Optimization of the Production Schedule of Movie Making Using PERT

[1]S. Aramuthakannan[2]S.Lokesh

[1]*Associate Professor, Department of Mathematics, PSG Institute of Technology and Applied Research, Coimbatore -641062*
[2]*Associate Professor, Department of Computer Science and Engineering,PSG Institute of Technology and Applied Research, Coimbatore -641062*

ABSTRACT

The Indian media and entertainment industry are the fastest growing industries in the country. Its various segments like Bollywood, Tollywood, and Kollywood have witnessed tremendous growth in the last few years. Tamil Movies attracts fans in most parts of the world using a variety of technologies and techniques. Tamil film industry contributes a marginal share to Gross Domestic Product (GDP) of the Tamil Nadu state economy. Tamil movie makinginvolves with number of interrelated activities requiring artiste, technicians, cine equipment, sets, costumes and catering. It is impracticalfor a production company to plan and implement optimum schedule just by perception, based on capabilities and work experience. A systematic scientific approach has become necessary.This paper introduce a new approach to the pre-production stage of the Tamil movie making by applying network scheduling techniques, Critical Path Method (CPM) and Programme Evaluation and Review Technique (PERT) for shooting scheduling problems. Tamil Movies released after the year 2010 are considered for this work.Findings of this study indicate that, a marginal reduction in production time in movie making. This approach is illustrated with numerical example in the concluding part of the paper.
KEYWORDS: *Pre-production, Network techniques, shooting schedule, PERT, CPM*

I. INTRODUCTION

The critical path is the one from the initial stage of the project to the finishing stage of the project where the slack times are considered as zeros. (H.N.Ahuja*et al*., 1994). The acknowledgment ofseriousof activities on the critical path is completed by CPM, hence the resources may be governed on these activities in order to reduce the length of the project. (D L Mon *et al*., 1995.) The activity duration obtained by CPM often, is an uncertain value so that the result of classical CPM calculation cannot complywith the real-world situation. The tenure of particular project activities can be defined in a real time by using appropriate tool. The PERT has been developed for obtaining the project duration.(J.E.Kelley and M.R.Walker,). So in this paper, PERT is used as a tool for planning and coordinating Tamil movie making.

Genre of the Movie	No of Tamil Movies produced in the year 2010	No of Tamil Movies produced in the year 2011	No of Tamil Movies produced in the year 2012
Action	27	25	13
Adult	6	7	3
Comedy	7	6	10
Crime	1	3	3
Drama	34	32	58
Fantasy	4	0	4
Horror	9	1	1
Masala	34	4	1
Romance	10	32	38
Thriller	1	7	5
others	8	10	7
Total	141	127	143

Table 1. Data Collection on Genres of Tamil Movies [1] (Source: Wikipedia)

Movie production controllers apply a process called crashing,while performing most of the projects in which they have to shorten the movie production schedule. As in the crashing problems (Z.Zhu and R.B.Heady,1994)money has to be spend to further curtail the projects duration, it can be said that money is

being compromised with time, known as time cost trade-off problem. (H. Nikoomaram*et al*., 2010).Minimizing the original movie production schedule (project duration) is done by 'crashing of activities in PERT/CPM networks' which results with the lowest amount of cost useful for movie production controllers.

II.   PHASES OF PROJECT MANAGEMENT

Planning:It involves sorting of tasks or jobs (work break down structure or (WBS) that must be created to the successful completion of a project to be concerned.

Scheduling: It analyses laying out the activities of the project in a sequence of time in which they have to be performed. It also deals with the initial and concluding time for each activity, critical path on which activities requires special attention and applying float for non-critical paths.

Control: This phase consists of reviewing the development of the project and verifies whether the actual performance is according to the planned schedule and also finding the reasons for the difference. The important aspect of control is to analyze and correct this difference by taking remedial action wherever possible.

III.   PROJECT EVALUATION AND REVIEW TECHNIQUE
Beta distribution is assumed as an activity time distribution in PERT also the mean and variance of the activity time are to be estimated. (Lau Ahl*et al*., 1959).To obtain the expected project duration and variance of the critical path, the mean and variance of an activity are used.This technique, computing a network flow for project cost curvestakes in to account the uncertainty of the movie production duration. If the durations of the activities in a film production are uncertain, then activity scheduling calculations done (D. Fulkerson ,1961)using the expected value of the durations. However, such expected durations may not give an accurate solution. Hence, rather than estimating directly the expected completion time of an activity, three –time estimates are considered. From these, a single value is estimated for future consideration. (W.J. Stevenson, 2005) This is called three-time estimates in PERT.

Optimistic time(t_0) is the time period of any activity when everything goes on well throughout the project. That is, artiste and technicians are accessible and reach in time, cine equipment reached the location point and working properly, finance is available whenever needed, the scarcity of the material is strictly to be avoided and so on.
Pessimistic time(t_p) is the duration of any activity, when almost everything goes against the idea of a director of the movie and lots of difficulties are faced during a shooting like weather, illness of an artist, local holidays, and non-receipt of permission for shooting location.
Most likely time$(t_m)$is the duration of any activity when something goes on well but something goes wrong during a shooting process due to the factors explained in the previous phase. Figures 1.1 explain this concept briefly.
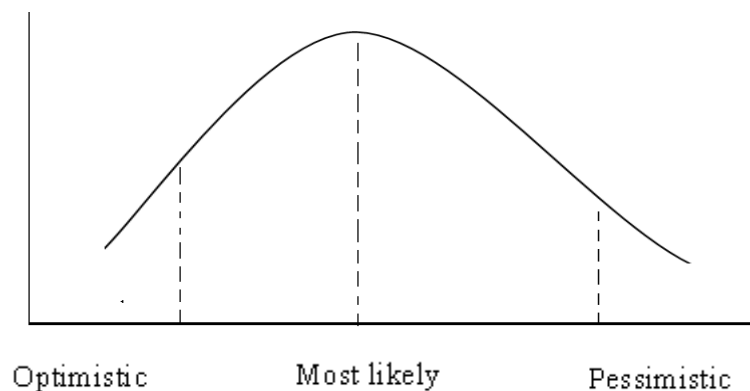

Figure 1. Time distribution curve

IV.   ASSUMPTIONS IN PERT
The following assumptions may occur in PERT calculations:
i.   The activity durations (Keefer DL and Verdini, 1993) are independent. That is, the time required to complete an activity will have not have any impact on the completion time of any other activities of the project.

ii. The activity durations pursue β distribution. It is aprobability distribution with density function.(Cho JG and Yum BJ,1997)

$$(K(t-\alpha)^{\alpha}(b-t)^{\beta}\quad)$$

with mean $t_e = \frac{1}{3}\left[2t_m + \frac{1}{2}(t_0 + t_p)\right]$ (1.1)

and standard deviation $\sigma = \frac{t_p - t_o}{6}$.   (1.2)

V. PERT PROCEDURE

(i) Sketch the project network.

(ii) Calculate the expected duration of each activity using, $t_e = \frac{t_o + 4t_m + t_p}{6}$ (1.3)

(iii) Find the expected variance σ^2 of each activity.

(iv) Work out the earliest start, earliest and latest finish and total float of each activity.

(v) Find the critical path and recognize critical activities.

(vi) Determine the expected variance of the project (length $)$ σ_c^2 which is the sum of variances of all the critical activities.

(vii) Work out the standard deviation of the project length (variance of the critical path $)$ σ_c^2 and hence calculate the standard normal deviate using $\frac{T_s - T_E}{\sigma_c}$

Where, T_s = Specified or scheduled time to complete the project.

T_E = normal expected duration.

σ_c = expected standard deviation of the project length.

VI. TAMIL MOVIE PRODUCTION SCHEDULE

  The production schedule of Tamil movies are designed as in Table 2 by the team comprising of Director, Production Manager, Location Manager and Assistant Directors with Camera man. The director of the movie initially categorizes the outdoor and indoor shots according to the script given to him by the screen play writer. The scenes will be conveyed to the camera man for the lighting and assistant directors for making the shooting arrangement including artiste availability and cine crew. The location manager's responsibility is to get permission from the concerned authorities well in advance for the smooth running of the shooting process. (P.N. Ramesh Kumar, 2012) Any kind of delay in this stage will result in additional expenditure to the production company.

Activity	Description	Immediate predecessor	(t_0)	(t_m)	(t_p)
A	Narration of Story to Producer(s)	---	7	10	13
B	Budget	A	2	4	6
C	Confirming Artistes	B	6	12	15
D	Shooting Schedule	C	4	7	10
E	Fixing of Locations	C,D	7	10	13
F	Composing Songs	A	3	5	7
G	Transportation for cine crew	E	2	4	6
H	Accommodation	G	4	6	8
I	Installation of set	D,E	4	6	8
J	Start shooting process	I	18	21	30
K	Post Production	J	7	9	11
L	Advertisement	K	7	10	13
M	Releasing of movie	K, L	2	3	4

Table 2. Production Schedule of aMovie produced in 2012

VII. POM SOFTWARE

  Nowadays, the role of software in solving the mathematical problems is praiseworthy. Linear programming problems with large number of decision variables are not complex today by the advent of soft wares. The Microsoft excel solver can solve more than 300 decision variables and 200 constraints in a short

time. Another software LIPS is used to solve the LPP with 100 decision variables. Since, our LPP in movies is confined to 35 decision variables, the Project Object Model (POM) is chosen as in Table 1.2 to solve the Tamil Movie shooting schedule problem based on PERT. Here, the usage of this software will bring the solution of PERT (Z.Zhu and R.B.Heady, 2005)with 13 activities. The solution of the above problem is displayed in the Table3 and Table 4.

Initially the values for the thirteen activities are considered for the shooting process with three estimates as we discussed in the section 1.4 optimistic, most likely and pessimistic. The values of mean and standard deviation of the each activity are calculated using the equations (1.2) and (1.3).

*** PROGRAM EVALUATION AND REVIEW TECHNIQUE (PERT)				
PROBLEM NAME : Pre - production of Tamil movie making				
Activity	Optimistic Time	Most Likely Time	Pessimistic Time	Mean Time	Variance
A	7.00	10.00	13.00	10.00	1.00
B	2.00	4.00	6.00	4.00	0.44
C	6.00	12.00	15.00	11.50	2.25
D	4.00	7.00	10.00	7.00	1.00
E	7.00	10.00	13.00	10.00	1.00
F	3.00	5.00	7.00	5.00	0.44
G	2.00	4.00	6.00	4.00	0.44
H	4.00	6.00	8.00	6.00	0.44
I	4.00	6.00	8.00	6.00	0.44
J	18.00	21.00	30.00	22.00	4.00
K	7.00	9.00	11.00	9.00	0.44
L	7.00	10.00	13.00	10.00	1.00
M	2.00	3.00	4.00	3.00	0.11

Table 3. The Mean and Standard deviation of production schedule using PERT

Similarly, the computation of the initial start, initial finish, recent start, recent finish and total float of each activity is mentioned in Table 4. From the table, we noticed that the expected duration of the completion of the movie starting from the activity A i.e. from narration of story to the producers and releasing schedule of the Tamil Movie can be completed 92.5 Days as seen in the Table 5. The producers expectation is the movie should be produced within 100 Days. Hence, by the application of PERT in to the pre-production stage of Tamil Movie making, we can optimize the project duration marginally. The computation of float and slack time are also displayed, and the negative value of the independent float is considered as zero.

Activity	Initial Start	Initial Finish	Recent Start	Recent Finish	Slack
A	0.00	10.00	0.00	10.00	0.00
B	10.00	14.00	10.00	14.00	0.00
C	14.00	25.50	14.00	25.50	0.00
D	25.50	32.50	25.50	32.50	0.00
E	32.50	42.50	32.50	42.50	0.00
F	10.00	15.00	87.50	92.50	77.50
G	42.50	46.50	82.50	86.50	40.00
H	46.50	52.50	86.50	92.50	40.00
I	42.50	48.50	42.50	48.50	0.00
J	48.50	70.50	48.50	70.50	0.00
K	70.50	79.50	70.50	79.50	0.00
L	79.50	89.50	79.50	89.50	0.00
M	89.50	92.50	89.50	92.50	0.00

Table 4. Optimization of time estimates in shooting schedule problem using PERT

The principle of the critical path method (CPM) is to recognize critical activities on the critical path so that resources are allocated on these activities in order to minimize project the project duration. The critical path of a project network is obtained in two different computations. Initially, the earliest and latest times of each

activity are evaluated. Depending on the times, the slack time for each activity is evaluated and the critical path of the network is obtained.

EXPECTED PROJECT DURATION: 92.5

CRITICAL PATH(S) :

A B C D E F I J K LM

Variance of the critical path : 11.694
Standard deviation : 3.42
Customer required time : 100
Number of standard deviations off required time : 2.193

Table 5. Solution of Shooting schedule problem using PERT

VIII.   CONCLUSION

In this paper, application of PERT in the pre-productionstage of the movie making is discussed with the shooting schedule. The solution of the numerical problem is obtained by POM. The duration is reduced to 92.5 days against the customer required time of 100 days. This application will influence the budding producers in the Tamil movie industry for their movie production.

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