|-----------------------|-----------|
| Group 1 | Coaches | 3 |
| Group 2 | National team players | 3 |
| Group 3 | Average players | 4 |

We have different age groups such as -9, 10-12, 13-15, 16-18, 19-39, 40-49, 50-59, 60-69, 70+ by gender. However, my target group would be age level

19-39 which is considered as a most competitive level. It also balanced the number of participants by gender. The research sample was chosen from national-level coaches, national team players, and other average players. The coaches had at least five years of working experience as a coach, and additionally, both of the coaches (and players) had at least ten years of experience as a player. Initially, 10 respondents were selected for the research. Included are four Mongolian players who played in a different country such as the US and South Korea, which are both countries that already implemented national rating systems.

3.3.2. Interview

(Alshenqeeti 2014) stresses that qualitative interviewing is justified whenever a depth of understanding is required. The researcher conducted an in-depth interview with a semi-structured, and open-ended interview-style following a developed general interview guide. In a semi-structured interview the researcher has a list of questions or fairly specific topics to be covered, often referred to as an interview guide, but the interviewee has a great deal of leeway in how to reply. Questions may not follow in the exact way outlined in the schedule. Questions that are not included in the guide may be asked as they pick up on things said by interviewees. But, in the end, all of the

questions will be asked, and a similar wording will be used from interviewer to interviewee (Wells 2002).

The interview questions were constructed around the background research, and the objectives the researcher set out in the beginning, and cover three main areas; (i) General perception of a rating system; (ii) How to go about introducing a rating system, (iii) How important the rating system is for the advancement of Mongolian table tennis. In this research, participants were asked semi-structured, open-ended questions during a phone call (or equivalent medium of communication). All the interviews were conducted in the Mongolian language. Afterward, the interview was transcribed and translated into an English language data file for further study. The interview has been conducted either via Skype or telephone calls with the interviewee depending on the interviewee's availability for the choices.

3.3.3. Procedures

First, I contacted the selected participants' through social media (Facebook Messenger) and appointed their proper time to interview. Facebook and Facebook Messenger are the most common communication methods for Mongolians. The purpose of the interview, introduction and general information was given before the interview. I contacted and interviewed two

of the participants in face-to-face interviews, and three participants interviewed through a video call. For good quality of the recording, the other five participants were contacted using voice calls through the Viber messenger application. After writing down all of the interview transcripts (Appendix B) they were thematically analyzed using coding methods.

3.4. Data Analysis

The thematic coding analysis of qualitative research was used in this study. Thematic analysis is the process of identifying patterns or themes within qualitative data and it is suggested that it is the first qualitative method that should be learned as ‘it provides core skills that will be useful for conducting many other kinds of analysis’ (Braun and Clarke 2006). A further advantage, particularly from the perspective of learning and teaching, is that it is a method rather than a methodology (Braun and Clarke 2006) (Clarke and Braun 2013). This means that, unlike many qualitative methodologies, it is not tied to a particular epistemological or theoretical perspective. This makes it a very flexible method, a considerable advantage given the diversity of work in learning and teaching (Stranges, Ul Haq, and Dunn 2014). Thematic analysis ensures the systematic analysis of the information and

helps in developing the foundations of theories and concepts that account for the research problem, whereas it also helps in comparing the findings with the prior scholars as a means to determine the consistency of results. The thematic analysis in this study will be conducted by using the axial coding, by which the data will be coded at three different levels as a means to ensure the systematic organization of data. It helps in interpreting the organized data, which results in the identification of the concise findings. Similarly, the prevalence of identified codes ensures that the findings are appraised and compared with the prior scholarly findings. Hence, the researcher is provided with the direction to identify the limitations, significance, dissimilarities, and similarities with the generalized findings. Therefore, the findings are found to be labeled with the prevalence of specific categories that results in the efficient drawing of conclusions (Vaismoradi and Snelgrove 2019). (Braun and Clarke 2006) provide a six-phase guide which is a very useful framework for conducting this kind of analysis (see the table). We recommend that you read this paper in conjunction with our worked example. In our short example, we move from one step to the next, however, the phases are not necessarily linear. You may move forward and back between them, perhaps many times, particularly if dealing with a lot of complex data.

Table 6. Braun and Clarke's Six Phases of Thematic Analysis

| Phase | Process | Result | Reflexivity Journal Entries |
|----------------|---|--|---|
| Phase 1 | Read, and re-read data in order to become familiar with what the data entails, paying specific attention to patterns that occur. | Preliminary "start" codes and detailed notes. | List start codes in the journal, along with a description of what each code means and the source of the code. |
| Phase 2 | Generate the initial codes by documenting where, and how patterns occur. This happens through data reduction where the researcher collapses data into labels in order to create categories for more efficient analysis. Data complication is also completed here. This involves the researcher making inferences about what the codes mean. | Comprehensive codes of how data answers the research question. | Provide detailed information as to how and why codes were combined, what questions the researcher is asking of the data, and how codes are related. |
| Phase 3 | Combine codes into overarching themes that accurately depict the data. It is important in developing themes that the researcher describes exactly what the themes mean, even if the theme does not seem to "fit". The researcher should also describe what is missing from the analysis. | List of candidate themes for further analysis. | Reflexivity journals need to note how the codes were interpreted and combined to form themes. |

| | | | |
|----------------|--|--|---|
| Phase 4 | In this stage, the researcher looks at how the themes support the data and the overarching theoretical perspective. If the analysis seems incomplete, the researcher needs to go back and find what is missing. | Coherent recognition of how themes are patterned to tell an accurate story about the data. | Notes need to include the process of understanding themes and how they fit together with the given codes. Answers to the research questions and data-driven questions need to be abundantly complex and well-supported by the data. |
| Phase 5 | The researcher needs to define what each theme is, which aspects of data are being captured, and what is interesting about the themes. | A comprehensive analysis of what the themes contribute to understanding the data. | The researcher should describe each theme in a few sentences. |
| Phase 6 | When the researchers write the report, they must decide which themes make meaningful contributions to understanding what is going on within the data. Researchers should also conduct " <u>member checking</u> ." This is where the researchers go back to the sample at hand to see if their description is an accurate representation. | A <u>thick description</u> of the results. | Note why particular themes are more useful at making contributions and understanding what is going on within the data set. Describe the process of choosing the way in which the results would be reported. |

In this study, thematic analysis was conducted to acquire insights about the perception of all levels of player's and coach's perceptions, and their understanding of the rating system in the case of Mongolian table tennis. The

analysis will aid in knowing how important these factors really are to the various groups within the sport.

Chapter 4. Findings and Discussion

This chapter provides the findings of the interview results using a thematic analysis from data collected from coaches, national team players, and other players. The findings will help clearly understand the coach's and player's perception of the rating system.

4.1. Findings

The participants were interviewed with ten questions related to rating systems. There are 10 interviewees from the Mongolian Table Tennis Association who have playing experience of at least 10 years. Also, coaches were experienced with five or more years at the national team, and club level. Results were obtained for thematic analysis by the method of coding.

4.1.1. Lack of attractiveness and motivation

The first three questions of the interview aimed to define their perception related a rating system. I wanted to know if they clearly understand what rating systems are, and what the differences of having a rating system versus no rating system are. About the question “What are the disadvantages of not having a rating system in table tennis?,” five of the participants P1, P3, P4, P6 and P9 answered ‘we don’t know players ranking and strength clearly’.

They also said that the strongest players succeed in the tournaments by winning. They got medals and won first place. But they recognized that there were no benefits or no advantages for other players, no matter how many times they won or how much they improved. There are only two indicators, win or lose. This is less attractive for the weaker players who do not participate in many events. P1 and P3 said; *we don't know the total number of players in Mongolia*, because it is impossible to know the total number of the players until they are included in the rating system. P1 and P5 also mentioned that the rating system will be helpful in organizing events, and selecting players. P2, P5 and P8 said that they believe the rating system motivates the players *'That will be a big motivator for the players and it is more interesting'*. Having a rating system is beneficial for all of the players who are playing in national tournaments. Every single player will have the benefit of participating in events, they gain points, and increase or decrease their status in the ranking list. That will be a tangible numerical value for everyone. To demonstrate further, as P3 and P6 said; the rating system indicates a player's performance and abilities for the long term, not just once. P2, P7, P9 and P10 believe that the rating system will make people more competitive, players will play to improve themselves by gaining more points, not only for the glory of winning in absolute terms. The player in the US who

is from Mongolia had one more important idea; The US rating system recognizes players as a professional, advanced or an amateur through the rating system score. We also need this indicator.

4.1.2. No clear indicator

For the question ‘how to rate yourself or your players and which method do you use?’ Participants P1, P2 and P6 are answered ‘*We rate the players through qualification events results*’ and P1, P2, P3, P5 and P6 said, *we also use the results of the latest tournaments such as the national championship, the national cup, league, etc.* P1, P2 and P3 talked about how to rate their players: ‘*Rating my players is not a big deal, because I know my players’ abilities and strength. There is no trouble for those few players, but the problem is to rate all of the Mongolian players. In this case, we use the latest tournament results, or hold a qualification tournament among the players.* But this method has a weakness, because sometimes the best players win and sometimes they lose. Therefore, qualifying through one contest result is sometimes inadequate. P4 talked about the national degree system of table tennis. *We have levels of degrees such as master, sub-master, I Degree, II Degree, III Degree, and those degrees are recognized. Masters and Sub-Masters are professional players, whereas I, II and III Degrees and no degree are used to indicate amateur players.* P8 (who is playing in South Korea now)

said, *my degree in South Korea Level 4 upper-intermediate level. I degree in Mongolian table tennis.* Two of the participants P9, P10 (average players) mentioned: *I don't try to rate myself, and I don't care about rating systems much.* P9 said, *table tennis is a healthy lifestyle for me. I enjoy playing table tennis and competing in tournaments, not for earning a rating.*

4.1.3. The proper time to introducing a rating system

My purpose is to know participant's perceptions of the importance of introducing a rating system to Mongolian table tennis. For the question "would you like to introduce a rating system to Mongolian table tennis?" All of the participants P1 to P10 answered *YES*. P1, P2 and P5 said: *we need to work together with development and modern technology. We need to have a rating system by gender, and by different age groups, and publish it online. It is better to develop a website or application for player's ratings.* P1, P2, P3, P4, P6, P8 and P9 answered: *The rating system is good for development and career* and P3 said: *It will be better to have a rating system compared to now. It is a necessary thing for table tennis.* P10 said: *A rating system will link people to each other. I think everyone will like it.* P7 said: *most of the high level players dominate for the long-term.* The cycle of the player's domination is longer in Mongolia. The top 12 players are not renewed for many years. Of course, they are good players, but I think this is a lack of our athletes'

development too. The progress of renewing as a new generation is too slow. For question #6, do you think this is the right time to introduce a rating system? All participants P1 to P10 answered, *yes it is the right time to establish it*. P2 and P4 said: *we talked about a rating system for many years. We need to implement it immediately because we are late for development*. P1, P3 and P6 said: *Table tennis is developing quickly and the number of players and amateurs increasing rapidly. In this case, we need to introduce the rating system, it is a thing that we really need*. P6 said: *We need to engage over a thousand players through the rating system*. P7 said they want to rate their success and performance through the rating system, but is lacking a tangible indicator. Only P9 had a different idea and said: *It is good to introduce the rating system to table tennis, but I think it is not an urgent issue, because we have very few numbers of players at the professional level. If introducing a rating system requires a lot of money and work, it will be okay to introduce it later. We have many issues to improve right now*.

4.1.4. Lack of professionalism

Four of the participants P1, P3, P7 and P8 said they are ready to establish a rating system that is newer and supported. P2, P4, P6 and P10 said they would test the rating system and share their ideas through comments. P5

and P9 will follow the new rule and respect its purpose, so they, too, expressed their acceptance.

Through question #8, I wanted to know the necessary things to consider in table tennis' development in Mongolia for the participants. Coach's development and coach's education was mentioned five times by participants P1, P2, P5, P6 and P9. They said: *We need a high level of coaches, especially in the national team. Educating coaches is very important.* P1, P2, P3, P7, P8 and P9 talked about athlete development. *There is no systematic training program, and we need to train players as full-timers. Academic training and full-time training are necessary as players are not trained enough hours per week.* Also, P9 said: *We need to have a specific policy to increase the number of professional players. Many kids join at the grassroots level, but very few players leave their competitive age. We need a long term development program to keep those players for longer. Another necessary thing is learning from other table tennis programs in developed countries such as China, Korea, and Japan and to actively engage with them.* P1, P2, P6 and P7 said: *We need to send some players to those countries for training, and also bringing some experts to Mongolia will be helpful.* P1, P5, P6 and P7 talked about facilities. *We need to increase the number of the facilities, and capacity. Also, it is important to improve current player's conditions. Many people use*

the same facilities with national team players and it is hard to train players for a long time. P1, P2, P5 and P9 mentioned the importance of financial support and sponsorship. P4 said: *We need to support players, because I cannot participate in many international events per year. We only participate in main events such as the World Championship, Asian Championship, and Asian Games. Without participation in international tournaments, we cannot raise our world ranking and reach the success we strive for.* The rating system is mentioned three times as a necessary issue by P5, P6, and P3. According to the answers of the 6 participants P2, P5, P6, P7, P9 and P10 say good management, managers and human resources are the big issues to improve. As P7 said: *We need to organize the events more professionally for the timing, playing system, organizing, registration etc.* Another important thing said by P10 was: *We have an opportunity to use the thousands of table tennis players and amateurs for developing professional sport. There is only a lack of the professional human resources and good managers.*

4.1.5. Importance of introducing a rating system

Most of the participants said, introducing a rating system is very important. P3, P4, P5, P6, P7 and P8 said the rating system is necessary in table tennis. For example; *The differences of table tennis compared to traditional sports is a ratings gap. Table tennis is good for ratings,*

calculations, and numerical values and is essentially like other sports such as swimming, fencing, etc. Sometimes we have conflict on the ranking of the players, but if we have a rating system, there will be no conflicts or misunderstandings. We can decide the success for the long term. Right now there is no clear measure to compare two or more player's individual success.

According to the answer 'introducing a rating system is one of the important things' which is said by P1, P2, P5 and P9, we can understand they think it is important, but not a thing to do in the first priority. As P1 said: *I think it is important. But if I list the important issues, it will be 1st Coaches development, 2nd Athletes Development, 3rd study international experiences, 4th Rating system".* And, P9 said, *rating is important, very important for professional players, but not for me.*

4.1.6. Not influencing due to the short period of player competitiveness

Many of the participants agreed that the establishment of the rating system affects a player's competitiveness and development. For example; P1, P2, P3 P4 and P6 said: *If the players have rating system, they will try to beat those players who have a higher rating. Everyone will play to gain points, not only for winning. Every single point will be important.* P7 said: *A rating system should be easy to understand, and everyone needs to know how it*

works. I will play to raise my rating, and try to beat everyone who has the same rating as me. It makes me more competitive and motivates me.

P3 said: After establishing the rating system, we can see the difference of the players' strength and how ratings change.

P5, P9 and P10 talked about how the rating system won't influence the competitiveness within a short period of time. They said the rating system will not make changes immediately, but think it will begin to have a greater influence after one or two years and the results would be for the long-term. One or two years later, the player's rating would become familiar to everyone.

4.2. Discussion

My first research hypothesis was "We didn't initiate the establishment because of a lack of understanding of the importance, advantages, and requirement of the national rating system." While interviewing the participants and in the interview responses, I felt those participants had a greater knowledge of the rating system than I had expected. All participants understood the rating system of the international ranking system of the ITTF based on their experience. They were mentioning that they see it as an indicator or athlete evaluation system for the professional level. However,

one of the best findings among the responses was that the rating system is more important for the average level of players, rather than elite athletes because we can rank elite athletes based on the success of the tournaments. Only those few players always winning the tournaments for many years. Other players who haven't benefited from this system have no clear evaluation because we are not counting their success in the tournaments. If the player couldn't win the tournament, no matter how strongly they competed, only winning and losing are the two indicators at play. Some participants mentioned the national rating system will help to link all of the players and also clarify the detailed number of the total players. Participants want to have an indicator to measure their success and performance. The indicator will work on skill performance and the average value of the long term participation. From the beginners to the winner there are many challenges, successes, and failures. Those things need to be measured over time because, generally, the winner is not suddenly born. From the findings, participants understand the advantages and importance of the rating system, but lack knowledge and ideas on how to establish it. They expect to establish a rating system from the national association, and are ready to endorse it while supporting the implementation. According to the question “What are the necessary things for Mongolian table tennis,” participants named many issues

such as financial support, coach development, athlete development programs, and facilities, etc. Additionally, the rating system was mentioned three times, but it seems that it is not an urgent issue or highly recommended by the survey participants. This is a pressing issue in table tennis community, but is not viewed as a first priority. Also, the establishment of the national rating system won't influence the player's competitiveness and development within a short period of time. It takes at least one or two years to get familiar with the rating system and accurately measure the skill differences of all players.

Chapter 5. Conclusion and Limitation

5.1. Conclusion

In the results of the study, we can see a certain number of the improvements necessary to make in table tennis in Mongolia. When we are seeing our weaknesses in the same box, generally it makes it impossible to improve anything. Therefore, it is important to categorize issues according to their dependencies and magnitude of importance. For example, some of the issues really depend on finance such as new facilities, and travel expenses of the national team players. But we still can find something more related to our abilities and professionalism, rather than just pointing out financial concerns. If I rank the necessities on the same list, the national rating system will be behind the other issues. But it will be in the first priority of the things we can do based on the current possibilities. For the members of the federation who are not familiar with the rating system, it is a better way to establish a proper rating system according to the initiative of Federation first, and then implement it. Further, we still have a chance to improve and change the rating system based on player's and coach's opinions.

Indicating the growth of a player's success by a certain numerical values is more realistic, and more effective. I have learned that we understand the

importance of the rating system and want to establish it, but I am also aware that the reason for not having (and not trying to have one), is a lack of knowledge and concern coupled with the need of a dedicated expert to work on its' development.

5.2. Limitations

Limited number of the sample size

Research conducted via qualitative research interviewed a total of ten participants from three different groups (coaches 3, national team athletes 3, and average players 4). Those ten participants cannot represent more than a thousand table tennis players in Mongolia.

Lack of knowledge and experience about rating systems

Participants had a basic knowledge and understanding of the rating system, but they had no idea and no experience in the principles and how those rating systems work differently. Because of this, it introduced some difficulties to ask about a comparison of the different rating systems. Interview questions were therefore limited by a participant's direct knowledge on the subject. Participants are future users, but not experts of the rating systems.

Lack of previous research studies

It is not challenging to find academic research papers and statistical models. Mathematicians have compared a variety different rating systems, and are still debating which rating system is the most accurate through their own academic research and theorems. But there is a lack of studies related to the selection of the rating system, and usage in real life. The rating system is always changing and is a hotly debated issue, but not much research considers coach's and player's perspectives. Therefore there are not many literature reviews, research publications or theories related to this study.

5.3. Future Research

There are a number of systems claiming to give the most accurate rating. Some countries have more than one rating system that are conflicting with each other in some cases. My suggestion for future research is at the national level, to explore how the rating system will affect a player's success in competitiveness after its establishment. As a result of that research, it could be helpful for other sports federations and events to implement rating models for the same positive outcome in terms of competitiveness. And, in future research, the sample size should be increased by means of a random sampling method that will result in the generalization of the results in the broad

population. The research should also be conducted in a quantitative research method. Also in the international arena, it will be great to conduct qualitative research on the comparison of the different rating systems based on user experience with experts on rating systems, rather than mathematics and theory. It would help to choose a proper rating system and rate their players properly for the sports federations or leagues.

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Appendix A

Research Questionnaire

The questionnaire included two sections.

1. “Demographic information” section has 6 questions
2. “Open questions” section has 13 questions all two sections of the questionnaire are reproduced below

(Section 1)

Demographic questions:

Age:

Gender:

Profession:

Educational qualification:

How long have you playing table tennis?

How is playing frequency of you?

(Section 2)

Interview questions

1. What do you know about the rating system?
2. What are the disadvantages of not having a rating system in table tennis?

3. What would be the importance having a rating system in table tennis?
4. How do you rate your or your players' strength and what method do you use?
5. Would you like to introduce a rating system in Mongolian table tennis? Why?
6. Do you believe it is an appropriate time to introduce a rating system newer?
7. How would be your participation in the establishment of the rating system?
8. What are the necessary things to do for Mongolian table tennis development?
9. How important to introducing a national rating system in Mongolian table tennis?
10. Do you believe the establishment of the rating system affects competitiveness and development?

Appendix B

1. What do you know about the rating system?

| | |
|--------------------------------|--|
| P1 (coach 1) | Is it the same thing with the ranking? I think it is thing to show how strong national team players. We need to know who the best player is. Every year, we organize many competitions with many participants. We know the ranking list of ITTF. Players play for increasing their ranking. This is the evaluation. |
| P2 (coach 2) | I know that other countries have a rating system and they send their best athletes to the world championship, Olympic games. For example, we can see Chinese national team players rating, who is most successful in playing this time and who became in top ranking. Players get point from competitions, from their winning. |
| P3 (coach 3) | This is the indicator of the players based on their skill, performance. Compare the players to each other. |
| P4 (national team player 1) | Yes, we are ranked in the ranking of ITTF. All players have ranked. When I participate and win in international tournament my ranking goes up when we are not participating the ranking goes down or stop. |
| P5 (national team player 2) | The players' evaluation system, database. |
| P6 (national team player 3) | Every player has different abilities and different experiences. We indicate players' strength through a rating system. I understood rating is a calculation of players' abilities. |
| P7 (player 1) | I became a member of the US table tennis Association (USTTA). Every member has a rating. This is the method to make a ranking list. |

| | |
|-------------------|--|
| P8 (player 2) | As I know, the rating system is the calculation, if a weaker player beat a higher level of player, he will gain many rating points and higher-rated player lose his points depending on their ratings. |
| P9 (player 3) | I heard about rating system, don't know much more detail how it works. |
| P10 (player 4) | This is the indicator to indicate players individually by the gained points from competitions. |

2. What are the disadvantages of not having a rating system in table tennis?

| | |
|--------------------------------|--|
| P1 (coach 1) | Nowadays, many people playing table tennis in Mongolia. Actually we don't know the total number of active players. It is not clear how many players in different age groups. Want to know how an Increasing number of professional players and amateurs. Also, we see only one competition results. Don't know who is who. |
| P2 (coach 2) | For elite athletes, usually, they placed in first places at national competitions. We can count their success by how they placed in the competition. But for other players, there are no benefits. I know many players and amateurs play actively. They participate in many events. Without a rating system, we cannot evaluate their success. |
| P3 (coach 3) | Players' performance not clear, no official indicator, don't know the ranking. No clear number of the players, |
| P4 (national team player 1) | I am not sure, maybe less competitiveness. It cannot evaluate players properly. Sometimes we debate on the ranking and decide it through a match or a competition result. |

| | |
|--------------------------------|---|
| P5 (national team player 2) | We participate in many tournaments but nothing left. We spend all day, sometimes 2-3 days play-in tournament. Only the first 3 places will get medals for other players nothing left. No history and no notes about my participation. |
| P6 (national team player 3) | Don't know the players' strength properly. Sometimes we lost in the event, sometimes win. When we lost there is no benefit, no points, nothing left. No matter how many times win and just lost. |
| P7 (player 1) | We don't try to participate in all events. Because of less chance to win for me. Now I am playing for raising my rating rather than winning. If we have a rating system, we will participate in many events. |
| P8 (player 2) | As I mentioned above, we cannot get these points. Sometimes weaker players beat a high level of player, then bitten by another one. There is no difference. Only one indicator win or lose works. |
| P9 (player 3) | Every sport has a rating and ranking system. We don't know the national players' ranking. |
| P10 (player 4) | Without a rating system, we don't use players' success in the competition, only winners will get the honor. For other players left nothing. I want to measure my improvement. Sometimes it seems like I waste my time due to the participating tournaments. Because I won't beat all the players. |

3. What would be the importance having a rating system in table tennis?

| | |
|-----------------|--|
| P1 (coach 1) | Knowing athletes' rating and ranking means much easier to select players. For example, when we go to international competition, we can select athletes based on ranking. No debates. |
|-----------------|--|

| | |
|--------------------------------|---|
| P2 (coach 2) | Maybe it can be a big motivation for players. Players play in the competition to increase their ranking, gaining rating points. Also, the number of participants will increase. Every member will have their ranking on the list. It is important. |
| P3 (coach 3) | Good to indicate players' performance and abilities for the long term. We can rate players by the results of all competitions average |
| P4 (national team player 1) | Some countries, for example in the United States, have a rating system. They distinguish players as professionals or beginners through the rating system. We also need to have a rating system. We need an indicator like the US. Also, it shows the players' abilities individually. |
| P5 (national team player 2) | It could be a big motivation. It will help to organize the events, we can divide players into the groups by rating. |
| P6 (national team player 3) | If we have a rating system, when we lost the competition we still have benefits. We can gain some points for a win, at least we gain a point for participation. The difference in the rating system than the competition is the rate of players' abilities and performance for the long term. This is what I am thinking. |
| P7 (player 1) | We don't try to participate in all events. Because of less chance to win for me. Now I am playing for raising my rating rather than winning. If we have a rating system, we will participate in many events. Events will be more competitive. |
| P8 (player 2) | in Korea, there is 7 level of rating system works for all. Every weekend many players, amateurs, elders play in league tournaments actively. This rating system interesting and involve many people to table tennis. |
| P9 (player 3) | I think it is more important for competitive athletes. |
| P10 (player 4) | I think the rating system makes people more competitive and interesting. Players need to have a purpose to do sport. If they rate the players properly, that will be more interesting for players. People like to win themselves. The important thing is a tangible numerical value. |

4. How do you rate yourself or your players' strength and what method do you use?

| | |
|--------------------------------|---|
| P1 (coach 1) | Usually, we held a qualification competition among players. Coaches know our athletes who are better than others. If we rate the athletes, we count the results of qualification events and other events. |
| P2 (coach 2) | Trough qualification competition, juniors' competition results. Sometimes debate. But not difficult to rate less number of players. |
| P3 (coach 3) | I know some of the players but not everyone. Generally, we rate the player's latest tournament results such as national championship and league. |
| P4 (national team player 1) | We have a level of degree such as master, sub-master, I degree, II degree, III degree. I to III degree and no degree are amateurs. |
| P5 (national team player 2) | Actually, we cannot rate properly. Someone rate the players manually, no guarantee it is 100% correct or not. |
| P6 (national team player 3) | Federation rate the rating of top 12 players through the performance of the main events, national championship, the national cup, league. Also, we host the qualification tournaments. |
| P7 (player 1) | I don't know how my ranking in Mongolian table tennis players is. Want to know. I think around 300 players around my level. |
| P8 (player 2) | Now I am playing in South Korea in level 4, upper-intermediate. I degree in Mongolia. No certain number of rankings. |

P9 For me, table tennis is a healthy lifestyle. I enjoyed to play and
(player 3) enjoyed the competition.

P10 I don't rate myself, I don't know how my ranking in table tennis
(player 4) is.

5. Would you like to introduce a rating system in Mongolian table tennis?

Why?

P1 Yes, we need to walk together with development and modern
(coach 1) technology. It will be good for us to rate players through the
rating system.

P2 Yes, this is one more step. Good for us. Someone need to the
(coach 2) responsible person. We need to publish players rating by
gender and by age groups.

P3 Yes, it will be better to have a rating system. It is a necessary
(coach 3) thing for table tennis.

P4 Yeah, that will be good for our career.
(national
team
player 1)

P5 Yes, if possible. I think someone needs to work on it. That will
(national be great if we have a rating system and see the ranking on the
team website or application.
player 2)

P6 Yes, as soon as possible. It will be Good to introduce and
(national establish it for all players.
team
player 3)

| | |
|-------------------|--|
| P7 (player 1) | Most of the Mongolian high levels of players dominate for the long term. The cycle of the one player domination period is longer. Top 12 players are not renewing for many years. They are good players, but I think this is the lack of athletes' development, the process of renewing as new generation is too slow. |
| P8 (player 2) | Yes, like to introduce Korean playing system for amateurs, and a national rating system for professional players. |
| P9 (player 3) | Yes, it will help table tennis development and players. |
| P10 (player 4) | Yes, the rating system will communicate with people to each other. We need the rating system and everyone will like it. |

6. Do you believe it is an appropriate time to introduce a rating system newer?

| | |
|--------------------------------|--|
| P1 (coach 1) | Yes. Now, the number of players and amateurs increasing rapidly. More than a thousand, maybe 2000 players we have. This is the proper time to introduce a rating system. |
| P2 (coach 2) | I think so, this is the right time. We talked about the rating system since a few years ago. Good to have a rating system. |
| P3 (coach 3) | Yes. Table tennis is developing quickly, there are many new young players playing in other provinces. We need to involve all players in a rating system. It is the right time. |
| P4 (national team player 1) | Yes, we need to introduce and use it immediately. Because we are late introducing. |
| P5 (national team player 2) | Yes, it is the right time, we need to establish it and create a database from now. |

| | |
|--------------------------------------|---|
| P6 (national team player 3) | Yes, many players playing everywhere. Now it is time to develop a rating system. Need to communicate those players through a rating system. |
| P7 (player 1) | Yes, I would like to improve my performance. Many players also want the rating. That will be great if we have a rating system. |
| P8 (player 2) | Yes, we need a proper and accurate rating system. |
| P9 (player 3) | Yeah, It is good to introduce now but I think this is not an urgent issue. We have very few numbers of professional players if the introducing national rating system spend much money and much works that will be okay to introduce later too. |
| P10 (player 4) | Now many players playing table tennis. The rating system is the thing that we really need. |

7. How would be your participation in establishment of the rating system?

| | |
|--------------------------------------|--|
| P1 (coach 1) | I will include my club players and help them to understand it. Support as much as I can. |
| P2 (coach 2) | I can test and comment my idea. |
| P3 (coach 3) | I am ready to join this work if you need my help. Every coach needs to agree with this work then we can introduce it successfully. |
| P4 (national team player 1) | After establishment, if there is an issue to calculate or something wrong, I will comment on it. I will support to use it. |
| P5 (national team player 2) | Don't know, I will follow the rules and respect. |

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| P6 (national team player 3) | I will add my opinion and introduce this rating system to others. |
| P7 (player 1) | I will recommend the rating system to my colleagues. I will support as much as I can. |
| P8 (player 2) | I can share my experience about rating system of different countries. And try to help establishment. |
| P9 (player 3) | I am not sure, but I will support whatever we established. |
| P10 (player 4) | I will participate in events, and give my comments related improvement. |

8. What are the necessary things to do for Mongolian table tennis development?

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| P1 (coach 1) | We have many challenges, things to improve. Especially coaches development. We need to educate our coaches, to study experiences from China, from Japan, full-time training, athletes development program, increase the number of clubs, government support, etc. many things we still need. |
| P2 (coach 2) | Lot of things we need to do. We need sponsors, financial support, condition to train athletes as full time. Bring table tennis experts to Mongolia and educate coaches. Send some players to training in other countries, human resources, management, etc. |
| P3 (coach 3) | Many things. The rating system, developing program, academic training, systematically training plan. |
| P4 (national team player 1) | We need some support for players. I cannot participate in many events. We only participate in a few main events such as world championship, Asian games, and Asian championships. We need to participate in other tournaments to raise the international ranking. |

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| P5 (national team player 2) | Lack of high level of coaches' experiences in the national team. Develop coaches and national team athletes. Human resources, government support, rating system, new facilities. |
| P6 (national team player 3) | I think we need proper management, human resources, experienced coaches, good managers, and need to learn from China, and other countries. The rating system also necessary, improve the athlete's condition, club capacity, coaches. |
| P7 (player 1) | I think the lack of the number of professional clubs and capacity. Mongolian professional players are not trained many hours per week. Many people use the same facilities as national team players. We also need to held tournaments more professional level, timing, organizing, registration, playing system, etc. |
| P8 (player 2) | Learn from table tennis best-developed countries, cooperate those countries, more attend the national team players' development. |
| P9 (player 3) | As I said, we need to increase the number of professional players at the competitive level, Many kids join table tennis at the grassroots level, but only a few athletes left. It is good to develop table tennis due to the policy. Good management, supports, coaches development, long term development program. |
| P10 (player 4) | Use the thousands of players for the development of the professional table tennis in Mongolia, Improve the management, |

9. How important to introducing a national rating system in Mongolian table tennis?

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| P1 (coach 1) | I think introducing a national rating system is important, but if I list the important things, it will be in 3rd or 4th important issue. 1st coach development program, 2nd athletes' development program, 3rd study international experiences and 4th will be introducing rating system and development. |
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| P2 (coach 2) | This is one of the important issues. Every table tennis developed countries such as Japan, China, and Korea have rating systems. We also need it. It will help table tennis development and develop players. |
| P3 (coach 3) | Of course, It is important. First, we need to rate all players on the national level. Then we can choose the best players and need to send them to the international level. No conflict if we have a proper national rating system. Some countries have more than one ratings. |
| P4 (national team player 1) | This is important and one more step in Mongolian table tennis. It is necessary to have it. Sometimes we had conflict-related players rating. If we have a rating system, I hope, there will be no conflict and misunderstanding. |
| P5 (national team player 2) | One of the important things is the rating system. Very important for national team players. |
| P6 (national team player 3) | The difference of the table tennis sport to compare national sports, it is more accurate to rate numerical value. Also possible to develop a rating system as software like swimming, fencing, etc. We held many tournaments per year, tournament results should be linked. |
| P7 (player 1) | It is important, we need a more scientific and accurate rating system. Also important to use modern technology, membership application, tournament running software, rating system, etc. |
| P8 (player 2) | It is important. I think there isn't a proper comparison or indicator by each player. The rating system will compare two and more players' performance and skills. |
| P9 (player 3) | Definitely the rating system is important for young players who want to succeed at the national and international levels. Some other people like me, it is not important. |
| P10 (player 4) | That will be great for all players after one year everyone will be familiar in the rating system. This is one of the important things. |

10. Do you believe the establishment of the rating system affects competitiveness and development?

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| P1 (coach 1) | I think so. Every single match will be important for players. If it is clear the player won't go to the final, some players stop playing early or not try their best. Because lost is lost. If we have a rating system, the player will play for winning competitors. Each match will bring rating points. |
| P2 (coach 2) | Sure, If the player knows his rating, he or she will try to gain more points. Also, wish to be the best player. Rating will help them. |
| P3 (coach 3) | Yes, after establishing a rating system, we can see players ranking differences. How the players rating increasing and decreasing. Good to evaluate players properly. Of course, player will try to win everyone who is in front of him. |
| P4 (national team player 1) | Yes, it will affect players, especially competitive players. I want to win who has a higher ranking than me. Then the player's abilities and skills will increase. |
| P5 (national team player 2) | Yes, the rating system will affect competitiveness but not much influence. It will affect for the long term. |
| P6 (national team player 3) | sure, some players will train themselves more for winning, and get improve. For example, I will spend more time on training, because of the rating. |
| P7 (player 1) | Yes. The rating system should be easy to understand, everyone needs to know how it works. Then players will go to raise their rating. I will try to win all players who are on the same level with me and will go to the upper level. |
| P8 (player 2) | We can divide players' different levels of groups based on our rating like a beginner, intermediate, advanced, professional, etc. Then everyone wants to go up. |

- P9
(player 3) The rating system can affect the competitiveness of the players.
I think it will influence after one year. Some amateurs won't care about the rating system.
- P10
(player 4) I think the rating system won't affect competitiveness and table tennis development directly within a short period. Maybe one or two years later people will understand the importance of the rating system and try to increase their rating.
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국 문 초 록

국내 랭킹 제도에 대한 스포츠 선수와 감독의 인식 탐색적 연구: 몽골 탁구 사례

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서울대학교 석사과정을 공부할 하면서 저자가 배운점은 성공한 대부분의 스포츠 종목마다 적어도 한가지의 평가 시스템이 국가 기준이나 리그 기준으로 존재한다는 것이다. 국제 레벨의 국제연맹에서는 랭킹 포인트 제도를 사용하고있다. 국제 테니스 연맹

(ITTF)에서는 개인전 마지막 포지션을 토대로 "월드랭킹" 포인트가 부여된다. 현재 몽골 탁구연맹과 (MTTA) 다른 연맹에서는 국제연맹 방식과 흡사한 방식을 갖추고 있다. 하지만, 각 선수들과 팀은 해당국가에 적합한 평가제도를 적용해야 더 정확한 평가를 할 수 있다. 본 연구에서는 국제연맹에서는 사용되고 있는 세계랭킹 시스템과 국가랭킹 시스템의 차이를 파악하는게 매우 중요하다고 생각한다. 평가제도는 다음과 같이 설명 할 수 있다: “Being competitive is a core element of human nature and a rating system is a great tool for satisfying the need of ranking players for the skills they demonstrate” (Visti, Joelsson, and Smed 2017). 스포츠 평가 시스템은 수학적 모델을 바탕으로 선수들에게 다른선수들에 비한 자신의 능력을 순위로 제공한다. 평가 차이는 선수나 팀이 상대의 능력치에 따라서 다른점수가 부여되며 대부분의 세계랭킹 점수는 경기결과를 토대로 부여되고 있다.

코치/선수 개발 프로그램, 정책, 시설, 인사, 정책지원과 같이 스포츠 개발 도상협회들이 감당해야 할 중요한 문제들은 인터뷰 결과를 통해서 다시 발견 할 수 있었다. 몽골에 평가 시스템 도입은 언급된 다른 중요한 문제들을 보다 우선순위가 떨어진다는

주장이 나올수도 있지만 현 상황에 비추어 보면 어느 다른 문제보다도 시급하다는 것을 볼 수있다. 적합한 평가 시스템의 도입은 연맹, 리그와 클럽들의 선수 경쟁을 향상시킬 것이다. 단순히 아무 형태나 적용시켜보는게 아닌 그 나라 스포츠 특성에 맞는 적절한 평가 시스템을 컴퓨터 모델을 기반으로 개발하는 것이다.

본 연구의 목적은 몽골 탁구에 이상적인 평가시스템을 코치와 선수들의 인식들을 반영하여 만들기 위한 것이다. 인터뷰 과정을 통하여 국내평가시스템의 도입이 매우 중요하다는 점을 코치와 선수들의 인식을 확인 할 수있었다.

키워드: 스포츠 랭킹; 스포츠 평가; 탁구; 평가 시스템

핵심어: 스포츠 랭킹; 스포츠 평가; 탁구; 평가 시스템

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