

APPLICATIONS OF OPERATIONS RESEARCH IN THE SPORTS INDUSTRY

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ABSTRACT

The study on the chosen topic aims at addressing the major problems and challenges faced by different organizations while conducting events like inter-city, inter-state tournaments, with the help of operations techniques. The research will be inclined more towards solving issues like- Minimizing player's transportation time and the organizer's cost concerning the venues. Maximizing player's productivity by allotting them with the most suitable equipment (the taken case is on Badminton) aligning the player's attributes with the apparatus. Secondary or unseen underlying issues that arise in the functionality of a sports organization will also be addressed in the case. The concluding note for the solution after its derivation will be a combination of the application of OR techniques and Management techniques. Real-life case studies and the mechanism of its working will also be specified to support the final arguments.

INTRODUCTION

From the early traces of birth of sports between 794 and 1333, where sports were a means of military training and served just as a showcase of physical combat ability, to the present 21st-century world where sports counts money, franchises, and country's pride in international events, sports industry came through a long way with its evolution. Advanced mass communication and more human interaction have further attracted market player's stake in these areas. With changing culture and the public's spirit towards sports and games, political involvement is evident and is indeed one of the prime focuses by the governments in many countries. The sports industry having gained this huge attention has lead-to many prestigious international events like- Olympics, commonwealth games, world cups, and many intra-national premier leagues accommodating international players in various series of sports across the globe. Be it a local tournament within the city or an international sporting event, the host stadium, city, state, or country (in case of an international event) receives recognition, attracts sponsors and in case of a mega-event, it puts the hosts on the world map, boosting not only tourism and awareness but also helps the country revive numerous economical-benefits. Since a lot of money is at stake-there are many factors that are to be considered for smooth and successful conduction of an event- Appropriate dates, venue, supplies for the players and staff, volunteers allotment, promotion platforms, scheduling, the residential facilities, etc. Here, is the point when the Operations research comes into the picture.

APPLICATION- The team will be visiting the nearby stadiums, coaching centers, or sports academies from where well-elaborated data of the sports camps conducted during the year can be collected. The data might include- the cities toured, their past residence venue, number of players, transportation mode and cost incurred, player refreshment, food, equipment allocator's data, and other miscellaneous expenses. *The*

main agenda of application of OR techniques in this regard will be to minimize the troop's transportation cost concerning their future camps keeping in mind the cities they are going to tour (here, all the available nearby places for residence from the venue will be taken into consideration) and providing the management with a proper analysis of player's attributes with a series of apparatus to allot the most suitable and customized equipment and boost efficiency. Further, a comprehensive advertising budget will be chalked out considering the channels available and minimize the promotional expenses.

OR TECHNIQUES- GRG Non-linear and Simplex LP of MS Excel solver.

TOOLS AND SOFTWARES- MS Excel Solver.

OBJECTIVES:

- Minimizing player's transportation costs and the organizer's cost concerning the venues.
- Maximizing player's productivity by allotting them with the most suitable equipment aligning player's attributes with the apparatus. (BADMINTON)
- Minimize the promotion cost, taking into consideration the available media.

LITERATURE REVIEW

It is perceptible that the sports industry has seen an unimaginable level of growth in the past few decades, in terms of technology and mass broadcasting right from the Time-tracking systems, Clothing, and equipment, GPS data tracking, Virtual imaging, Accuracy and decision systems et cetera, tech advancements have covered almost all indoor and outdoor sports, including athletics. The global sports technology market size was valued at USD 11.70 billion in 2020, with some of the prominent players in the global sports technology market being- Infosys, IBM, Apple, and many more. Irrespective of this electronic advancement, which eased and enhanced the planning and decision-making process, there were instances when management's inefficient decision-making led to many undesired results.

One of the prime examples was witnessed in the year 2010 commonwealth games, where questions were raised against delays in the construction of main Games venues, infrastructural compromise, poor transportation, and the state of the accommodation for the players and staff. Similarly in 2008, in the Beijing Olympics, limitations to internet access, threats of physical violence, and the rise in room prices leading to high accommodation costs were the major issues faced. Extensive *use of transportation and assignment algorithms* of Operations research in the above mention cases would have helped in predicting and avoiding such unforeseen circumstances.

These days an interesting inclusion of effort is observed by the big franchises and national teams in the player selection and training process. Teams and franchises conduct many phases of the selection process through which the players undergo. Eligibility, fitness, physical factors like height, weight, qualifying matches, emotional and mental well-being et cetera are some of the major steps of the selection process.

But after the selection of players, inadequate sporting resources, lack of customized equipment, and appropriate resource allotment for the players is another heap of challenge sports academies face.

According to research conducted by the students of the University of Nigeria, Hargeisa, and Africa- 89.3% of the respondents believed that primary schools in Bwari Area Council lack sports equipment. In a country like India, with a population of over 1.25 billion, the existing sports infrastructure is not satisfactory. The lack of world-class infrastructure and insufficient government support is reflected in the poor performance of Indian athletes in major international events such as the Olympics. One of the secondary reasons for poor performance is the inefficient allocation of pertinent equipment according to the player's attributes. According to a research article published by *SPRINGER LINK* - "When children preferred using scaled equipment over adult equipment, they were more engaged in the task and had greater self-efficacy to execute skills." Similarly, children or sportsmen performed skills better when the equipment and play area were scaled. Hence, the team feels that with the help of appropriate data, *the Hungarian algorithm can be put to use for maximizing the net element of consideration* and allocate the best-suited equipment for the players.

In the 1980s, Nike launched its "JUST DO IT" campaign, in print, television, and internet media, promoting the idea of starting a process of change. In 1988, Nike sales were at \$800 million; by 1998, sales exceeded \$9.2 billion, further lead to attracting major market player's stake in Nike. The above example clearly shows how proper advertising can lead to the inflow of funds in the organization. The majority of the local sports academies in tier-I and II cities have a very unorganized advertising budget allocation which gives rise to inefficient outcomes and further leads the organization to neglect or ignore the advertising duty. This turns to be a liability for the academy in the future due to a lack of awareness among the public irrespective of the academy's achievements and progress. One of the key objectives of advertising - attract sponsors for equipment and apparatus, will be lost. So, a detailed analysis of the amount charged with a suitable media can act as the data for *the Hungarian algorithm of assignment*, where efficient allocation of advertising budget can be drawn down, reducing the unnecessary wastage of money.

ANALYSIS AND FINDINGS

I) AJITH SINGH CRICKET ACADEMY-MINIMIZING THE TRANSPORTATION COST

Ajith Singh cricket academy, situated in Ambala, established in 2019 is one of the latest coaching centers in town. Working with 20 on-ground duty staff, 3 coaches, and a senior mentor Mr. Saketh Mishra, former Ranji player. The academy provides coaching in three different categories-

AGE GROUP:

6-13

14-19

20 & above.

The academy falls under the state-funded authorities and usually conducts inter-stadium matches within the city. In the upcoming month of February, the selected players for U-19, who cleared the initial selection process are to report in Mumbai's **RAJIV GANDHI STADIUM CBD BELAPUR**, for trial matches.

The academy usually travels by a coach and the selected players via train to any of the five stations in Mumbai (mentioned below), and travel to the stadium through a local mini-bus hire, “Shahji travels” which charges- 32 rupees/km with the additional 500/day as the driver’s compensation.

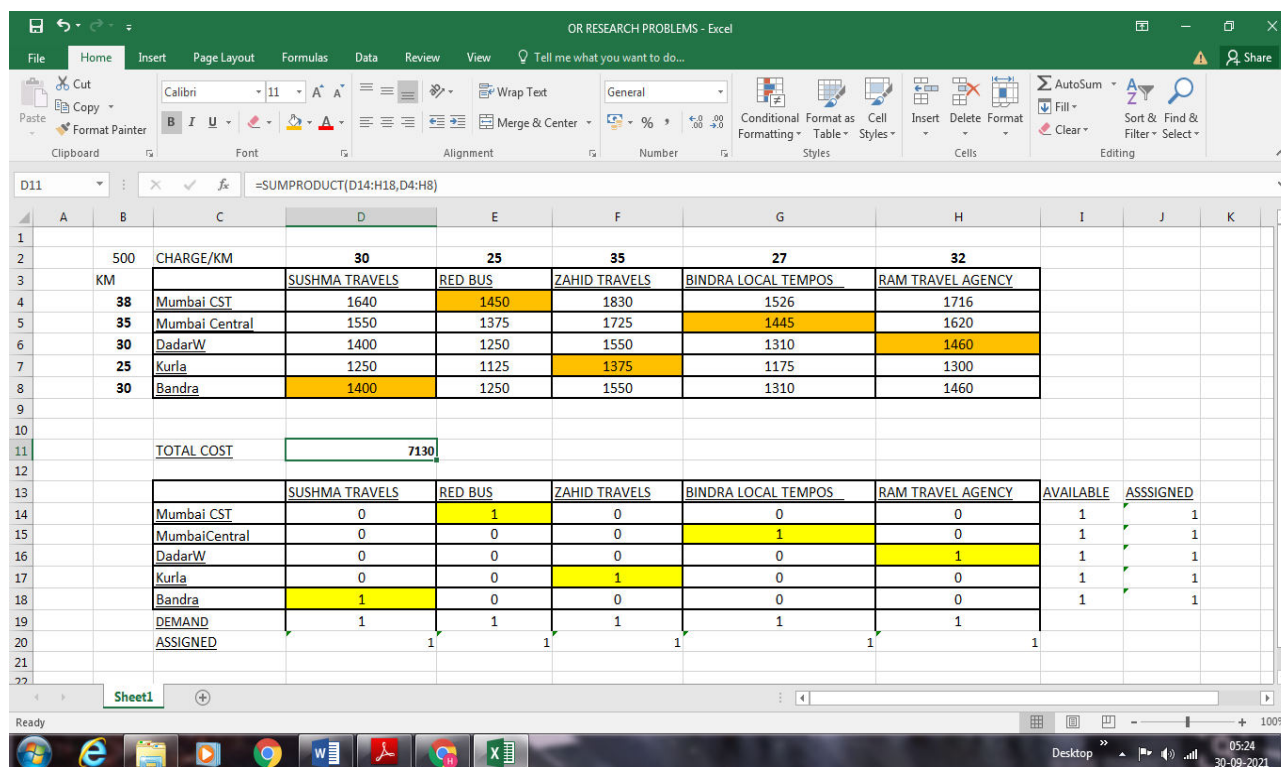
Our team after thorough research finalized 5 most economical mini-bus hires in Mumbai-

<u>COMPANY</u>	<u>RATES</u>
SUSHMA TRAVELS	30 rupees/km+ 500 Driver charges
RED BUS	25 rupees/km+500 Driver charges
ZAHID TRAVELS	35 rupees/km+500 Driver charges
BINDRA LOCAL TEMPOS	27 rupees/km+500 Driver charges
RAM TRAVEL AGENCY	32 rupees/km+500 Driver charges

Also, the team has selected five stations (which act as source points) to cut down the distance and minimize the transportation, namely-

<u>STATION</u>	<u>DISTANCE FROM THE STADIUM</u>
Mumbai CST	38 KILOMETRES
Mumbai Central	35 KILOMETRES
Dadar- W	30 KILOMETRES
Kurla	25 KILOMETRES
Bandra	30 KILOMETRES

The formulation of the elements was done in the following manner- Transportation cost = [Company’s rate per km* Respective distance from the destination + 500]



Station	SUSHMA TRAVELS	RED BUS	ZAHID TRAVELS	BINDRA LOCAL TEMPOS	RAM TRAVEL AGENCY	AVAILABLE	ASSIGNED
Mumbai CST	1640	1450	1830	1526	1716	1	1
Mumbai Central	1550	1375	1725	1445	1620	1	1
DadarW	1400	1250	1550	1310	1460	1	1
Kurla	1250	1125	1375	1175	1300	1	1
Bandra	1400	1250	1550	1310	1460	1	1
DEMAND	1	1	1	1	1	1	1
ASSIGNED	1	1	1	1	1	1	1

By using GRG Non-linear method through the excel solver, it was deduced that-

IF THE SOURCE STATION IS -	THE BEST ALTERNATIVE TO CHOOSE IS-
Mumbai CST	RED BUS
Mumbai Central	BINDRA LOCAL TEMPOS
Dadar- W	RAM TRAVEL AGENCY
Kurla	ZAHID TRAVELS
Bandra	SUSHMA TRAVELS

Had it been the academy’s past routine of choosing “SHAHJI TRAVELS” of 32rupees/kilometer. The total cost would have been –

$$(38+35+30+25+30)*32+ (500*5) = 7556$$

But, through the Hungarian algorithm, the total cost has been reduced by 426 rupees that is- **7130**. Also, the individual costs are decreased.

Hence, there was an improvement in cost-saving as the solution reached its optimality.

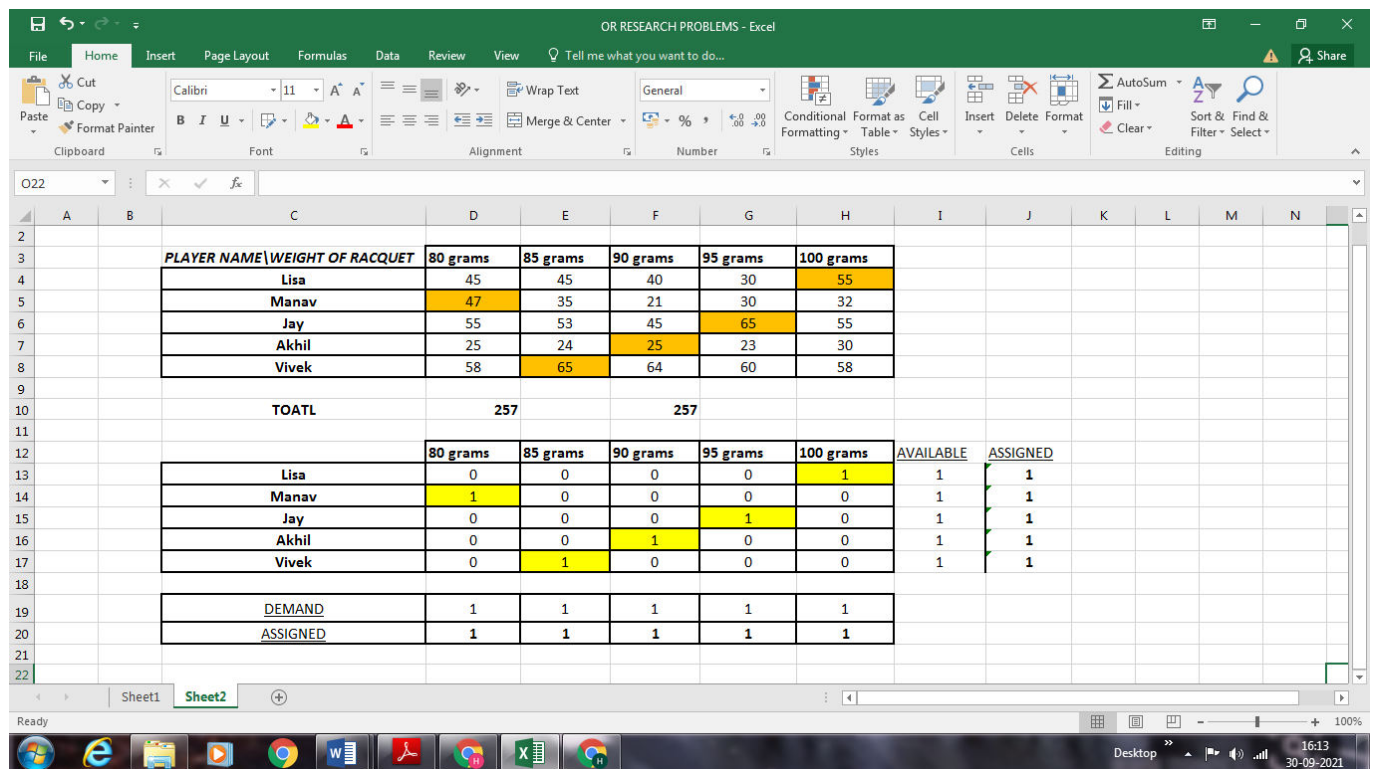
II) SHUTTLETT’S BADMINTON ACADEMY-MAXIMIZING THE PLAYER PRODUCTIVITY BY ALLOCATION OF MOST SUITABLE EQUIPMENT

Shuttler’s Badminton Institution started in 2002. It is situated in Borivali, Mumbai. Over the years the academy was successful in training players in Badminton. They are mainly known for nurturing the tactics and skills of the players. The coaches provide personalized guidance to the players on how to perform in the best and the most effective manner. One of the biggest reasons for the success of Shuttler’s is providing Badminton Racquets based on the efficiency and the adaptability of the player. They provide complimentary racquets to the players at the time of admission.

Shuttler’s want to equip their best performing players, i.e. players maintaining their name in the top 5, in the weekly leagues, with racquets which are of appropriate and suitable weights so that it can improve their game and boost the productivity of the player in the future matches. The major problem academy is facing is- identification of a method to assign the right racquet to the deserving player. The top 5 consistently performing players from the previous league are -LISA, MANAV, JAY, AKHIL, and VIVEK and to whom the academy wants to provide the equipment.

TEAM’S ANALYSING MODEL

In the practice sessions, players will be provided with racquets of differing weights, and the players will face a series of 75 consecutive shots, out of which 40 will be to analyze the defense and the remaining 30 will be to check the smashing ability and agility of the player. A successful attempt has one condition – the shuttlecock lands in the opponent’s court and no fouls are made. The total number of missed shots will be subtracted from the total number of shots (i.e. 75). After the analysis of the player is done the candidate’s best performance record with a respective racquet will be provided. The player can increase productivity and efficiency when the customized scaled equipment is allotted after the assignment algorithm. The coaches recommend five racquet weights 80 gram, 85 gram, 90 gram, 95 gram, 100 gram. And the academy can only allot five racquets for this season’s league.



PLAYER NAME\WEIGHT OF RACQUET	80 grams	85 grams	90 grams	95 grams	100 grams
Lisa	45	45	40	30	55
Manav	47	35	21	30	32
Jay	55	53	45	65	55
Akhil	25	24	25	23	30
Vivek	58	65	64	60	58
TOATL	257		257		

	80 grams	85 grams	90 grams	95 grams	100 grams	AVAILABLE	ASSIGNED
Lisa	0	0	0	0	1	1	1
Manav	1	0	0	0	0	1	1
Jay	0	0	0	1	0	1	1
Akhil	0	0	1	0	0	1	1
Vivek	0	1	0	0	0	1	1
DEMAND	1	1	1	1	1		
ASSIGNED	1	1	1	1	1		

By using the Simplex LP method, through the excel solver, it was deduced that-

<u>PLAYER</u>	<u>SUITABLE RACQUET WEIGHT</u>
LISA	100 GRAMS
MANAV	80 GRAMS
JAY	95 GRAMS

AKHIL	90 GRAMS
VIVEK	85 GRAMS

The total productivity has been maximized at 257. The above allocation of weighed racquets will best suit the players and will boost their productivity.

III) DRR MUNICIPAL INDOOR STADIUM- MINIMIZING THE PROMOTION COST, TAKING INTO CONSIDERATION THE AVAILABLE MEDIA.

DRR Municipal indoor stadium, situated in Labbipet-Vijayawada, Andhra Pradesh, is one of the state government-run sports authorities in the district. The stadium has coached for – badminton, table tennis, and chess. As many as 50 children have a regular membership as trainees. After the conclusion of the upcoming table tennis inter-district tournament, the stadium authorities intend to advertise their players' achievements in the form of short articles. The authority feels that newspapers will be a suitable channel for the promotion. Further, the management intends to minimize the cost of publishing the articles, in the state-run Telugu daily.

METHODOLOGY:

Our team has chosen five prominent Telugu daily namely-

1. Eenadu
2. Sakshi
3. Andhra Jyothi
4. Surya
5. Praja Shakti

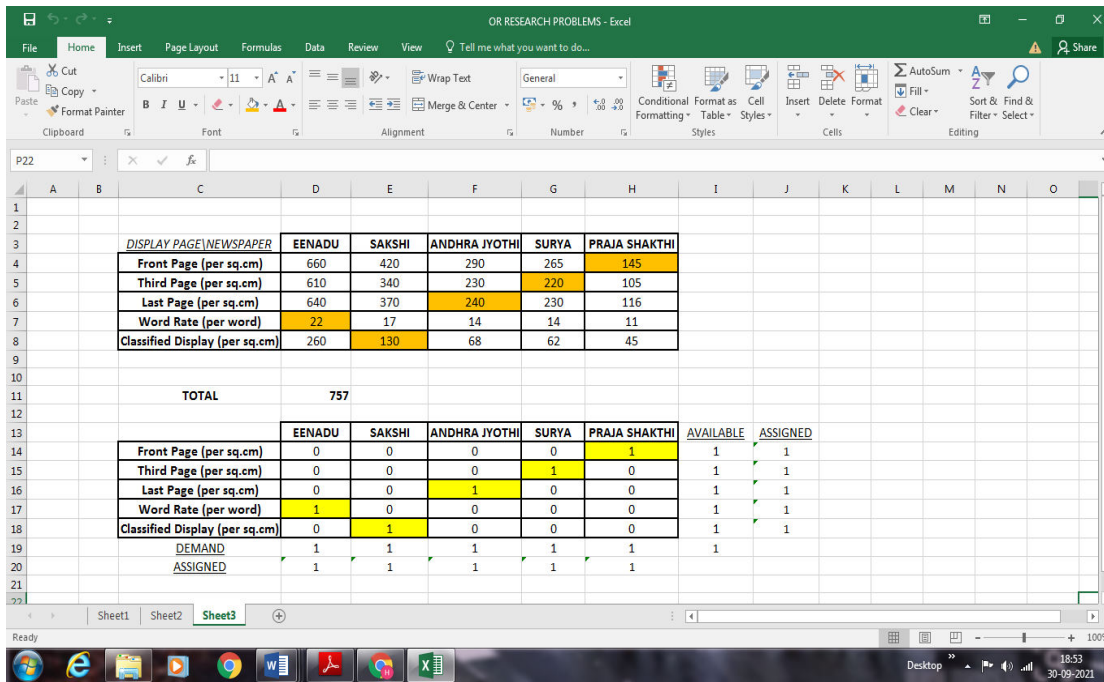
Our team decided that the assignment can be formulated by comparing the display page rate (where rates are specified for a 100-word article) of all the selected newspapers. This methodology will even help the management to select the cheapest display page according to the value of the article they want to publish*.

** Here the value of the article signifies how big the achievement of the player is. The bigger the achievement of the player, the higher the articles go in terms of the main paper (front, 2nd, or 3rd page of the newspaper). If the publishing article or snippet signifies general achievements the management can go with the classifieds section of the district edition that comes with the main paper.*

The charges are as follows-

	<u>EENADU</u>	<u>SAKSHI</u>	<u>ANDHRA JYOTHI</u>	<u>SURYA</u>	<u>PRAJA SHAKTHI</u>
<u>Front Page (per sq.cm)</u>	660	420	290	265	145
<u>Third Page (per sq.cm)</u>	610	340	230	220	105
<u>Last Page (per sq.cm)</u>	640	370	240	230	116
<u>Word Rate (per word)</u>	22	17	14	14	11
<u>Classified Display (per</u>	260	130	68	62	45

<u>sq.cm</u>					
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DISPLAY PAGE\NEWSPAPER	EENADU	SAKSHI	ANDHRA JYOTHI	SURYA	PRAJA SHAKTHI		
Front Page (per sq.cm)	660	420	290	265	145		
Third Page (per sq.cm)	610	340	230	220	105		
Last Page (per sq.cm)	640	370	240	230	116		
Word Rate (per word)	22	17	14	14	11		
Classified Display (per sq.cm)	260	130	68	62	45		
TOTAL	757						
	EENADU	SAKSHI	ANDHRA JYOTHI	SURYA	PRAJA SHAKTHI	AVAILABLE	ASSIGNED
Front Page (per sq.cm)	0	0	0	0	1	1	1
Third Page (per sq.cm)	0	0	0	1	0	1	1
Last Page (per sq.cm)	0	0	1	0	0	1	1
Word Rate (per word)	1	0	0	0	0	1	1
Classified Display (per sq.cm)	0	1	0	0	0	1	1
DEMAND	1	1	1	1	1	1	
ASSIGNED	1	1	1	1	1		

From the application of the Simplex LP of the excel solver, it was deduced that-

<u>DISPLAY PAGE</u>	<u>CHEAPEST NEWSPAPER</u>
Front Page	PRAJA SHAKTHI
Third Page	SURYA
Last Page	ANDHRA JYOTHI
Word Rate (per word)	EENADU
Classified Display(per sq.cm)	SAKSHI

The total cost was minimized to -757. And the suitable allocation has been done which reduced the advertising expenses of the stadium.

CONCLUSION

The operations research techniques-mainly the Hungarian algorithm of assignment used in the solving process proved to minimize and maximize the required data, whenever needed and served the optimality in

every case taken up in the research paper. The application of operations research in the sports industry is visible and is indirectly used in many unseen segments of the industry. With growing complications and advancements in technology, the industry will need very highly sophisticated algorithms in the future. In the cases taken up, operations techniques not only provided optimal solutions in materialistic data but also, helped in increasing the efficiency of human resources. It was also observed in the data collection process that an organization lacks productivity when the allotment is done on a first come first serve basis, without proper analysis of the available opportunities. On a whole, the research undertaken and the final deductions made fulfilled the purpose of benefiting the small space of the sports industry chosen.

LIMITATIONS-

1. Lack of sufficient data and time-restricted the elements of consideration in the process of optimization.
2. New roads, flyovers, or shortcut routes may be present, which might result in reduced traveling distance than considered in the case taken up.
3. More efficient and sophisticated ways can be brought in the case of maximizing player's productivity. Consideration of more factors other than defense and smashing ability is possible.

ACKNOWLEDGMENT

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Also, we thank all the sports authorities for all the valuable data and stats they provided us with for the research. Namely-

1. **AJITH SINGH CRICKET ACADEMY- AMBALA.**
2. **SHUTTLE'S BADMINTON ACADEMY- MUMBAI.**
3. **DRR MUNICIPAL INDOOR STADIUM- VIJAYAWADA.**

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