

APPLICATION OF OPERATIONS RESEARCH IN PLANNING OF FILMS

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Abstract: The Indian Film Industry has a wide array of departments where OR can be applied to benefit the people involved. There are a huge number of departments, from Pre-Production to Post-Production, from Lighting to Make-up, etc. meaning there are a large number of areas where OR can be used to reach to an optimal solution. The main objective of this paper is to show the connection between OR and Filmmaking and how OR helps to reach an optimal solution. The major focus of this paper is on how the Foreign and the Indian Film Industry work in different sectors. The paper contains various examples of actors, directors and other people from the industry, which shows how OR can be used to turn various factors to their benefit. Thus from this paper we can draw a conclusion as to how OR benefits the industry of Filmmaking.

INTRODUCTION

Operations Research is the application of the methods of science to complex problems in the direction and management of large systems of men, machine, materials and money in industry, business, government, defence and in many other operations or industries. In simpler words, it is most often used to analyze complex real life problems typically with the goal of improving or optimizing performance.

Examples where Operations Research is being successfully used are:

1. Airline Industry (routing and flight plans, revenue management and crew scheduling)
2. Telecommunications (network routing, queue control)
3. Manufacturing Industry (system throughput and bottleneck analysis, production scheduling, capacity planning and inventory control management)
4. Healthcare (hospital management, facility design), and
5. Transportation (traffic control, logistics, network flow.
6. Sports (Duckworth-Lewis method)

Since Operations Research can be used in entertainment industries like Sports, it can also be used in planning of movies. Planning of a movie or making a movie is not an easy-to-do task, this requires huge funds, efficient utilisation of resources, creativity and effective management. This is exactly where Operations Research comes to place.

Taking the example of Disney, The Walt Disney Company, commonly known as Walt Disney or simply Disney is an American diversified multinational mass media and entertainment conglomerate. Disney's legacy of storytelling is translated into simulation models that help them deliver excellent experiences to its viewers/guests.

Marvel Studios, LLC is an American motion picture studio dedicated to producing films based on Marvel Comics characters. Marvel Studios has released around 20 films since 2008 until 2018 within the Marvel Cinematic Universe. The films all share continuity with each other, along with the television shows produced by Marvel Television. The series has grossed over \$17 billion at the global box office, making it the highest-grossing film franchise of all time. Just like many other production houses like Disney, Marvel also uses Operational Research in planning and strategizing its movies. Marvel strategically reveals their plans for the future by way of Comic Con as extremely eager comic books fans await to see if their favourite super hero will be played by the calibre of actor they desire or if the film will be in the right hands of a suitable director. They often listen to fan opinion in the blogs when it comes to their hiring choices and are highly motivated by fan desires. This relationship between the studio and their audience is unique as Marvel relies on anticipation for much of their success. Blogs, big reveals from comic conventions, events in the comic books, and after credit scenes add fuel to the immense burning fire Marvel Studios masterfully sustains. One of the Operation Research techniques/models is the Network Model. Network Planning is an approach to planning, scheduling and controlling complex projects. Marvel very strategically plans its movies and times its release. They see every aspect of the environment while releasing a movie to make sure they provide the best possible entertainment to its viewers at that time.

The Flight of the Phoenix (2004) movie is a perfect example of Operations Research. It highlights the importance of technical issues in projects – the controlling of budgets, the trade offs in the project management triangle, the impact interpersonal issues etc.

Operational Research is important in planning or making of movies. It will help in effective utilisation of capital/budget so that a movie can be made at the least possible cost, the movie can be made faster with effective management and can be distributed to the maximum audience.

OVERVIEW OF THE INDUSTRY

Operations research is used everywhere around the world in the film industry minimally in India. It is a new tool to utilise to our benefits. I would like to elaborate on how foreign and Indian film industry works in different areas.

- **Development** – Resource plays a factor to manage the shoot time and also many productions have a set schedule of day and night shoots as to efficiently allocate their resources. For example, Mel Gibson said this while promoting his film ‘Hacksaw Ridge’ that there was a time when war related movies used to take 2-3 months to shoot their period dramas whereas due to technology and efficiency of time he shot this feature film in just 30 days. (Galloway, 2017)
Yes, restrictions in capital is a reason for the need to schedule for independent or small scale movies but the fact that they always create next best possible option to meet their needs so that production never stops is a huge difference in how they work and we work in our Indian film industry. There is a set procedure planned for pre, shoot, and postproduction. Departments like lighting, camera, music also extensively make use of OR as they use different back up options and best possible scenarios to create a perfect shot. Leaving aside the artistic differences one of the reasons the management and representation of films works out smoothly in foreign industries is due to their practices. The way our industry works has always been unorganised. Lengthy unplanned night shoots, no record of where and in what quantity resources are spent, casual workers mostly unskilled which delay the process, etc. are many areas to work on where having mathematical models can be of huge help. The amount of resources spent on marketing has no bounds for example – Padmaavat.

A concept of sequencing which means models that provide basis for the choice as to the ‘order in which multiple tasks can be performed’ in minimum duration can be partially seen used in Indian industry. There is a tendency of hiring one person who is also working at marketing, performing prop and resource allocation on set and various other works, which is not concerning his work profile, which leads to a bigger problem in management. As we are moving forward with the digital world, we see changes in making of a film too where earlier it was use of celluloid film and now digital cameras which change the whole shooting process and have their own benefits. Example – many sci fi, war movies are shot digitally but Christopher Nolan still shoots his movies in 70mm, 65mm or 35mm film like “Dunkirk”, “Interstellar”, “The Dark Knight” etc. (Bailey, 2017)

Damien Chazelle on his recent film “first man” shot it from 16 to 35mm to full IMAX with different formats which created difficulties to make it a common dialogue. (First Man, imax, behind the featurette, 2018)

This movie took every technical aspect that goes into a real space mission like structure of space ships, details of space suits, simulation and models used on Gemini 8, X15, Apollo mission with real documents and the actual use of space station at NASA so it used scientific techniques in the process of shooting a movie about the biggest space mission including the knowledge of those techniques. (INSIDER, 2018) (Bloopers, 2018)

2015 film “the revenant” by Alejandro González Iñárritu faced many difficulties with the shooting process. They shot the film in interior parts of Canada and Argentina so they set up the shot for 10 – 12 hours and had to shoot in maximum 2 hours due to lack of sunlight so the prep for 1 shot was extensively prepared to keep the schedule on time and utilising resources. It played with models and options to save time. (galloway, 2016)

Government of India has set up two film schools but we are not changing in our work pattern so our youth is also learning the same old methods.

- **Distribution** – This area deals with OR extensively because it uses models and analysis of distributing in various cities, countries with decisions in relation with price, release format either limited or broad.
We have 10000 movie screens in India. The structure of market defines the availability and the productivity of theatres. Some measures to understand if theatres are under/over screened could be the population of active moviegoers, services, movie timings, ticket price, etc. PVR is our leading movie supply chain. Another problem we face in Bollywood is dispute over revenue where distributors refuse to release movies to big theatre chains until they get 50 % of revenue from ticket sale. (StephenFollows, 2017). Studios also have different marketing strategies where in India we have more than 50 releases a year depending on festivals and movie star clash whereas in foreign industry it depends on availability, film festivals, award seasons, etc. release of a film is well planned pertaining these factors including press tours. Example- Karan Johar production has a set pattern of entertainment releases whereas A24 focuses on bringing indie, small budget, highly artistic films. Hollywood has seen a big shift in how A24 became a global language to cinema with winning academy awards and many accomplishments and getting the opportunity to distribute in various countries. (Mcinnis, 2017)

Hollywood has faced this issue too in the recent times. Paramount pictures refused to distribute a film by Alex Garland “Annihilation” due to their low confidence in gaining revenue out of it so they sold it to Netflix. These instances have been having often.

Overall, supply chain has been changing due to online platforms like Amazon prime, Hulu, Netflix, etc. In addition, they have their set of OR techniques that they use. Recently, Netflix bend its rules by giving “ROMA” by Alfonso Cuarón a national theatrical release. (nick, 2018)

These platforms are not a threat to movie theatres, as we will always have an audience for it unless productions sell their rights. Film tourism, enhancement, skill development and employment are certain areas where foreign industries have an extensive work management as compared to us. PVR has taken an initiative called VKAAO where there is a movie

library (Hollywood, foreign language, regional, etc) and audiences can create a screening with minimal prices at a given time in any near theatre. It is aimed to keep cinema-going spirit alive.

- **Piracy** - Despite the ongoing digitization of the film industry, piracy continues to be a key issue resulting in industry losses of INR 190 billion a year. Over 150 sites thrive on piracy where content is stolen from Indian movies; quick copies are made and distributed globally. Nearly half of the 150 are from the US, followed by 11 from Canada, 9 from Panama and 6 from Pakistan. The top 100 sites make INR 35 billion (\$510 million) highlighting the extent of the issue (Deloitte, 2016). The problem is exacerbated for regional films. For example, Baahubali, which had one of the highest budgets in the film industry, was pirated on the day of its release. About 1.6 million people downloaded the movie and another 1 million people watched it illegally through 1,500 links (Deloitte, 2016). Additionally, the Telugu film industry lost about INR 3.6 -13824 in 2015 due to online piracy through 18 million downloads or web streaming. (Deloitte, 2016)
- **Audience** – Indian films are dominated by the ‘STAR’ factor, which in turn creates a huge impact whereas it differs everywhere else. There is active participation and open criticism by the audiences abroad. The issues they are dealing with are different like gender pay gap, black representation, etc.
- **Reviews** – these play a major role for moviegoers. Sites like imdb, journals, critics TV shows, etc. are such platforms. Internationally, festivals as if Cannes, Tiff, Venice film festival, etc. set base for the award season whereas in India we have film critics who largely affect a cinema viewing. These scenarios highly affect the result for a movie financially. It's very well known that the times of India paper is often bought for positive reviews in our Hindi industry. For example, a film by Darren Aronofsky “Mother!” in 2017 was given zero tomatoes on rotten tomatoes and was given negative ratings over all platforms. It was regarded as a highly divisive movie, which resulted low profit due to creative, religion and belief differences.
- **Producers** – studios consider certain factors while picking up scripts. In our industry it works where we have star cast, big financial budget or sure chances of profits for the most part. This however is changing with time. Foreign industries concentrate more on quality of content which they have come to after a long journey. Example – Josh Horowitz, producer on “La La Land” was a first time producer but his love for musicals and faith in the director Damien Chazelle made him active on financing. On the other hand a film like “Manto” by Nandita Das which released this year had several issues to get it financed for years.

LITERATURE REVIEW

The three major stages of film making are production, distribution and exhibition. The filmmaking industry has higher economic value in the global economy as it employs half a million people alone in the US. Spending on tickets amounted to \$11 billion in 2004. (Jehoshua Eliashberg, 2005). The financial process and the production activities fall state under the Production stage where as distribution and advertising falls under the Distribution stage. Exhibition refers to the activities followed by the theatres. The production process involves pre-production, production and post-production. Pre-production, according to the general observation of movie making, the first step of production involves either creating or finding a story/concept/idea, or researching on a true event. After the screenplay process is over, the next step involves submitting it to studio-affiliated producers. It is necessary to submit it to a studio-affiliated producer as they have enough finance and hence there will not be any sudden termination or delay in the movie making process at least. If a producer is not affiliated with a studio, then he could borrow capital from other sources. If the producer is interested, there will be signing of an agreement, purchase of the screenplay and advance payment. Next, the producer has to recruit a director and crewmembers. After a thorough analysis, there will be selection of cast as per their vision. Selection of locations, designing sets and costumes also takes place. The producer estimates the budget, which depends upon the script, salaries given to the cast and crew, post-production process (special effects) and other financing possibilities. All this was a part of pre-production process. The actual production refers to when the film is shot. The post-production process involves editing, dubbing, creating music, special effects and getting it rated (U, U/A). So even though the process is systematic, then why do some films fail? As explained by (Caves, 2001) when the cost sinks the information of the project is leaked which results top losses. Another error takes place when a good film or project is rejected at the beginning, (Quench, 2004). There are several models available to check if the cost exceeds the budget and on how the films are going to work on box-office. This can be tested before releasing the movie. Distribution process includes buying of the films, theatrical release, how many screens to be made available for the film. There is a positive relation between advertising and opening revenue. Buzz marketing is a type of mouth-to-mouth publicity, it is a key driver of films for earning higher revenue. (Jehoshua Eliashberg, 2005) The timing of the release is also crucial. Movie release requires complicated timing model.

Exhibition depicts theatres in the market and how they are used. The US market is over screened while the rest of the world is under screened. The ticket prices of one theatre depend upon the prices of other theatres in the locality. The agreement between the distributors and exhibitors is not efficient leading to issues in the process. There is room for improvement by conducting micro scheduling which determines optimal day of the week for a movie. (Jehoshua Eliashberg, 2005). The filmmakers are expected to give a quality film to the audience and hence use of operation research is necessary in this field.

Without the use of a systematic method, it is difficult to achieve the result. For example, in Zimbabwe, there is only one TV channel, so the market is smaller. In addition, the channel has not adapted to digitalisation and hence many filmmakers do not produce good quality films, as they are not compatible with the channel. There is huge unemployment in Zimbabwe due to which many people try filmmaking. However, since they have less or rather no knowledge about the industry and operation research in general, many fail. Piracy takes place in Zimbabwe on large scale. Hence, there is a dire need to develop a national distribution method to reduce piracy. It is very difficult for Zimbabwe to compete globally without using operation research. Film industry creates enough opportunity levels in any economy. However, this is not seen in Zimbabwe. If the industry uses proper operation techniques then it might be able to reduce the problem of unemployment there. Operation research makes sure that the input effectively helps and gives the desired output. It will ensure that the production and on field takes place smoothly through supervision which will be done by a team. Operation research will include creating a budget, utilising the resources optimally, hiring the right people, effective ways to distribute the film and meeting other business objectives. There will be a production analyst to manage the script, production manager and schedule coordinator for other on field and production related activities. (Pradhan, 2017) suggests hiring a head for each of the operation criteria will help the industry achieve the desired results. On how to strengthen the Zimbabwean industry:

Research: Researching on the target audience, which will help to select right script or if the script comes first then selecting the right target audience. Researching on the latest technological advancements is part of the process of filmmaking.

Technology: Use of equipments, which help achieve better quality.

Professionals: Recruiting the best possible staff in order to get work done effectively.

Partnership & Marketing: Researching on various platforms and selecting the one, which is most efficient with respect to cost, profit and exposure. (Pradhan, 2017)

The Bollywood industry does not integrate production and distribution. It is highly unorganised as small independent operators who exploit content for profit operate it. The distributors play an important role in income generation for films. Sometimes the film is bought during its production phase. The Indian market is divided into 14 geographical territories, which help in distributing films accordingly. For instance, the revenues generated from 'masala' movies territory wise are Mumbai circuit: 30-40%, Delhi, UP, Punjab circuit: 25-30%, Rajasthan/Central India and Central Province: 5-6%, etc. (R. Dyondi, Strategic Risk Issues for Film Distributors of Hindi Film Industry in Mumbai: A Grounded Theory Approach, 2015). Following are the three different types of distribution arrangements, which exist in India: The minimum guarantee system: which involves the distributor bearing the loss if the film fails? If the film works on box office and if the minimum guarantee amount is recovered, then the distributor charges 20% of the amount and rest is divided as 50-50 Commission-basis distribution: includes financial safety title distributor as he charges on the net profit earned by the movie. The percentage is mutually decided by the filmmaker and the distributor and ranges from 3-15% (R. Dyondi, Strategic Risk Issues for Film Distributors of Hindi Film Industry in Mumbai: A Grounded Theory Approach, 2015) depending on the box office trend and earnings. It is further divided into two categories:

- Fixed commission: the producer is charged with a lump sum amount in advance.
- Advance commission: here the amount is paid to the producer in advance but is refundable if the film fails. The distributor also charges some amount as commission based on box office trend.

Grounded Theory defined as, "is an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data" (R. Dyondi, Strategic Risk Issues for Film Distributors of Hindi Film Industry in Mumbai: A Grounded Theory Approach, 2015)

The analysis of Grounded theory depicts that, the distributor us make sure that the film offered by the producer should be good enough and should be available at the right cost. The papers states that movie is the core product of the business and the content / cast/music director/director judges it.

While filming, a director constantly requires to check whether the particular take will work in the movie. Whether the dialogues are in sync with the plot, check for plot holes, take care of the light, sound and other technical factors, check for scheduling budgeting conflicts, etc. (Berkeley, 2008). Also, the cast and crew also play an important role in creating an optimum environment for work as smooth functioning is possible when there is proper coordination.

The issue of piracy remains, which needs to be tackled by systematic distribution, integrated with laws, regulations, and transformation in the industry model. It is a very prominent issue in film industry. Facts state that people like to watch a movie domestically as soon as it is released. 49.23% of the respondents of town, 33.33% from and 10.49% of the village respondents were found engaging in online piracy (Scaria, 2013). People who have more technological knowledge are found engaging in piracy. Solution for piracy involves legal action but that is not enough. The average Indian is drawn to such sites because they are free of cost and they offer movies to watch though phones. In addition, these sites are systematically organised (alphabetical, genre, time order). (Scaria, 2013) appreciates the government for using broader words for legal action and asks the Indian film industry to change their age-old model and adapt to the technological advances to stop its audience from deviating from cinema halls to new digital avenues.

Use of advanced technology in the process of filmmaking would be simpler if there was integration between IT and the film industry. It suggests that with the use of IT the cost of transportation, distribution, storing would eventually decrease. Use of IT in operations will improve the image quality through use of software. It will also help to add special effects at a lower cost. E marketing and e-sales could be done easily. E-service could enable the consumers with any information regarding the movie. E-procurement will reduce the cost of input, as digital cameras do not require film stocks. E-HRM would help the producers to

include operations management in their production process efficiently. E-technological development would help the research, online movie portal, quality, etc. Experts point out that IT will change the face of filmmaking process and that filmmaker should start utilising them and take risks before it is too late. (Wei, 2009). A survey was conducted and results showed that Face book is more popular amongst the youth and twitter was less popular. Out of the participants of the survey, around 82% watched movies in theatre around 6-12 times a year. (Wilcox, 2012). When these participants wanted to know more about a movie, they looked up on IMDB, rotten tomatoes, and the official website of the movie. 17% referred face book and twitter. Movie marketing affects the ticket sales. In order to maximize it, is necessary to promote your movie on the right platform to get maximum exposure. Hence, it is important for a producer to increase his declining youth towards the cinema hall.

Accidents while performing stunts are very common. The use of simulation for stunt performances which helps in analysing how wills a particular stunt work without physically performing it. Disney has been successful in finding a new and efficient alternative. The robot is well equipped with accelerometer and gyroscope and it can take the structure, shape of any character and can be clothed as per the tester's vision. (Panzarino, 2018). The simulation provides safe testing avoiding unnecessary accidents and lack of wastage of resources.

SIGNIFICANCE OF OPERATIONS IN THE MOVIES

Film is a powerful means of recreation and an artistic work that should be seriously considered in India. Film genres, such as documentaries, have become teaching tools in academic institutes to deliver information to students on history, science and other disciplines. It is a service that entertains and educates, frames how other countries perceive the country. The Indian film industry lacks proper operations management. Which results in poor quality products due to which the industry is losing its audience. Notwithstanding the increasing profitability of the industry, the quality of the scripts are substantially mediocre. The film industry needs to strengthen operations management in order to make itself viable and to compete with international film companies. This will also create employment and positively contribute to the economy of India. If the nation focuses on adapting operations management of international standards and uses new technology and moves into digitalization, then the Indian film industry will run smoothly. (R. Dyondi, Strategic Risk Issues for Film Distributors of Hindi Film Industry in Mumbai: A Grounded Theory Approach, 2015)

Of the 217 movies Bollywood had produced in the year 2017, 59 movies contributed to nearly 95% of all the box office earnings in the year. (Samrudh_David, 2017) This dismal proportion of successful movies to the total is indicative of how inefficient the production process of movies is in Bollywood. Operations management will allow producers to know every aspect that governs the success of a movie.

Injuries to actors and stunt doubles are commonplace in the Movie making industry. Operations Research and development is expecting to create software that is more and more powerful and able to virtually replace real actors or to create amazing special effects. (Panzarino, 2018)

ANALYSIS

ASSIGNMENT PROBLEM MODEL

Q] Netflix plans to distribute an upcoming film in theatres. So choose which film would maximise their profits in which country? (Figures in crores)

Step 1 – rows = columns (3=3 therefore, it is an unbalanced AP.)

Films/countries	roma	Annihilation	Gerald's game
India	30	70	60
USA	100	90	80
UK	50	50	40

Step 2 – row minimisation

	1	2	3
Films/countries	roma	Annihilation	Gerald's game
India	0	40	30
USA	20	10	0
UK	10	10	0

Step 3 – column minimisation

No of

Films/countries	roma	Annihilation	Gerald's game
India	0	30	30
USA	20	0	0
UK	10	0	0

allocations= order of AP.

India	roma	30
USA	annihilation	90
UK	Gerald's game	40

Step 4 –

	1	2	3
Films/countries	roma	Annihilation	Gerald's game
India	0	30	30
USA	20	0	0
UK	10	0	0

Assignment

METHODOLOGY

We arrived at this topic with our interest in finding out the use of OR in film industry as India are a land of culture and heavily invested in art forms of every kind. We were curious to know how an upcoming time management tool could be used to our benefits to take us to greater parameters of storytelling.

CONCLUSION

Hollywood has helped us analyse that the process that we follow is not systematic enough. We need to understand that only profit making should not be our concern but minimising the risk and cost should also be our focus. Nowadays a good plot is rejected on basis like less star power or less “masala” which has restricted the competence level of Bollywood in the global scenario. For example a film like “Newton” or “Manto” are films that have been lauded internationally but were not given much importance in India or the fact that they were over shadowed by the more star studded films or the fact that they were not marketed extensively as the distributors thought they won't generate more revenue. Bollywood or Indian cinema does not focus on the factor of time management and creating a backup plan for different scenarios, which has restricted us from expanding in various areas like the

content, or restricting the profit margin as and when release dates are pushed ahead. It is also important to recruit the right people for the right job to save costs and improve efficiency. For example, any of the crewmembers can leak the movie plot, so recruiting loyal and trustworthy staff here is important. In addition, giving due credit to the people for instance in the case of writers, they are not given due credit and payment worth their work which discourages them to work better. Many times sets are building and scrapped or are prone to accidents, which increase costs. Hence creating a model for sets, evaluating them is necessary. In a land that is so attracted to art and films, we need to pay our due to stay connected and with so many technological advancements every day we can create cost effective, well planned and beautiful cinema where operations research could come in handy.

LIMITATIONS

The problems that we faced while writing this paper was the lack of understanding to use OR methods. It was more focussed with the theory aspect of proving the subject.

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