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## Assessment Of Performance Of An Individual Player In Kabaddi With The Help Of Analytic Hierarchy Process (AHP)

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**Abstract:** Assessment of individual performance of a player in a team game is a complex task. But this measurement is essential to ascertain the impact of several factors on performance of a player in that game, and in turn to formulate strategies of selection of player and coaching them. Analytic Hierarchy Process (AHP), a multi-criteria decision-making approach and a decision support tool, has been introduced by Saaty in 1977. A multi-level hierarchical structure of objectives, criteria, sub-criteria, and alternatives are used here and the weights of importance of the decision criteria are obtained by pair-wise comparisons. Attacking and defending, the two main criteria have the weights 0.70 and 0.30 respectively. There are ten sub-criteria of attacking and seven sub-criteria in defending. The weights of importance of the decision criteria are obtained by pair-wise comparisons. A complex decision making task such as assessment of individual performance in a team game can be successfully done by using AHP.

**Keywords:** Multi-Criteria Decision-Making, Analytic Hierarchy Process, Pair-wise Comparisons.

### I. INTRODUCTION

#### Individual Performance

Some individual members constitute a team; they have different responsibilities in the team. Evaluating the performances of an individual member of a team is very complicated. So, the assessment of the performance of an individual player in a team game is actually a very complex decision making problem. But this assessment is necessary for the research work relating to formulate the strategies to select a player and coaching him/her. Actually, the assessment of individual performance in a team game is essential to ascertain the impact of psychological, physical and anthropological factors on performance of a player in that game.

#### Kabaddi a Team Game

Relative to other team games Kabaddi is one of the most popular of folk-games in the world, mainly in India. The use of analytical methods is very useful in Kabaddi. Kabaddi is attacking and defending game played between two teams having seven players each. Kabaddi is primarily a 4,000 years old Indian game. Buddhist literature speaks of the Gautam Buddha playing Kabaddi for recreation. The game is known as Hu-Tu-Tu in Western India. In eastern India and Bangladesh it is fondly called Ha-du-du (for men) and Kit-Kit (for women), Che-du-gu-du in Southern India and Kaunbada in Northern India. This game has undergone changes through the ages. Modern Kabaddi is a synthesis of the game played in its various forms under different names. The game has been played in its original form since Vedic times. Kabaddi attained National status in the year 1918. Kabaddi was played as a demonstration sport at the 1936 Summer Olympics in Berlin. The game got further recognition when the School Games Federation of India included it in the school games in the year 1962. Thereafter, qualified coaches in Kabaddi are being produced every year. The Amateur Kabaddi Federation of India (AKFI) was founded in 1973. After formation of the Amateur Kabaddi Federation of India, the first men's nationals were held in Madras (renamed Chennai). This body was formed with a view to popularize the game in the neighbouring countries and organize regular National level Men and Women

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

tournaments. The Governing body of Kabaddi in Asia is Asian Amateur Kabaddi Federation (AAKF) headed by Mr. Janardan Singh Gehlot. Parent body to regulate the game at international level is International Kabaddi Federation (IKF). Kabaddi was introduced and popularized in Japan in 1979. The Asian Amateur Kabaddi Federation sent Prof. Sundar Ram of India to tour Japan for two months to introduce the game. Federation Cup Kabaddi matches also commenced in the year 1981.

Kabaddi was included as a demonstration game in the IX Asian Games hosted by India in the year 1982. The South Asian Federation included Kabaddi as a regular sports discipline from the year 1984. During the Tri-Centenary celebrations of the city of Calcutta, an Inter-National Invitation Kabaddi Tournament was organized in the city. Bangladesh became runner-up again in 1985 in the Asian Kabaddi Championship held in Jaipur, India. Kabaddi was played for first time in the SAF games at Dacca, Bangladesh. In the 1998 Asian games the Indian Kabaddi team defeated Pakistan in a thrilling final match at Bangkok (Thailand).

## Kabaddi in Global Perspective

Kabaddi World cup was first played in 2004 and then in 2007 and 2010. So far India is the unbeaten champion in Kabaddi World Cup. Iran is the next most successful nation being twice runner-up. Pakistan was the runner-up in 2010.

The Punjab government organized a Circle Style Kabaddi World Cup from 3<sup>rd</sup> to 12<sup>th</sup> April, 2010. On April 12<sup>th</sup>, 2010 Indian team emerged as the winner after beating Iran in the finals. The opening match of the tournament was held in Patiala while the closing ceremony took place in Ludhiana. India won the first edition of the Circle Style Kabaddi World Cup, Beating rival Pakistan in a 58-24 victory. The final of this 10-day tournament was played at Guru Nanak Stadium.

## National member of International Kabaddi Federation

The names of the members of International Kabaddi Federation are as follows:

- a) America – (i) United States and (ii) West Indies
- b) Asia – (i) Afghanistan, (ii) Bangladesh, (iii) Bhutan, (iv) Cambodia, (v) Chinese Taipei, (vi) India, (vii) Indonesia, (viii) Iran, (ix) Japan, (x) Kyrgyzstan, (xi) Malaysia, (xii) Maldives, (xiii) Nepal, (xiv) Oman, (xv) Pakistan, (xvi) South Korea, (xvii) Sri Lanka, (xviii) Thailand and (xix) Turkmenistan.
- c) Europe – (i) Austria, (ii) France, (iii) Germany, (iv) Great Britain, (v) Italy, (vi) Norway, (vii) Spain and (viii) Sweden.
- d) Oceania – Australia

## Importance of Research

As the game is gaining popularity in the world population, systematic studies are needed to select the player, to train up them, to manage their stress and to augment their individual and group performances.

## II. METHODS AND MODEL FORMATION

### Analytic Hierarchy Process (AHP)

Multi Criteria Decision Analysis (MCDA) provides an approach that is able to handle a large amount of variables and alternatives assessed in various ways and consequently offer valuable assistance to the decision maker in mapping out the problem. A typical MCDA problem consists of a decision matrix with  $i$  number of alternatives and  $j$  number of criteria. Additionally, a set of weighting factors  $w_j$  are introduced to represent the relative significance of criteria in a particular application. The final goal of MCDA is to classify and/or rank the alternatives. The steps of MCDA are as follows:

- (i) Establish the decision objectives (goals) and identify the decision maker(s).
- (ii) Identify the alternatives.
- (iii) Identify the criteria (attributes) that are relevant to the decision problem.
- (iv) For each of the criteria assign scores to measure the performance of the alternatives against each of these and construct an evaluation (decision) matrix.
- (v) Standardize the raw scores of decision matrix.
- (vi) Determine a weight for each criterion to reflect how important it is to the overall decision.
- (vii) Compute an overall assessment measure for each decision alternative.
- (viii) Perform a sensitivity analysis to assess the robustness of the preference ranking.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

The pair-wise comparison method and the hierarchical model were developed in 1980 by T.L.Saaty in the context of the Analytical Hierarchy Process (AHP) (Saaty, 1980, 1983 [1, 2]). AHP is an approach for decision making that involves assessing the relative importance of these criteria, comparing alternatives for each criterion and determining an overall ranking of the alternatives (Christos & Ian, 1994) [3]. AHP helps to capture both subjective and objective evaluation measures, providing a useful mechanism for checking the consistency of the evaluation measures and alternatives suggested by the team thus reducing bias in decision making (Lai, Trueblood & Wong, 1992) [4]. Some of its applications include technology Choice (Akkineni & Nanjundasastry, 1990) [5] and vendor selection of a telecommunications system (Maggie, Tam, & Rao, 2001) [6].

Analytic Hierarchy Process (AHP) was introduced by Saaty in 1977 [7]. It is a multi-criteria decision-making approach as well as a decision support tool. Due to the nice mathematical properties and the fact that the required input data are rather easy to obtain the AHP has attracted the interest of many researchers. A multi-level hierarchical structure of objectives, criteria, sub-criteria, and alternatives are used here and the weights of importance of the decision criteria are obtained by pair-wise comparisons. The AHP can be used to solve complex decision making problems, such as evaluating the individual performance in a group game, like Kabaddi, a folk game, which has been gaining popularity.

A set of axioms that carefully delimits the scope of the problem environment is the foundation of the Analytic Hierarchy Process (AHP) (Saaty, 1986) [8]. This is based on the well-defined mathematical structure of consistent matrices and their associated right eigenvector's ability to generate true or approximate weights, Merkin (1979) [9], Saaty (1980, 1994) [1, 10]. The AHP methodology compares criteria, or alternatives with respect to a criterion, in a natural, pair-wise mode. To do so, the AHP uses a fundamental scale of absolute numbers that has been proven in practice and validated by physical and decision problem experiments. The fundamental scale has been shown to be a scale that captures individual preferences with respect to quantitative and qualitative attributes just as well or better than other scales (Saaty 1980, 1994) [1, 10]. It converts individual preferences into ratio scale weights that can be combined into a linear additive weight  $w(a)$  for each alternative  $a$ . The resultant  $w(a)$  can be used to compare and rank the alternatives and, hence, assist the decision maker in making a choice. Given that the three basic steps are reasonable descriptors of how an individual comes naturally to resolving a multi-criteria decision problem, then the AHP can be considered to be both a descriptive and prescriptive model of decision making. The AHP is perhaps, the most widely used decision making approach in the world today. Its validity is based on the many hundreds (now thousands) of actual applications in which the AHP results were accepted and used by the cognizant decision makers (DMs), Saaty (1994) [10].

## Selection of Criteria

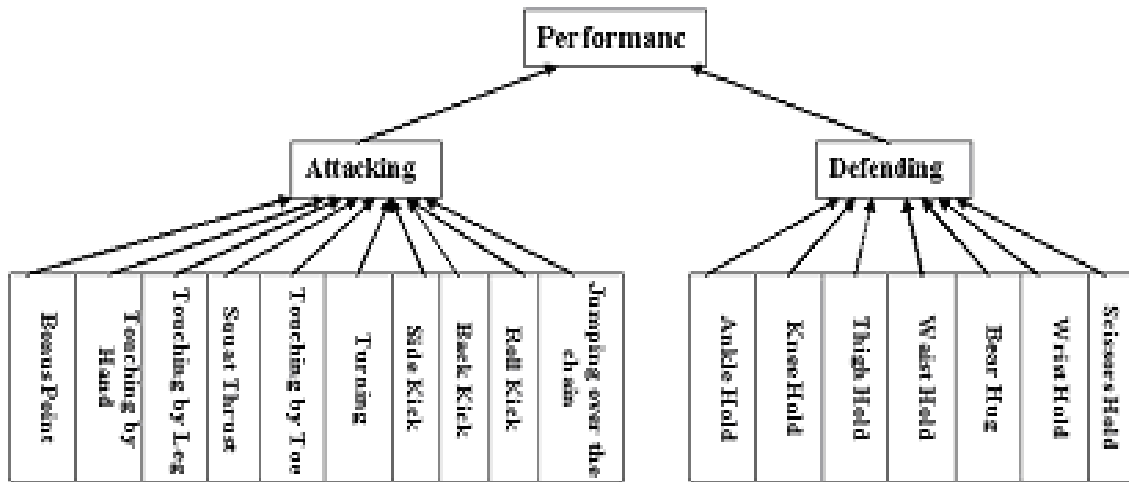
The two main criteria to evaluate the performance of an individual player in Kabaddi are – (a) Attacking and (b) Defending

**Attacking** can again be subdivided into ten sub-criteria such as – (i) Bonus Point, (ii) Touching by Hand, (iii) Touching by Leg, (iv) Squat Thrust, (v) Touching by Toe, (vi) Turning, (vii) Side Kick, (viii) Back Kick, (ix) Roll Kick and (x) Jumping over the chain. Whereas, **Defending** can also be subdivided into seven sub-criteria such as – (i) Ankle Hold, (ii) Knee Hold, (iii) Thigh Hold, (iv) Waist Hold, (v) Bear Hug, (vi) Wrist Hold and (vii) Scissors Hold.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013



**The steps for implementing the AHP process**

The steps for implementing the AHP process for weighting the criterion are as follows:

**Step – 1 (Pair-wise Comparison)**

The weights of importance of the decision criteria are obtained by pair-wise comparisons. Pair-wise Comparison is performed. Saaty (1980) [1] nine-point preference scale is adopted for constructing the pair-wise comparison matrix. This scale is shown in table – 1.

**Table – 1: Scale of Relative Importance (according to Saaty, 1980 [1])**

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two Activities Contribute Equally to the Objective
3	Weak Importance of one over another	Experience and Judgement Slightly Favour one Activity over Another
5	Essential or Strong Importance	Experience and Judgement Strongly Favour one Activity over Another
7	Demonstrated Importance	An Activity is Strongly Favoured and its Dominance Demonstrated in Practice
9	Absolute Importance	The Evidence Favouring one Activity over Another is of the Highest Possible Order of Affirmation
2,4,6,8	Intermediate Values between the two Adjacent Judgement	When Compromise is Needed
Reciprocals of Above Nonzero	If Activity i has one of the above nonzero numbers Assigned to it when Compared with Activity j then j has the Reciprocal Value when Compare with i	

Let A represents  $n \times n$  pair-wise comparison matrix:

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

$$A = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ a_{22} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & 1 \end{bmatrix}$$

**Step – 2 (Normalization)**

The normalization of the raw score is done by taking Geometric Mean as given below:

$$w_i = \frac{\left( \prod_{j=1}^n a_{ij} \right)^{1/n}}{\sum_{i=1}^n \left( \prod_{j=1}^n a_{ij} \right)^{1/n}} \quad i, j = 1, 2, \dots, n$$

**Step – 3 (Consistency Checking)**

**Step – 3a**

Let C denotes a n-dimensional column vector describing the sum of the weighted values for the importance degrees of the attributes, then

$$C = [C_i]_{n \times 1} = AW^T, \quad i = 1, 2, \dots, n$$

Where,

$$AW^T = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ a_{22} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & 1 \end{bmatrix} \times \begin{bmatrix} w_1 & w_2 & \dots & w_n \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ \dots \\ c_n \end{bmatrix}$$

**Step – 3b**

To avoid inconsistency in the pair-wise comparison matrix, Saaty [19] suggested the use of the maximum eigen value  $\lambda_{max}$  to calculate the effectiveness of judgment. The maximum eigen value  $\lambda_{max}$  can be determined as follows:

$$\lambda_{max} = \frac{\sum_{i=1}^n c_i \cdot v_i}{n} \quad i, j = 1, 2, \dots, n$$

**Step – 3c**

With  $\lambda_{max}$  value, a consistency index (CI) can then be estimated by the formula –

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

**Step – 3d**

Consistency ratio (CR) can be calculated and used as a guide to check the consistency –

$$CR = \frac{CI}{RI}$$

Where, RI denotes the average random index with the value obtained by different orders of the pair-wise comparison matrices are shown in table -2.

For the consistency judgement the value of CR must be  $\leq 0.10$ .

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

**Table - 2: Table of Random Index**

Matrix Order	1,2	3	4	5	6	7	8	9	10	11	12	13	14
R.I.	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46	1.49	1.52	1.54	1.56	1.58

**Determination of Weights**

The weights of importance of the decision criteria were obtained by pair-wise comparisons.

**Weights of Criteria**

The researchers consulted with the experts about the weights of the two main criteria and the weight of attacking ( $\omega_A$ ) was 0.70 and that of defending ( $\omega_B$ ) was 0.30.

**Weights of Sub-Criteria**

Weights of the sub-criteria were determined by the method of pair-wise comparison as proposed by Saaty (1977). The experts were requested to make the comparison and average was taken.

**The Use of Pair-wise Comparisons**

Pair-wise comparisons were used to determine the relative importance of each sub-criterion in terms of each criterion. In this approach the experts were requested to express their opinions about the value of one single pair-wise comparison at a time. Each choice was a linguistic phrase. Some examples of such linguistic phrases were: "Ankle Hold is more important than Knee Hold", or "Knee Hold is of the same importance as Ankle Hold", or "A is a little more important than B", and so on (see also table-1).

The main problem with the pair-wise comparisons was how to quantify the linguistic choices selected by the experts during their evaluation. The values of the pair-wise comparisons in the AHP were determined according to the scale introduced by Saaty (1980). According to this scale, the available values for the pair-wise comparisons were members of the set: {9, 8, 7, 6, 5, 4, 3, 2, 1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7, 1/8, 1/9} (see also table-1).

**Calculation of Principal Eigenvector**

The next step was to extract the relative importance implied by the previous comparisons. How important were the sub-criteria when they were considered in terms of judging performance of an individual player in a team game like Kabaddi?

**Table –3: Showing the Pair-wise Comparison Matrix of Ten Sub-Criteria within the Main Criteria "Attacking" and the Weights of the Ten Sub-Criteria**

	Bonus Point	Touching by hand	Touching by leg	Squat thrust	Touching by toe	Turning	Side kick	Back Kick	Roll kick	Jumping over the chain	Geometric Mean of the Row	Weights: Eigenvector ( $\omega$ )
Bonus Point	1	5	4	3	4	6	3	3	4	0.25	2.58	0.194
Touching by hand	0.2	1	1	0.33	0.5	3	0.5	0.33	0.2	0.17	0.48	0.035
Touching by leg	0.25	1	1	0.25	1	2	0.33	0.33	0.25	0.2	0.48	0.036
Squat thrust	0.33	3	4	1	3	5	0.5	0.5	0.33	0.2	1	0.075

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

Touching by toe	0.25	2	1	0.33	1	4	0.5	0.5	0.33	0.17	0.63	0.047
Turning	0.17	3	0.5	0.2	0.25	1	0.25	0.25	0.2	0.17	0.35	0.026
Side kick	0.33	2	3	2	2	4	1	1	0.5	0.33	1.18	0.089
Back Kick	0.33	3	3	2	2	4	1	1	0.33	0.5	1.23	0.092
Roll kick	0.25	5	4	3	3	5	2	3	1	0.5	1.92	0.144
Jumping over the chain	4	6	5	5	6	6	3	2	2	1	3.48	0.261

CI= 0.131144

CR= 0.088016

Saaty has asserted that to answer this question one has to estimate the right principal eigenvector of the previous matrix. Given a judgment matrix with pair-wise comparisons, the corresponding maximum left eigenvector is approximated by using the geometric mean of each row. That is, the elements in each row are multiplied with each other and then the  $n^{\text{th}}$  root is taken (where  $n$  is the number of elements in the row). Next the numbers are normalized by dividing them with their sum.

From the table-3. it is clear that the weights of the ten sub-criteria of (i.e. Bonus Point, Touching by hand, Touching by leg, Squat thrust, Touching by toe, Turning, Side kick, Back Kick, Roll kick and Jumping over the chain) of the main criteria of attacking were 0.194, 0.035, 0.036, 0.075, 0.047, 0.026, 0.089, 0.092, 0.144 and 0.261 respectively. Again, the CR = 0.088016, which indicates that the judgement was highly consistent.

**Table -4: Showing the Pair-wise Comparison Matrix of Seven Sub-Criteria within the Main Criteria “Defending” and the Weights of the Seven Sub-Criteria**

	Ankle hold	Knee hold	Thigh hold	Waist hold	Bear hug	Wrist hold	Scissors hold	Geometric Mean of the Row	Weights: Eigenvector ( $\omega$ )
Ankle hold	1	0.5	0.5	2	0.33	0.25	0.2	0.505	0.055
Knee hold	2	1	1	2	0.5	0.33	0.2	0.75	0.081
Thigh hold	2	1	1	1	0.5	0.33	0.25	0.701	0.076
Waist hold	0.5	0.5	1	1	0.25	0.2	0.17	0.414	0.045

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

<b>Bear hug</b>	3	2	2	4	1	0.33	0.25	1.219	0.132
<b>Wrist hold</b>	4	3	3	5	3	1	0.33	2.1	0.227
<b>Scissors hold</b>	5	5	4	6	4	3	1	3.557	0.385

CI= 0.048652

CR= 0.036858

Again, from the table-4 it is clear that the weights the seven sub-criteria of (i.e. Ankle hold, Knee hold, Thigh hold, Waist hold, Bear hug, Wrist hold and Scissors hold) of the main criteria of defending were 0.055, 0.081, 0.076, 0.045, 0.132, 0.227 and 0.385 respectively. Here the CR = 0.036858, which indicates that the judgement was highly consistent.

### Synthesis and Calculating the Overall Performance

After the sub-criteria are compared with each other in terms of each one of the main decision criteria and the individual priority vectors are derived, the synthesis step is taken. The priority vectors become the columns of the decision matrix. Therefore, if a problem has M sub-criteria and 2 main criteria, then the decision maker is required to construct 2 judgment matrices (one for each criterion) of order M×M.

Finally, given a decision matrix the final priorities, denoted by,  $A_{AHP}^i$  of the sub-criteria in terms of all of the two criteria combined are determined according to the following formula (1).

$$A_{AHP}^i = \sum_{j=1}^n a_{ij} w_j, \quad \text{For } i = 1,2,3,\dots,M \text{ -----(1)}$$

Here n = 2 (number of criteria, i.e. Attacking and Defending)

### III. EXAMPLE TO USE THE MODEL

Here an example may be sighted to use the model. In course of running a game the experts were given the following score sheet to fill up with tally marks.



# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

East Zone Interuniversity Kabaddi (Men) Tournament

October 12-14, 2006

(Organized by University of Kalyani)

Individual and Team Performance

Name of the Team:

Serial Number	ATTACKING														DEFENDING							
	Raid		Bonus Point	Touching by hand	Touching by leg	Squat thrust	Touching by toe	Turning	Side kick	Back Kick	Roll kick	Jumping over the chain	Ankle hold	Knee hold	Thigh hold	Waist hold	Bear hug	Wrist hold	Scissors hold			
	Successful	Unsuccessful																				
1																						
2																						
3																						
4																						
5																						
6																						
7																						

In a game the seven players of the M.G. Kashi University Team had the chest numbers as 10, 2, 11, 5, 6, 3 and 4. After counting the tally table – 5 and 6 were prepared.

**Table – 5: Performance of Individual Player in Attacking of M.G. Kashi University Team**

Serial No	Chest No	Attacking										Performance
		Bonus Point	Touching by hand	Touching by leg	Squat thrust	Touching by toe	Turning	Side kick	Back Kick	Roll kick	Jumping over the chain	
1	10	0	1	0	0	1	1	0	0	0	0	0.108
2	2	1	2	1	0	2	3	0	0	0	0	0.472
3	11	0	0	0	0	0	0	0	0	0	0	0.000
4	5	0	0	0	0	0	0	1	0	0	0	0.089
5	6	0	1	0	0	0	0	0	0	0	0	0.035
6	3	0	0	0	0	0	0	0	0	0	0	0.000
7	4	0	0	0	0	0	0	1	0	0	0	0.089

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

**Vol. 2, Issue 12, December 2013**

To calculate the performance of an individual player in attacking the following matrix product A×B was done.

$$\begin{array}{c}
 \text{A} \\
 \left( \begin{array}{cccccccccc}
 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\
 1 & 2 & 1 & 0 & 2 & 3 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0
 \end{array} \right) \times \begin{array}{c}
 \text{B} \\
 \left( \begin{array}{c}
 0.19 \\
 0.04 \\
 0.04 \\
 0.08 \\
 0.05 \\
 0.03 \\
 0.09 \\
 0.09 \\
 0.14 \\
 0.26
 \end{array} \right)
 \end{array}$$

The performance in attacking of the players with the chest numbers 10, 2, 11, 5, 6, 3 and 4 were 0.108, 0.472, 0.000, 0.089, 0.035, 0.000 and 0.089 respectively.

**Table – 6: Performance of Individual Player in Defending of M.G. Kashi University Team**

Serial No	Chest No	Defending							Performance
		Ankle hold	Knee hold	Thigh hold	Waist hold	Bear hug	Wrist hold	Scissors hold	
1	10	0	0	1	0	1	0	0	0.208
2	2	0	0	0	0	0	0	0	0.000
3	11	0	0	0	1	0	0	0	0.045
4	5	0	0	0	0	0	0	0	0.000
5	6	0	0	0	0	0	0	0	0.000
6	3	1	0	0	0	0	0	0	0.055
7	4	0	0	0	1	0	0	0	0.045

To calculate the performance of an individual player in defending the following matrix product A×B was done.

$$\begin{array}{c}
 \text{A} \\
 \left( \begin{array}{cccccc}
 0 & 0 & 1 & 0 & 1 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 1 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 \\
 1 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 1 & 0 & 0
 \end{array} \right) \times \begin{array}{c}
 \text{B} \\
 \left( \begin{array}{c}
 0.055 \\
 0.081 \\
 0.076 \\
 0.045 \\
 0.132 \\
 0.227 \\
 0.385
 \end{array} \right)
 \end{array}$$

The performance in defending of the players with the chest numbers 10, 2, 11, 5, 6, 3 and 4 were 0.208, 0.000, 0.045, 0.000, 0.000, 0.055 and 0.045 respectively.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

The overall performance of the individual players in the game was calculated by the matrix product  $0.70 \times A + 0.30 \times B$ .

$$\begin{array}{rcc}
 & & \begin{array}{c} A \\ 0.108 \\ 0.472 \\ 0.000 \\ 0.089 \\ 0.035 \\ 0.000 \\ 0.089 \end{array} \\
 0.70 \times & & + \quad 0.30 \times \\
 & & \begin{array}{c} B \\ 0.208 \\ 0.000 \\ 0.045 \\ 0.000 \\ 0.000 \\ 0.055 \\ 0.045 \end{array}
 \end{array}$$

**Table – 7: Overall Performance of Individual Player of M.G. Kashi University Team**

Sl. No.	Chest No.	Performance		Overall Performance	Individual Performance
		Attacking ( $\omega_A = 0.70$ )	Defending ( $\omega_B = 0.30$ )		
1	10	0.108	0.208	0.138	13.800
2	2	0.472	0.000	0.330	33.000
3	11	0.000	0.045	0.014	1.400
4	5	0.089	0.000	0.062	6.200
5	6	0.035	0.000	0.025	2.500
6	3	0.000	0.055	0.017	1.700
7	4	0.089	0.045	0.076	7.600

All of the members of the overall performance vector were decimal numbers and were not easily conceivable for further statistical calculations. So, individual performance of a player was calculated and to do so a linear transformation was given by multiplying the overall performance vector by 100. The individual performance in a game of the players with the chest numbers 10, 2, 11, 5, 6, 3 and 4 were 13.800, 33.000, 1.400, 6.200, 2.500, 1.700 and 7.600 respectively. The players with chest numbers 10 and 4 exhibited their good performance in both attacking and defending. But the players with chest numbers 2, 5, 6 and 4 were mainly attackers and the players with chest numbers 11 and 3 were mainly defenders. The player with chest number 2 was the best attacker and according to his individual performance he was the best player in the game.

## IV. CONCLUSION

The importance of an individual player in a team is decided through his activity. Thus, it is a matter of decision making from the part of the selectors and coaches to decide about which player to be included in the team. Therefore, such a model can help them to take a decision. The paper seeks to highlight the tremendous scope that exists to improve and develop on the measures currently used to describe the performances of individual players in general especially for Kabaddi game.

## REFERENCES

[1] Saaty, T. L., "The Analytic Hierarchy Process." McGraw-Hill, New York, 1980.  
 [2] Saaty, T. L., "Priority Setting in Complex Problems." IEEE Transactions on Engineering Management, Vol 30, Iss 3, pp: 140-155, 1983.  
 [3] Christos, D. & Ian J. P. , "A Telecommunications Quality Study Using the Analytic Hierarchy Process." IEEE Journal on Selected Areas in Communications, Vol 12, Iss 2, 1994.  
 [4] Lai, V.S., Trueblood, R.P. & Wong, B.K., "Software selection: a case study of the application of the analytical hierarchical process to the selection of a multimedia authoring system." Information & Management, Vol 25, Iss 2, 1992.

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- [5] Maggie, C.Y., Tam V.M. & Rao, T., "An application of the AHP in vendor selection of a telecommunications system." Omega, Vol 29, pp 171-182, 2001.
- [6] Akkineni, V.S. & Nanjundasastry, S., "The Analytic Hierarchy Process for Choice of Technologies." Technological Forecasting and Social Change, Vol 38, pp 151-158, 1990.
- [7] Saaty, T. L., "A Scaling Method for Priorities in Hierarchical Structures." Journal of Mathematical Psychology, Vol 15, pp 57-68, 1977.
- [8] Saaty, T. L. (1986). Axiomatic Foundation of the Analytic Hierarchy Process. Management Science, 32: 841-855.
- [9] Merkin, B. G., "Group Choice." John Wiley & Sons, NY, 1979.
- [10] Saaty, T. L., "How to Make a Decision: The Analytic Hierarchy Process." Interfaces, Vol 24, pp 19-43, 1994.