India's Take on Sports Analytics

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ABSTRACT

Purpose – The aim of this paper is to study what is sports analytics, what are the different roles in this field, which sports are prominently using this, how big data has impacted this field, how this field is shaping up in Indian context. Also, the aim is to study the growth of job opportunities in this field, how B-schools are shaping up in this aspect and what are the interests and expectations of the B-school grads from this sector.

Keywords

Sports analytics, Sabermetrics, Moneyball, Technologies, Team sports, IOT, Cloud
Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Design Approach

The paper starts by explaining about the origin of sports analytics, the most naïve form of it, then moves towards explaining the evolution of it over the years (from emergence of sabermetrics to the most advanced applications), how it has spread across different sports and how the applications of it has increased with the advent of different enabling technologies. Then the Indian context is studied, in terms of opportunities, supply and demand, growth of the field, how the B-schools are faring in this context, initiatives by independent institutions and lastly the survey of the B-school grads to understand their knowledge about the sector, interests, exposure and expectations from it.

Introduction

Sports analytics in nutshell, is capturing the required data with the help of technology, then running the data through statistical model, tools and visualization to provide insights into player performances and assist in giving recommendations to the player or the team**.** Though Henry Chadwick ,one of the pioneer writers of baseball, who was inducted in the national baseball hall of fame in 1938 [31] invented the box score in 1859 which is used to evaluate players, the initial efforts in sports analytics (emerged from baseball) started in the early years of 20th century, with Hugh Fullerton predicting the outcome of the world series [26]. Later on, in the year 1910, he published an article "The Inside Game", where he gave insights to the analysis, he had done on approximately 10000 deliveries. Another writer, for one of the US magazines, F.C Lane was of the opinion that the batting average of the individual doesn't reflect the complete picture of the individual's performance. There were other significant efforts made by other statisticians or writers such as George Lindsey, Allan Roth, Earnshaw Cook till 1969. In this year The Baseball Encyclopedia was published by Macmillan Inc, founded by George Brett. This encyclopedia was a comprehensive collection of the major-league baseball statistics right from the year 1871. This paved the way for further research which was carried out by different writers. Bill James was one among them, who coined the term sabermetrics. Sabermetrics also known as SABRmetrics (Society for American Baseball Research) can be understood as analysis of the actual (empirical) data to assist in decision making. Bill James's Baseball Abstract from 1982 till 1988 included his work on sabermetrics and its fundamentals. There were other sabermetricians such as Pete Palmer, who along with John Thorm, published The Hidden Game of Baseball – which had a summary of the sabermetric principles. Apart from this it also had few associations with the work done by F.C Lane. In 2002, Bill James wrote Win Shares, which he summarized the performance of every player in the major league by a single number for every season, which succeeded Palmer's Total Player Rating.

In the year 2003, Michael Lewis wrote Moneyball that gave insights on the work done by Oakland athletics and its general manager Billy Beans. It

was from this moment, where teams understood the importance of sabermetrics and how teams can improve their performances by analyzing the data. By 2012, almost all the Major league Baseball teams had employed at least one statistician (sabermetrician).

Literature Review

Having looked at the emergence of sports analytics, now the further parts will concentrate on the nuances of the field, divergence to different sports, impact of technologies and other points as mentioned previously. The study focuses on the team sports which are considered to be highly valued or rated in terms of financial metrics [2]. From the application point of view the work done by researchers, major leagues in the sports – standards adopted by them, individually on team basis or as a league and the work done by the companies who have published the white papers has been explored.

The Sports analytics market

The worldwide sports market is expected to reach approximately the value of US $4 billion by 2022 [47] and US $5.2 billion by 2024 [48]. Sports analytics is majorly concerned with Data driven decision making (to assist coaches, managers, players etc) and predictive analytics (to predict the outcome of games, performance of individuals etc). The market, based on the application is prominently stratified into performance analysis, player safety & fitness, valuation, fan engagement and broadcast management. The performance analysis and fan engagement are the two areas growing at a rapid pace [48], due to the increase in demand for the relevant metrics and data analysis by coaches for improving the team or player performance and by board management for increasing the revenues by engaging the fans in the most effective way. The market is also stratified on the basis of the sport – team sport & individual sport. The team sport market is expected to grow more rapidly than the individual sport segment [48].

Different sports and its applications

a. Cricket

The early forms of visual analytics in cricket was observed with the emergence of hawk-eye in 2001 [36]. Hawk-eye developed by Dr. Paul Hawkins, while he was working for Roke Manor research. Hawk-eye uses cameras (for triangulation and creating 3d image), speed gun for measuring the speed of the ball, thereby predicts the trajectory of the ball. Over the years other applications of analytics have been introduced, such as performance analysis of the players from a specific country in IPL using cluster analysis[11], player ranking with respect to the performance in different formats of the game [15], team selection by using a multi-criteria and multi-objective decision making approach [15]. Another application is in predicting the out-comes of the game (the dynamic win percentage of the teams contesting) or predicting the score of the team batting. WASP (Winning And Score Predictor) is one such technique used to predict the scores and probable outcomes of the match [19]. Other technique predicts the outcome of the game considering the player strength and weaknesses, comparing it with the opposition and recommends team selection [9]. Another application is predicting or calculating the correct/winning score for the team batting second (in limited overs cricket) in case the match is called off due to inclement weather. ICC has formally adopted the DLS (Duckwroth Lewis Stern method) since before the 2015 world-cup [39]. Over the years the different statistical measures or KPIs are used to assess the player's performance – strengths, weakness etc. From batting average to finding out the most preferred scoring shot or the favorable scoring shot of the player [espn] different metrics are used by coaches, players, oppositions to devise a suitable strategy.

b. Football

Football being more past paced game than cricket has more need of real time data analysis than cricket. Also, the way the sport has been structured with teams playing at least 30 league games in a season (for leagues that have at least 15 teams), other domestic matches, champions league and players also representing their national side, the data being generated is huge and it needs in-memory analytics [37]. Approximately 6000 videos are added into the database of a company every month and around 500 people are employed to analyze it frame by frame [30]. English Premier league, had a tie-up with opta sports as a media data partner for 2017-18 season, where opta sports could collect data and was also made publicly

available to different media [27]. Opta had introduced an advanced metric system which had parameters such as expected goals, expected assists etc which calculates the expected goals or assists a player should have had during the match based on different parameters. This is somewhere between predictive analytics and descriptive analytics. Also, other applications include finding out or exploiting the weakness of the opposition team by analyzing their matches against other teams who were able to do well against them, creating game plans for specific instances or scoring opportunities – during a freekick or a corner [30].

c. Basketball

One of the prominent applications in basketball, towards assisting the players or coaches, is to figure out the trajectory of the ball, results in the shot getting converted into a basket or not. [20]. Traditional analytics include event driven play-by-play analysis (shots etc). Authors of the paper, presented their work where they had analyzed the spatiotemporal data to comprehend the team's offensive and defensive formations and whether they result in open plays or not [13]. Some researchers have also explored the acceleration of different players during different plays to determine during which part of the field the players try to accelerate[14]. Models/tools have also been created to simply the amount of data that is being generated and present it in a simple visual interactive form, which will assist the team in analyzing the play sequences, style of play employed based on player etc [12]. Similar to other sports, another major application is the ranking of the players, or more specifically finding the top or extreme performers based on archetypoid analysis.[22]. Hollinger's efficiency rating which is used for rating NBA players, is a rating that combines different parameters to give a per minute productivity of the player[53]. Another important aspect explored by researchers is the importance of the 3-point shot, as they accounted for more than 33% of the total number of shots in the NBA 2017-18 season[16]. The authors analyzed the shots using two distinct space-time models of player motion.

d. Hockey

Analytics is not just about assisting the coaches or players in improving the performance. As stated earlier effective fan engagement is also one of the areas that come under sports analytics. David Johnson once said that it is important for NHL and broadcasters to incorporate data to tell stories, instead of considering coach's or analysts opinion as gospel. He wanted data to back the storyline [28]. Up to 2010 analytics in NHL wasn't looked upon with great respect. [2]. But now most of the NHL teams have analytics staff and some have even recruited academic statisticians for the same. There are even few R packages available that provide the data for processing NHL games. One of the areas that has been explored in NHL is the timing when the goalie is substituted by a skater. Authors after doing analysis and simulations under different conditions have stated that the team should substitute the goalie with 3 mins left on the clock, if they are trailing by 1 goal. [1]. Another area is the identification of the performance trajectories of the players with respect to age. Authors have come up with the conclusion that the ages for forwards and defensemen are 26 and 28 when they are at the peak of their performance [24]. Other areas of research are, variation of pace across the areas of ice within the rink based on different parameters[pace], how face offs can be evaluated using different parameters and not the defacto measure of win percentages[5]

e. Rugby

As stated by Bill Gerrard, former analyst of Saracens F.C, rugby has evolved from analyzing basic parameters to analyzing data for monitoring fitness, injury prevention and GPS tracking[43]. Darren lewis has identified that the average number of points needed to win a rugby premiership match has increased from 25 to in last 10 years [35]. He also states about how, his team Gloucester Rugby, are one game-week cycle ahead when it comes to analyzing the opposition. The team, analyzes 4-5 matches of the opposition one week before the match. Just like Darren, other researchers also believe in taking the lead from other sports or other leagues in the same sport to get better insights. Data along with visual analytics is being combined to make interactive dashboards for giving insights to coaches and players[42]. Though there have been few instances where in the existing parameters to measure the performance have been challenged. Authors highlighted the issues with assessing the

isolated measures of performance which lack other contextual information such as opposition, position of the player on the field, period of the match, etc[4]. This is something similar to what was the norm in early days of sports analytics. KPIs, in the first years of 21st century, were drawn by comparing the winning team and losing team [7]. There have been few notable contributions by researchers towards suggesting a dynamic ticket pricing for the audience. Study has shown that teams that switched to variable pricing sold 2.95% more tickets [17]

Impact of enabling technologies

Computer vision

Sports usually involves fast motion, that is at times difficult to comprehend for the competitors but also for the team analysts. Computer vision is one such technology that is helping the analysts, where sensors and other devices can't always be fixed to the players or their equipment. Ball and player tracking are the major applications where computer vision is being used [21]. SportVu deploys 6 cameras for tracking players in basketball; for football it has 1 or 2 clusters of 3HD cameras in a given location. When it comes to ball tracking the applications are mostly for broadcasters, referees or viewer engagement. Hawk-eye was the earliest applications deployed. Latest ones include chryhogeno's tracab, which is installed in approximately 300 stadia, to capture and track live data over 4000 games played in one year in football across major prominent European leagues [52]

IOT – wearables and sensors

The sensors and wearables have enabled the collection of real time data that makes real time tracking possible. Smart sensors with smart environments facilitate one of the trends in data science – the quantified self.[10] Major applications include player development – analytics with sensors and game videos gives coaches the access to plethora of data for obtaining player efficiency metrics – and player safety – where doctors and therapists are leveraging the data to ensure the safety of the players by maintaining their health and fitness [8]. Catapult sports have embedded the sensors in the lining of the shorts worn by players. The sensors include GPS, accelerometer, gyroscope, magnometer and microprocessor. Gatordae – in it's fuel lab, had shown a prototype in 2016, that could analyze the sweat of the athlete and based on that the bottle will plan a custom hydration plan for the athlete [34]. Not just wearables, the sensors can also be attached to other equipment as well. Authors have explored the application of IMU and UWB sensors inside cricket ball that can help in tracking the ball trajectory [6]

AI & cloud

AI is about taking information and responding to it without human intervention. When it comes to sports, apart from the fan engagement and media related part, AI helps with the pre-game planning and talent identification [3]. It comes to pre-game preparation, machine learning and deep learning assist in training, nutrition, team selection, strategic and tactical planning. One of the areas under exploration is the deep learning models being used to analyze the match videos and come up with real time recommendations based on what is happening in the game.

Cloud on the other hand has ensured that the technology reaches everyone. Mehul Kapadia, former MD F1 business tata communications, once said that cloud is levelling the playing field between F1 and local F4 British championship [51]. For this, all you need is just few cameras and the production part is taken care by the cloud. Apart from broadcasting, cloud helps in users accessing data even via phones. ORRECO, had partnered with IBM to create an app that analyzes data and combines it with the behavioral data, sleeping patterns and other personal information of the athletes to create a customized training regime. [32]

Indian Context

When it comes to researching about sports in India, it has to start with cricket. BCCI had partnered with sportsradar to analyze the IPL matches, held in UAE, to detect betting irregularities [45]. The matches were analyzed and data-driven insights were provided to BCCI for further perusal. BCCI is also planning to set up a research analysis team for NCA along with a medical panel under the guidance of Fortius clinics (already partnered with Wimbeldon and rugby leagues, and has received FIFA medical center of excellence recognition) [29]. Indian

Super League (ISL) is another major Indian sporting event which is employing the services of sports analytics companies. The analysts have to watch the match after it has finished, get insights and related video clippings from the match and then present it to the coach and the players [38]. The analysts work differs, depending upon the coach's requirement. Few of the teams from the league have partnered with a Bengaluru based company called SportsKPI, for the analysis part – post match, opponent analysis etc [49]. Not just ISL teams but even few teams from the traditional I-league and also a couple of teams from Pro Kabbadi League have employed the services of the company. Even though many of the teams in ISL have employed an analyst to assist the coaches and the teams are also using software like sportscode, prozone, the teams still lack the resources to make full use of the technology available [50].

A degree in Sports management or a masters in business administration can lead you to sports analytics. Sports management courses have sports analytics as one of the core subjects and other select B-schools providing a master degree in business administration will have it as an elective subject. For undergraduate programs, a degree in computer science, maths, statistics or related courses can get land one person an entry level job as a data analyst. [glassdoor]

Hypothesis and explanation

As sports analytics is a growing field and there are lot of applications of it in different sports across the globe, with major brands – top leagues, etc being associated with it, the aim is to check how Indian population – between age group of 16 - 35 are responding to it. Hence the default status assumed is that people aren't interested in sports analytics (which becomes the null hypothesis in each case). Though there is no particular age limit to start a job in a new field, the age of 35 is considered as an upper limit for the study.

Hypothesis 1

To check the interest of the above-mentioned population in statistics and analysis of player performances This is being checked by asking them whether they regularly check the stats and analysis using any app or pre and post media coverage, what is the reason for checking the stats – for leisure, stat-geek or professional.

Hypothesis 2

To check if the above-mentioned population has enough exposure or awareness about sports analytics. This is being checked by asking the questions about whether the respondents know that statistical models, machine learning etc are used in sports analytics to assist coaches and players, do they know about any foreign or Indian sports analytics companies.

Hypothesis 3

To check if the above-mentioned population is interested in making a career in sports analytics, by asking a direct question regarding the same. And also, to know regarding their salary expectations, compensation or tradeoff between salary and other perks if any.

The hypothesis is being checked across different age groups, gender and different sports liked by them.

Research Methodology

Population Profile

The population considered for the research includes the entire population between the age group 16-35.

Sample Profile

It would be difficult to reach each and every individual between this age group. Hence an online survey was floated and the results are drawn based on the responses received.

Tools

Microsoft excel was used to conduct the analysis of the data received. A chi square test was performed on the data set considering gender, age group and sports as the differentiating factor and then the responses to the questions were noted down. The observed frequencies and the expected frequencies for the responses were the inputs to the embedded chi-square function, which returned the p-value for the same. A level of significance considered is 95% hence the factor is set to 0.05

Findings & observation

A total of 153 responses were received. Following graphs give the bifurcation of the respondents.

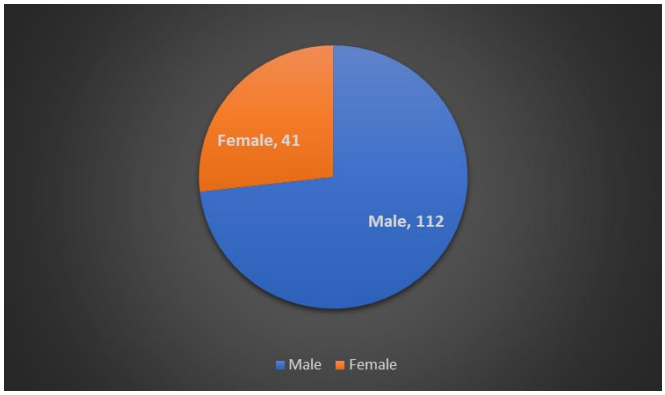

Fig – showing the breakup of male & female respondents

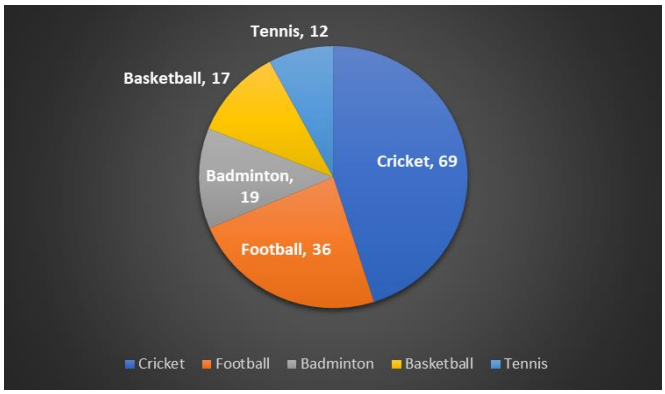

Fig – showing the breakup of number of respondents following the different sports

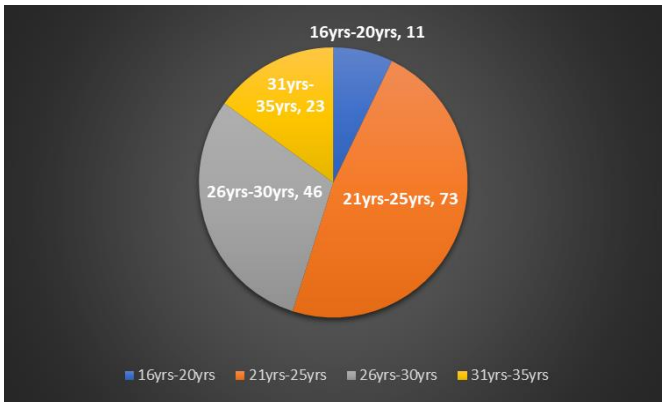

Fig – showing the breakup of the number of respondents in different age groups

Hypothesis 1 – interest in sports statistics

Null Hypothesis – Respondents are not interested in knowing the statistics or player performance analysis

Alternate Hypothesis – Respondents are interested in knowing the statistics or player performance analysis

The values are first checked for gender, then age group and favorite sports of the respondents

	Observed frequencies		Expected Frequencies	
Respondents Gender	**Yes**	**No**	**Yes**	**No**
Male	99	13	88.58	23.42
Female	22	19	8.57	32.43
Total	**121**	**32**	**97.15**	**55.85**

Gender vs interest

As the p value obtained is less than 0.05, we reject the null hypothesis

	Observed frequencies		Expected Frequencies	
Respondents Age group	**Yes**	**No**	**Yes**	**No**
16-20	7	4	8.7	2.3
21-25	63	10	57.73	15.27
26-30	37	9	36.38	9.62
31-35	14	9	18.19	4.81
Total	**121**	**32**	**121**	**32**

Age group vs interest

As the p value obtained (0.035) is less than 0.05, we reject the null hypothesis

	Observed frequencies		Expected Frequencies	
Respondents Favourite sports	**Yes**	**No**	**Yes**	**No**
Cricket	61	8	54.57	14.43
Basketball	12	5	13.44	3.56
Football	30	6	28.47	7.53
Badminton	10	9	15.03	3.97
Tennis	8	4	9.49	2.51
Total	**121**	**32**	**121**	**32**

Favourite sports vs interest

As the p value obtained (0.0075) is less than 0.05, we reject the null hypothesis

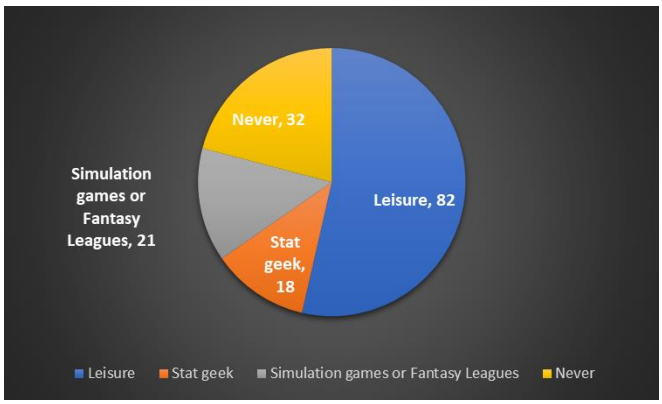

Fig – showing the breakup of the number of respondents checking the statistics or player performances for different reasons

Hypothesis 2 – Awareness or exposure to sports analytics

Null hypothesis – Respondents are not aware about role of statistical models (machine learning, deep learning etc) in assisting coaches and players

Alternate hypothesis – – Respondents are aware about role of statistical models (machine learning, deep learning etc) in assisting coaches and players

The values are first checked for gender, then age group and favorite sports of the respondents

	Observed frequencies		Expected Frequencies	
Respondents Gender	**Yes**	**No**	**Yes**	**No**
Male	33	79	37.33	74.67
Female	18	23	13.67	27.33
Total	**51**	**102**	**51**	**102**

Gender vs awareness

As the p value obtained (0.093) is more than 0.05, we fail to reject the null hypothesis

	Observed frequencies		Expected Frequencies	
Respondents Age group	**Yes**	**No**	**Yes**	**No**
16-20	2	9	3.67	7.33
21-25	26	47	24.33	48.67
26-30	11	35	15.33	30.67
31-35	12	11	7.67	15.33
Total	**51**	**102**	**51**	**102**

Age group vs awareness

As the p value obtained (0.077) is more than 0.05, we fail to reject the null hypothesis

	Observed frequencies		Expected Frequencies	
Respondents Favourite sports	**Yes**	**No**	**Yes**	**No**
Cricket	20	49	23	46
Basketball	6	11	5.67	11.33
Football	16	20	12	24
Badminton	5	14	6.33	12.67
Tennis	4	8	4	8
Total	**51**	**102**	**51**	**102**

Favourite sports vs awareness

As the p value obtained (0.55) is more than 0.05, we fail reject the null hypothesis

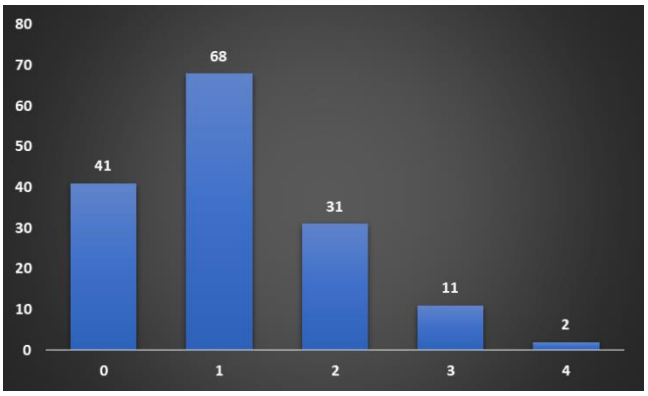

Fig – showing the breakup of the number of respondents knowing different foreign sports data analytics companies

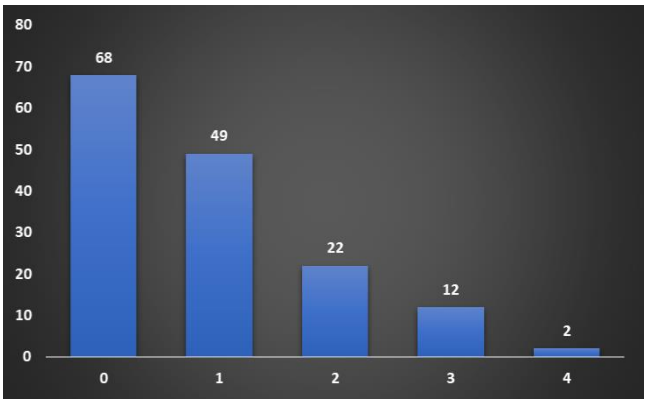

Fig – showing the breakup of the number of respondents knowing different Indian sports data analytics companies

Hypothesis 3 – Career in Sports analytics

Null hypothesis – Respondents are not that keen in pursuing a career in sports analytics

Alternate hypothesis – Respondents are keen in pursuing a career in sports analytics

The values are first checked for gender, then age group and favorite sports of the respondents

	Observed frequencies		Expected Frequencies	
Respondents Gender	**Yes**	**No**	**Yes**	**No**
Male	28	84	29.28	82.72
Female	12	29	10.72	30.28
Total	**40**	**113**	**40**	**113**

Gender vs career aspiration

As the p value obtained (0.59) is more than 0.05, we fail to reject the null hypothesis

	Observed frequencies		Expected Frequencies	
Respondents Age group	**Yes**	**No**	**Yes**	**No**
16-20	6	5	2.88	8.12
21-25	19	54	19.08	53.92
26-30	8	38	12.03	33.97
31-35	7	16	6.01	16.99
Total	**40**	**113**	**40**	**113**

Age group vs career aspiration

As the p value obtained (0.084) is more than 0.05, we fail to reject the null hypothesis

	Observed frequencies		Expected Frequencies	
Respondents Favourite sports	**Yes**	**No**	**Yes**	**No**
Cricket	18	51	18.04	50.96
Basketball	2	15	4.44	12.56
Football	13	23	9.41	26.59
Badminton	3	16	4.97	14.03
Tennis	4	8	3.14	8.86
Total	**40**	**113**	**40**	**113**

Favourite sports vs awareness

As the p value obtained (0.28) is more than 0.05, we fail reject the null hypothesis

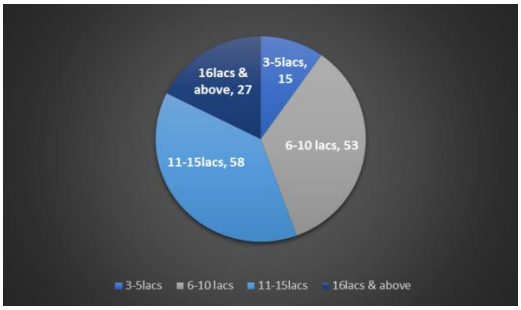

Fig – showing the breakup of the number of respondents expecting different salaries per annum

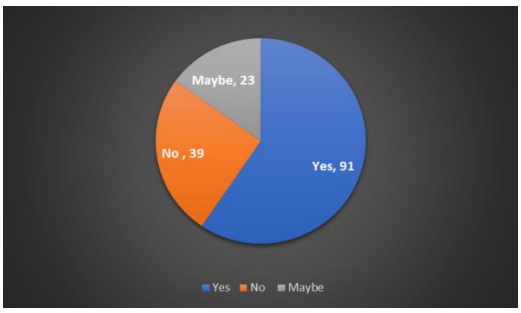

Fig – showing the breakup of the number of respondents whether they want to tradeoff between the salary in hand vs perks like match tickets etc

Conclusion

Based on the observations from the sample and corresponding analysis, it can be stated that the respondents are interested in match statistics and player performance analysis (for different reasons) and are checking that via different media, but there is less awareness among them when it comes to the science or technology behind sports analytics. Also, there isn't any hype or keenness towards making a career in sports analytics but majority of them are ready to tradeoff between on hand salary vs perks like match tickets etc. The results are consistent across age group, gender and favourite sports of the respondents.

Limitations

The survey was conducted online and the analysis was done on the responses that were received. Thus, the findings & results of the survey might not be a clear indicator of the current trend. Further the observations within the sub groups – different sports, gender etc. Also, there might be few results within the gender subgroup which might be skewed which may be due to either question not being interpreted by the respondents correctly or there should have been a question related to the frequency of checking of match or player related statistics. The different applications in various sports listed in the literature review might not be an exhaustive list. Also, some of the findings or techniques mentioned in reference research papers have done the analysis on selected areas which may not turn out to be the representative of the actual population

Future scope

Only team sports have been considered in the literature review. The study can be expanded to

consider individual sports as well and to check if any parallels can be drawn from the team sports.

The study can also be done to consider the cost factor of the technology, how the technologies are affecting the sports to a different extent (ex. Hawk-eye is used in cricket, football, tennis etc), a comparison on the technologies being used in different sports. Further the study can also be expanded to business analytics or intelligence of running the sports operations and not just restricted to the player or team performance. These can include factors such as study of KPI for broadcasting, brand management, club/team valuation etc

Another area of research could be the different mathematical models that are being deployed, or the mathematics behind the technologies (ex the triangulation fundamentals used in hawk-eye). This could be a cohesive collection of the present academic areas mapped to the different technologies in different sports (such as different machine learning models, analytical tools) and can pave way for further research into these academic areas.

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