



P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2016; 3(4): 117-121
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www.kheljournal.com
Received: 23-05-2016
Accepted: 24-06-2016

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Handicapping (headway-start) in sports-a review

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Abstract

The purpose of the study was to collect the review related to handicapping in sports & games. Google and Bing, search engines were used to collect the review from 2000 to 2016. Most of the time studies were conducted related to different aspects of handicapping, but the researchers focused on the studies that proposed a system of handicapping. So the culminated purpose of the study was to review the handicapping systems in different games and sports and how in other sports, particularly in cricket a handicapping system may be introduced so as to make them equitable for players / teams of varying ability.

Keywords: Handicapping, Golf, Horseracing, Slope Rating, Course Rating, Handicap Factor, Handicap Index.

Introduction

Handicapping (headway-start), in many sports and games is the practice of offsetting varying abilities of the contestants to compete fairly or method of assigning advantage to different competitors to equalize the chances of winning. (Encyclopaedia Britannica). The advantage may be in the form of scoring compensation or any other advantage given to the weaker contestants. The word handicapping also applies to the various procedures by which the compensation or advantage is calculated. Handicapping, sometimes known as headway-start is an advance start in a competition from the starting position of others or simply towards the goal line or desired outcome. Depending on the situation, this advance start may be inherent, obtained by special privilege or earned through one's accomplishments.

Handicapping, often complicated takes many forms, for example, In Horse, Racing weights are assigned to horses based on their speed in previous performances. Sometimes in Trotting, horses start at different positions (best one has to run farther than the other) (British Horse Racing Authority, 2014) ^[2]. Two unequal players in golf will have a close competition by assigning the weaker one a handicap, a certain number of uncounted strokes based on their previous accomplishments (European Golf Association, 2012) ^[4]. A certain number of uncounted strokes based on earlier performances also apply to 10-pin bowling. Handicapping in Sailboat racing is done by allowing different boats to compete under handicapping formulas that add time to the faster ones, actual elapsed time for a race; thus, the winner of a competition may be not the first one to complete but the boat that performs best in relation to its design.

Method of Collecting Review

The researchers studied literature related to handicapping in different games and sports. All the literature, which includes research papers, articles & handicap manuals are from 2000 to 2016 using Google and Bing search engines on the internet. Keywords such as "What is Handicapping", "Handicapping in different Sports", "Handicapping Manuals", "Handicapping in Golf", "Handicapping in Horse Racing", & "Handicapping in 10-Pin Bowling", etc. are used. It was observed that most studies have been carried on golf handicapping. In the present review, the focus has been on studies that proposed a method of handicapping.

Studies related to handicapping in games & sports

D. R. Bingham & Tim. B. Swartz (2000) ^[3] conducted a study "Equitable Handicapping in Golf". In this study, the researchers consider net medal play between two (2) golfers, when

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both players are playing well. Previous studies on handicapping have suggested that in matches between two (2) golfers, it is actually the better golfer that has an advantage in both medal play and match play. In this context, the authors argue that it is actually the weaker golfer who has an advantage. The authors propose a method for promoting fairness in matches that is based on normal model and consideration of the slope system. The authors, after investigating the performance of their system, the same way they have found inadequacy in traditional methods concluded that it is actually the best golfer who is disadvantaged in the tournaments.

The handicapping system of the Royal Canadian Golf Association (RCGA) (2008) [9], a system very similar to the handicapping system of the United States Golf Association is the official system to handicap the golfers of varying ability for making the game of golf more enjoyable by allowing players of differing abilities to compete on an equitable basis. The RCGA handicapping system makes use of *adjusted score* that is to be entered by every golfer for every round of golf. This *adjusted score* is no larger than actual score and is a consequence of imposing a maximum number of strokes allowed for each hole. The calculations performed on adjusted score give rise to factor “F” or handicap factor, a measure that quantifies the ability of a golf player. When F= 0, Golfer is referred to as “Scratch” golfer. Sometimes, F<0, these golfers are mostly professionals and are referred as “Plus” golfers.

F>30, Means weak golfers.

The handicap factor is an important quantity as it provides a means for players of varying skill levels to compete against one another reasonably. In RCGA handicapping system a handicap differential is derived from the four elements. These are,

- i. Adjusted gross score
- ii. Course rating
- iii. Slope rating
- iv. Slope rating of a course of standard difficulty, which is 113 in the RCGA.

The handicap factor is calculated for players who have completed five (5) or more rounds of golf. For convenience, the calculation of factor for a player completed 20 rounds, the differential for each round of golf is calculated by

$$D = 113 \left(\frac{X - R}{S} \right)$$

where, X = the adjusted score, R = Course rating, S = Slope rating & D is rounded to the first decimal place.

For calculation of handicap factor, consider a player whose recent 20 differentials are given as shown

9.9 10.3 10.5 11.1 11.4 12.4 12.9 13.2 13.8 14.1
14.4 14.9 15.2 15.8 17.3 17.5 19.1 19.7 21.2 22.5

The proposed handicapping system utilizes the best 10 out of the 20 recent rounds (Smallest 10 differentials, the upper 10 in this case). The next step in the system is to total of lowest handicap differentials.

$$9.9 + 10.3 + 10.5 + 11.1 + 11.4 + 12.4 + 12.9 + 13.2 + 13.8 + 14.1 = 119.6$$

Then, Average (119.6/10) = 11.96.

After that Average is multiplied by .96*

11.96 x .96 = 11.4816 (all digits after tenths are deleted)

i.e. 11.4. Therefore the handicap factor in RCGA handicapping system is 11.4.

* (Constant used in RCGA handicap system)

Tim. B. Swartz (2009) proposed a new system of handicapping in golf. The proposed system is very similar to the handicapping system of RCGA. The Swartz handicapping system has mainly two parts. One for *casual play* one for *Tournament play*. The proposed system also makes use of the existing *course ratings* and *slope ratings* as RCGA system but uses statistical theory as well to drive methodology. The handicap factor which is the main element of the RCGA system is replaced by μ (Mean) in Casual play, 16 differentials are taken into account instead of 10 and weights w_1, w_2, \dots, w_{16} are included (Sarhan and Greenberg (1962) [1] instead of .096 constant in RCGA system of handicapping.

The derivation of Mean (μ) under casual play is same as handicap factor F. Taking the example (1) from above, the Mean (μ) is given by

$$\begin{aligned} \mu = & w_1(9.9) + w_2(10.3) + w_3(10.5) + w_4(11.1) + w_5(11.4) + w_6(12.4) + w_7(12.9) + w_8(13.2) \\ & + w_9(13.8) + w_{10}(14.1) + w_{11}(14.4) + w_{12}(14.9) + w_{13}(15.2) + w_{14}(15.8) \\ & + w_{15}(17.3) + w_{16}(17.5) \end{aligned}$$

The author is of the view that weights are used instead of 0.96 *constant* because golf scores are discrete and the literature suggests that unadjusted scores are approximately distributed normally (Scheid, 1990). This means that for a given round of golf

$$113 \left(\frac{Y - R}{S} \right) \sim Normal(\mu, \sigma^2)$$

where Y denotes Gross score, μ & σ are normal distribution parameters.

The author concludes that the proposed system for casual play with these comments:

- i. Using Mean (μ) instead of the *factor F* theoretically makes the stroke play between two players fair.
- ii. Choosing the best 16 rounds instead of 10 from the most 20 recent rounds seems to be roughly optimal.

In tournament play involving players of different abilities. The author argues that the RCGA system is unfair. Swartz proposed an approach for tournament play as well that takes into account the variability of golfers. The introduction of the second statistic σ (Spread), which replaces μ (mean) and weights (best linear estimates for parameters of the normal distribution) are included from Sehran. D.E & Greenberg (1962). Spread statistic (σ) is an estimator of the standard deviation σ in the normal distribution and measures variability of a golfer, where the smaller values of Spread (σ) denote more consistent golfers. Taking above example (1) again, the spread is given by

$$\begin{aligned} \sigma = & q1 (9.9) + q2 (10.3) + q3 (10.5) + \\ & q4 (11.1) + q5 (11.4) + q6 (12.4) + \\ & q7 (12.9) + q8 (13.2) + q9 (13.8) + \\ & q10 (14.1) + q11 (14.4) + q12 (14.9) + \\ & q13 (15.2) + q14 (15.8) + q15 (17.3) + \\ & q16 (17.5) \end{aligned}$$

The calculation of spread (σ) is similar to the calculation of mean in casual play except the weights w_1, w_2, w_{16} are replaced by q_1, q_2, q_{16} and is rounded to two decimal place. The proposed tournament net score for tournament play is calculated by

$$NT = R + \left(\frac{Y - R}{S\sigma} \right) - \frac{4\mu}{\sigma}$$

where, Y = gross score, R = course rating, S = course slope
The author is of the view that the theoretical developments and the data analyses in the paper provide sufficient evidence that the proposed system of handicapping has many advantages over the RCGA system of handicapping as it provides improved fairness in tournaments involving players of different skill levels and easy interpretation of handicap. Victorian Athletic League (VAL), Australia (2011) [13] is another such competition where handicapping method is used to enable athletes of varying ability to compete regularly, consistently and to the best of their ability. VAL has separated the athletes into three categories. These are

- i. Established Athletes
- ii. Ongoing Assessed Athletes (OGA)
- iii. Interstate Athletes.

As per the ACL, an *Established athlete* for a particular event is one who has completed 20 or more races over that distance in VAL competition within the last five (5) years or has completed more than five (5) races in the previous year. *Ongoing Assessed Athletes* are those who do not satisfy the criteria of established athletes over a particular distance. The athletes permanently residing outside the state of Victoria and registered with a governing body other than VAL are known as *Interstate athletes*.

The handicappers of the VAL at the start of new season calculate the handicap for every registered athlete in the event in which they compete. They take into account that the current handicap for the season should not be greater than the last allocated handicap of the previous season. For Established Athletes the starting handicap is calculated by dividing the average of the athlete's best Rate Per Meter (PPM) from the last five (5) seasons and the next best RPM from the last two seasons, into the Starting Target Time (STT) for that event. Athletes who do not satisfy the criteria of Established Athletes are known as Ongoing Assessed Athletes (OGA). The starting handicap for OGA is calculated by VAL handicappers at their own discretion taking into account the athletes single RPM over the distance within the VAL or outside or performances within VAL or outside over the other distances.

The Victorian Athletic League handicappers at their discretion can adjust the handicap of both Established and Ongoing Assessed Athletes during the season by giving a lift in handicap after the athlete has had his first start of the season in an event. The VAL handicappers or VAL Stewards throughout the season reviewed the performance of an athlete every time he runs, in order to award a lift in a handicap for a particular event. The condition to receive a lift is that an athlete must achieve an optimal number of Acceptable Performance (AP's) while in the case of OGA and interstate athletes must achieve a sufficient number of Satisfactory Performances (SP's) over the recent distances. The handicap lift depends on upon the number of AP's and SP's but will vary depending on the distance and the category that the athlete falls into.

The assessment of performance is done by the VAL handicappers together with VAL Stewards for every run an athlete had with VAL. The performance is assessed on (i) The time run and (II) Assessing the performance for appropriate effort while watching an athlete running. Acceptable Deviation sets the time range within which an athlete has to run in order to ensure an AP or SP. For this VAL handicappers take into consideration the fastest heat time of the day and adds the Acceptable Deviation time. If an athlete runs a time that is faster or equal to this time then the athlete have run an AP (or SP) depending that the VAL Stewards agree that the athlete has given appropriate effort while running.

Example: If a sprinter runs 11.70 secs to run the fastest heat time of the day in 120 m race. The Acceptable Deviation taken from the VAL handicap calculations table is 0.55 secs for 120 m distance. Adding 0.55 secs to a sprinters fastest time 11.70 secs will give 12.25 secs. If the athlete runs equal to or faster than this time and performed satisfactorily in view of VAL Stewards then an athlete have run an AP. For OGA athletes, if the handicappers and stewards are happy with both time and effort of an athlete's performance then the performance will be classified as Satisfactory Performance (SP). If at times the run was not within the Acceptable Deviation i.e. it was slower but the VAL handicappers are satisfied with the effort of an athlete, the performance is classified as Non Acceptable Performance (NAP). Sometimes it may also be Unsatisfactory Performance (UP), if the VAL handicappers after reviewing the athlete's performance believe that the athlete did not give full effort throughout the race, in this case, the performance will be classified as UP.

British Horseracing Authority (BHA) (2014) [2] publishes and updates a manual titled, "A Guide to Handicapping". This is the complete authority on the handicap system of horse racing. The BHA is of the view that the speed of a horse at which it can gallop is ultimately affected by the weight a horse carries. In a horse handicap race, a weight according to the ability of the horse is allocated in an attempt to achieve a competitive race with the close finish and equalize every horse's chance of winning. Like VAL, a BHA handicapper or Racing Secretary after reviewing the performance of a horse every time in a race allocates a rating that depends on upon various factors. The handicapper has to judge every horse on their individual merits and take into consideration all variables like weight carried in relation to other runners, the distance, draw, finishing margins between runners, etc.

The BHA handicapping system is an amalgam of mathematical fact and an element of subjectivity (Handicappers Interpretation). The methodology of BHA handicap system is a two –part process.

- i. The BHA handicapping team reviews every horse's individual performance and award a performance figure.
- ii. This performance figure is used by BHA to produce a handicap rating, which further determines the specified weight that a horse has to carry during a particular race.

Performance figures are the main element in calculating handicap rating. They are calculated by taking into account the recent form of horses, whether the form is progressive or regressive, a particular horse is consistent or inconsistent. Due consideration is also given to a horse's recent handicap rating and performance figures. The handicapper while producing a performance figure for the horses that completed in any particular race identifies one or more yard stick. After locating the most plausible fit with the yardstick, the quality

between them and other horses is interpreted by the handicapping team according to an approximate pounds-per-length conversion (given below) and adjusted for weights carried.

For Flat Races

5f: 3lbs per length
6f: 2.5lbs per length
7f-8f: 2lbs per length
9-10f: 1.75lbs per length
11-13f: 1.5lbs per length
14f: 1.25lbs per length
15f+: 1lb per length

For Jumps

1 lb per length is used, except over very long distances. Producing handicap rating may be in the form of allocating *New Handicap Rating*, *Raising Existing Handicap Rating*, and *Lowering Existing Handicap Rating*. For New Handicap Rating, a horse in most cases has to run on three occasions. When handicapping a new horse, it is important that there should be a clear correlation between the horse’s various performance figures and the handicap rating. From a handicapping perspective, all the three qualifying races would be of similar level. For Example. In qualifying races, if a horse attains performance figures of 50, 50 and 50, it is certain that an initial handicap rating of 50 will be allocated. If the performance figures vary, the handicapper, in this case, gives more emphasis on the best performance figure as long as that race looks competitive.

Handicap ratings will be raised if the BHA handicapper believes that the horse needs to excel on its previous form to win a race. This to a great extent depends on the horse’s performance figure from the winning race. The raise in rating is not fixed and depends on many factors. On an average, it is 6lb on flat races and 7.5 lb in jumping. If the handicapper has formed a view that the current rating of a horse is not a fair reflection of its ability, its existing handicap ratings are lowered to give the horse a fair chance of competing. The handicap rating is not lowered only after one low performance but if the horse continues to return low-performance figures, then the rating is lowered in relation to its current handicap rating. For lowering handicap rating, there is no hard and fast rule, but to a great extent depends on upon the profile of the horse. The handicapping team by using their experience and taking into account what the horse is achieving currently take the decision to drop the existing handicap rating of a horse.

The United States Golf Association (USGA) approximately after 4 years publishes a manual with USGA Course Rating System and handicap decisions titled The USGA Handicap System. The USGA is the sole authority over the USGA Handicap System. The USGA is another such association which introduces handicapping in golf, thus allowing players of varying skill levels to compete against each other on somewhat equal terms. The USGA handicap is calculated by an arithmetic formula based on a golfer’s lowest 10 differentials out of 20 recent handicap differentials. To compute a USGA handicap, each Gross score (S) is converted to a Handicap Differential (HD). The USGA handicapping authority takes four elements into consideration for the calculation of HD. 1. Adjusted Gross Score.2. USGA Course Rating.3. Slope Rating and 4. 113. (Slope rating of a course of standard difficulty.

$$\text{Handicapping Differential} = \frac{S - R}{SR} 113$$

Where, S = Adjusted Gross Score, R = USGA Course Rating, SR = USGA Slope Rating

Example: A golfer having an adjusted gross score of 85 on a course with USGA course rating of 60.5 and slope rating of 122. The handicap differential of the golfer is given by.

$$HD = \frac{(85 - 60.5)}{122} 113$$

HD (rounded) = 22.6

Sometimes the golfers handicap differential may be negative also if the golfers adjusted gross score is less than the USGA course rating. Once all the 20 adjusted gross scores are converted into handicap differentials. A *Handicap Index* is produced by taking into account the best 10 differentials out of 20 most recent scores.

The number of acceptable scores for calculating Handicap Index is given below.

Number of acceptable scores	Differentials to be used
5 or 6	Lowest 1
7 or 8	Lowest 2
9 or 10	Lowest 3
11 or 12	Lowest 4
13 or 14	Lowest 5
15 or 16	Lowest 6
17	Lowest 7
18	Lowest 8
19	Lowest 9
20	Lowest 10

Calculation of *Handicap Index* is done by the following way in USGA handicapping system.

1. Determine handicap differentials.
2. Average the differentials being used
3. Multiply the average by .96
4. Delete all numbers after the tenth digits

Example.1: Less than 20 scores (13 scores available) Suppose the total of lowest 5 handicap differentials is 110.2 (see table above)

Average of handicap differentials is 110.2/5 = 22.04

Multiply average by .96= 22.04 x .96= 21.1584

Delete all the numbers after the tenth digit = 21.1, therefore, Handicap Index = 21.1

Example.2: for 20 scores available.

Suppose the total of 10 lowest differentials is 160.8. Average of the 10 differentials will be 160.8/10 = 16.08. Multiply the average with the constant .96

16.08 x .96 = 15.4368

Delete all the digits after tenths = 15.4. The handicap index for 20 scores available is 15.4. This handicap index is used to determine the number of strokes a golfer gets for a particular match through the following formula.

$$H = \left(\frac{H1 \times R}{113} \right)$$

Where, HI = Handicap Index, SR = Slope Rating, 113= Slope rating of a course of standard difficulty.

Example: A golfer's handicap index is 12.5 and if the course to be played have a slope rating of 130, then H is given by $H = 12.5 \times 130 / 113 = 14.38$

This means the golfer's net score for the particular match would be 14 strokes lower than his/her gross score.

Concluding Remarks

After reviewing all the preceded studies, the researchers concluded that various sports like Golf, Horseracing, Athletics, 10-Pin bowling, uses a handicapping method for players of varying skill levels to compete on an equitable basis and have fun. The researchers focused only on systems of handicapping and not how equitable or fair a particular handicapping method is. The authors are of the view that introduction of handicapping methods in other sports and games will help the weaker players to compete with the stronger players on an equitable basis, particularly in cricket, because in recent years, several teams have fallen behind the stronger nations of the cricketing world due to a combination of factors. In order to re-level this, Handicapping method is required in cricket. The Handicapping method (Headway-start) if introduced in the game of cricket has the potential of bringing dynamic and competitive new era in cricket, moreover, the associate and affiliate members of the ICC will get a chance to play with full members of cricketing world on an equitable basis. This will prove very helpful for weaker contestants to improve their game and for stronger teams, many more variations mean the game is more interesting and challenging.

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