INTERNATIONAL JOURNAL OF RESEARCH IN COMMERCE, IT & MANAGEMENT

A Monthly Double-Blind Peer Reviewed (Refereed/Juried) Open Access International e-Journal - Included in the International Serial Directories

Indexed & Listed at:

Ulrich's Periodicals Directory ©, ProQuest, U.S.A., EBSCO Publishing, U.S.A., Cabell's Directories of Publishing Opportunities, U.S.A.,
Open J-Gage, India [link of the same is duly available at Inflibnet of University Grants Commission (U.G.C.)],
Index Copernicus Publishers Panel, Polandwith IC Value of 5.09 &number of libraries all around the world.

Circulated all over the world & Google has verified that scholars of more than 2401 Cities in 155 countries/territories are visiting our journal on regular basis.

Ground Floor, Building No. 1041-C-1, Devi Bhawan Bazar, JAGADHRI – 135 003, Yamunanagar, Haryana, INDIA

http://ijrcm.org.in/

CONTENTS

CALL FOR MANUSCRIPTS

Weinvite unpublished novel, original, empirical and high quality research work pertaining to recent developments & practices in the area of Computer, Business, Finance, Marketing, Human Resource Management, General Management, Banking, Education, Insurance, Corporate Governance and emerging paradigms in allied subjects like Accounting Education; Accounting Information Systems; Accounting Theory & Practice; Auditing; Behavioral Accounting; Behavioral Economics; Corporate Finance; Cost Accounting; Econometrics; Economic Development; Economic History; Financial Institutions & Markets; Financial Services; Fiscal Policy; Government & Non Profit Accounting; Industrial Organization; International Economics & Trade; International Finance; Macro Economics; Micro Economics; Monetary Policy; Portfolio & Security Analysis; Public Policy Economics; Real Estate; Regional Economics; Tax Accounting; Advertising & Promotion Management; Business Education; Management Information Systems (MIS); Business Law, Public Responsibility & Ethics; Communication; Direct Marketing; E-Commerce; Global Business; Health Care Administration; Labor Relations & Human Resource Management; Marketing Research; Marketing Theory & Applications; Non-Profit Organizations; Office Administration/Management; Operations Research/Statistics; Organizational Behavior & Theory; Organizational Development; Production/Operations; Public Administration; Purchasing/Materials Management; Retailing; Sales/Selling; Services; Small Business Entrepreneurship; Strategic Management Policy; Technology/Innovation; Tourism, Hospitality & Leisure; Transportation/Physical Distribution; Algorithms; Artificial Intelligence; Compilers & Translation; Computer Aided Design (CAD); Computer Aided Manufacturing; Computer Graphics; Computer Organization & Architecture; Database Structures & Systems; Digital Logic; Discrete Structures; Internet; Management Information Systems; Modeling & Simulation; Multimedia; Neural Systems/Neural Networks; Numerical Analysis/Scientific Computing; Object Oriented Programming; Operating Systems; Programming Languages; Robotics; Symbolic & Formal Logic and Web Design. The above mentioned tracks are only indicative, and not exhaustive.

Anybody can submit the soft copy of his/her manuscript **anytime** in M.S. Word format after preparing the same as per our submission guidelines duly available on our website under the heading guidelines for submission, at the email address: infoijrcm@gmail.com.

GUIDELINES FOR SUBMISSION OF MANUSCRIPT

1. **COVERING LETTER FOR SUBMISSION:**

DATED: _____________

THE EDITOR
IJRCM

Subject: **SUBMISSION OF MANUSCRIPT IN THE AREA OF.**

(e.g. Finance/Marketing/HRM/General Management/Economics/Psychology/Law/Computer/IT/Engineering/Mathematics/other, please specify)

DEAR SIR/MADAM

Please find my submission of manuscript entitled '____' for possible publication in your journals.

I hereby affirm that the contents of this manuscript are original. Furthermore, it has neither been published elsewhere in any language fully or partly, nor is it under review for publication elsewhere.

I affirm that all the author (s) have seen and agreed to the submitted version of the manuscript and their inclusion of name (s) as co-author (s).

Also, if my/our manuscript is accepted, I/We agree to comply with the formalities as given on the website of the journal & you are free to publish our contribution in any of your journals.

NAME OF CORRESPONDING AUTHOR:
Designation:
Affiliation with full address, contact numbers & Pin Code:
Residential address with Pin Code:
Mobile Number (s):
Landline Number (s):
E-mail Address:
Alternate E-mail Address:

NOTES:
a) The whole manuscript is required to be in ***ONE MS WORD FILE*** only (pdf. version is liable to be rejected without any consideration), which will start from the covering letter, inside the manuscript.
b) The sender is required to mentionthe following in the **SUBJECT COLUMN** of the mail:
New Manuscript for Review in the area of (Finance/Marketing/HRM/General Management/Economics/Psychology/Law/Computer/IT/Engineering/Mathematics/other, please specify)
c) There is no need to give any text in the body of mail, except the cases where the author wishes to give any specific message w.r.t. to the manuscript.
d) The total size of the file containing the manuscript is required to be below **500 KB**.
e) Abstract alone will not be considered for review, and the author is required to submit the complete manuscript in the first instance.
f) The journal gives acknowledgement w.r.t. the receipt of every email and in case of non-receipt of acknowledgment from the journal, w.r.t. the submission of manuscript, within two days of submission, the corresponding author is required to demand for the same by sending separate mail to the journal.

2. **MANUSCRIPT TITLE**: The title of the paper should be in a 12 point Calibri Font. It should be bold typed, centered and fully capitalised.

3. **AUTHOR NAME (S) & AFFILIATIONS**: The author (s) **full name**, **designation**, **affiliation** (s), **address**, **mobile/landline numbers**, and **email/alternate email address** should be in italic & 11-point Calibri Font. It must be centered underneath the title.

4. **ABSTRACT**: Abstract should be in fully italicized text, not exceeding 250 words. The abstract must be informative and explain the background, aims, methods, results & conclusion in a single para. Abbreviations must be mentioned in full.

5. **KEYWORDS**: Abstract must be followed by a list of keywords, subject to the maximum of five. These should be arranged in alphabetic order separated by commas and full stops at the end.

6. **MANUSCRIPT**: Manuscript must be in ***BRITISH ENGLISH*** prepared on a standard A4 size ***PORTRAIT SETTING PAPER***. It must be prepared on a single space and single column with 1" margin set for top, bottom, left and right. It should be typed in 8 point Calibri Font with page numbers at the bottom and centre of every page. It should be free from grammatical, spelling and punctuation errors and must be thoroughly edited.

7. **HEADINGS**: All the headings should be in a 10 point Calibri Font. These must be bold-faced, aligned left and fully capitalised. Leave a blank line before each heading.

8. **SUB-HEADINGS**: All the sub-headings should be in a 8 point Calibri Font. These must be bold-faced, aligned left and fully capitalised.

9. **MAIN TEXT**: The main text should follow the following sequence:

   INTRODUCTION

   REVIEW OF LITERATURE

   NEED/IMPORTANCE OF THE STUDY

   STATEMENT OF THE PROBLEM

   OBJECTIVES

   HYPOTHESES

   RESEARCH METHODOLOGY

   RESULTS & DISCUSSION

   FINDINGS

   RECOMMENDATIONS/SUGGESTIONS

   CONCLUSIONS

   SCOPE FOR FURTHER RESEARCH

   ACKNOWLEDGMENTS

   REFERENCES

   APPENDIX/ANNEXURE

   It should be in a 8 point Calibri Font, single spaced and justified. The manuscript should preferably not exceed ***5000 WORDS***.

10. **FIGURES &TABLES**: These should be simple, crystal clear, centered, separately numbered & self explained, and **titles must be above the table/figure**. **Sources of data should be mentioned below the table/figure**. It should be ensured that the tables/figures are referred to from the main text.

11. **EQUATIONS**:These should be consecutively numbered in parentheses, horizontally centered with equation number placed at the right.

12. **REFERENCES**: The list of all references should be alphabetically arranged. The author (s) should mention only the actually utilised references in the preparation of manuscript and they are supposed to follow **Harvard Style of Referencing**. The author (s) are supposed to follow the references as per the following:

- All works cited in the text (including sources for tables and figures) should be listed alphabetically.
- Use (**ed.**) for one editor, and (**ed.s)** for multiple editors.
- When listing two or more works by one author, use --- (20xx), such as after Kohl (1997), use --- (2001), etc, in chronologically ascending order.
- Indicate (opening and closing) page numbers for articles in journals and for chapters in books.
- The title of books and journals should be in italics. Double quotation marks are used for titles of journal articles, book chapters, dissertations, reports, working papers, unpublished material, etc.
- For titles in a language other than English, provide an English translation in parentheses.
- The location of endnotes within the text should be indicated by superscript numbers.

PLEASE USE THE FOLLOWING FOR STYLE AND PUNCTUATION IN REFERENCES:

BOOKS

- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio" Ohio State University, Nigeria.

CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

JOURNAL AND OTHER ARTICLES

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

UNPUBLISHED DISSERTATIONS AND THESES

- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

ONLINE RESOURCES

- Always indicate the date that the source was accessed, as online resources are frequently updated or removed.

WEBSITES

- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

APPLICATION OF PERT TECHNIQUE IN HEALTH PROGRAMME MONITORING AND CONTROL

DR. SUSMIT JAIN
ASST. PROFESSOR
INDIAN INSTITUTE OF HEALTH MANAGEMENT RESEARCH
JAIPUR

ABSTRACT

The Program (or Project) Evaluation and Review Technique (PERT) and Critical Path Method (CPM) are two analytical techniques which could be applied in monitoring and control of health programmes and projects. The technique helps in answering the expected time of completion of projects, identifying the jobs and activities and their start and finish times, the effect of delay of certain activities, what resources are required at various points of time, revising and rescheduling the projects and what additional resources are required, etc. Some of the examples of projects or programmes where PERT/CPM techniques could be applied are carrying out vaccination drive, eradication of polio, construction of a new hospital, addition of new wing in the hospital, Commissioning of Primary Health Centers (PHCs) or Community Health Centers (CHCs), Air-conditioning of Hospitals, Construction and commissioning of an intensive care unit, setting up a medical college, Organizing a Family Planning Camp, Conducting a training programme for health workers, establishment of network of Family Planning Welfare Centers, Construction of hostel for nurses, Mass Health education campaign, Organizing a sanitation drive, etc.This research specifically discusses the use of PERT technique in carrying out Vaccination Programme and will try answer questions like expected project completion time, effect of delay in completion of activities and associated probability of completing the project by the specified time.

KEYWORDS
PERT; CPM; Activity; Event; Slack; Float; Crashing; Beta Distribution.

INTRODUCTION

In all the Five Year Plans there had been outlay on number of health programmes and projects for the purpose of providing health care services to the rural and urban population. But the projects generally suffer in terms of timely completion and according to the schedules laid down. The Program (or Project) Evaluation and Review Technique (PERT) and Critical Path Method (CPM) are two analytical techniques which could be applied in monitoring and control of health programmes and projects. The technique helps in answering the expected time of completion of projects, identifying the jobs and activities and their start and finish times, the effect of delay of certain activities, what resources are required at various points of time, revising and rescheduling the projects and what additional resources are required, etc.

Some of the examples of projects or programmes where PERT/CPM techniques could be applied are carrying out vaccination drive, immunization programmes and vaccination drives, national programmes for tuberculosis control, malaria control, blindness control, HIV preventions and control, construction of a new hospital, addition of new wing in the hospital, Commissioning of Primary Health Centers (PHCs) or Community Health Centers (CHCs), Air-conditioning of Hospitals, Construction and commissioning of an intensive care unit, setting up a medical college, Organizing a Family Planning Camp, Conducting a training programme for health workers, establishment of network of Family Planning Welfare Centers, Construction of hostel for nurses, Mass Health education campaign, Organizing a sanitation drive, etc.

HISTORICAL BACKGROUND

The PERT Methodology was developed in 1957 to simplify the planning and scheduling the U.S. Navy's Polaris nuclear submarine project. CPM was developed independently by Du Pont and Remington Rand Corporation USA at the same time.

METHODOLOGY

PERT/CPM techniques involve the depiction of the project in terms of activities and events. The activities consume time and resources and events mark the start or end of an activity. Some of the examples of 'activity' and events in health management context could be:

TABLE 1 : EXAMPLES OF ACTIVITIES AND EVENTS IN HEALTH SECTOR

Activity	Event
Preparing a medical plan of the hospital	Medical plan made or completed
Placing an order for vaccines	Order for vaccines placed
Vaccinating children	Vaccination drive completed
Preparing curriculum for health workers training	Curriculum for health workers completed

PERT/CPM require the use of network diagrams which are the graphical or diagrammatic portray of the project. We could take an example of a vaccination programme against smallpox comprising of 23 activities which are shown below:

ACTIVITIES IN VACCINATION PROGRAMME

1. Survey the population
2. Prepare policies and procedures for records and reports
3. Get the vaccinators into position
4. Prepare estimates of vaccine, equipment, vehicles, etc. required
5. Procure vehicles on loan from other departments and put them into position
6. Get the forms printed
7. Plan public meetings
8. Plan strategy to enlist the cooperation of community leaders
9. Orient vaccinators with respect to the project, plans, jobs, etc.
10. Place order for vaccine
11. Call tenders for equipment
12. Assign population and post vaccinators.
13. Receive vaccine
14. Give contract for equipment.
15. Deliver vaccine at PHC
16. Receive vaccine
17. Deliver equipment at PHC

18. Conduct public meetings
19. Motivate community leaders
20. Help vaccinators to develop rapport with the community
21. Vaccinate
22. Review performance
23. Prepare project report and submit it.

The next stage of implementation of project is to estimate the time of completion of the activities. In PERT, the average time for an activity takes into account three time estimates for each activity.

1. The optimistic time estimate: This is the estimate of shortest possible time within which a given activity can be completed. This assumes that ideal circumstances prevail and everything goes well. This is denoted by t_o or a.
2. The pessimistic time estimate: This is the estimate of longest possible time required to execute a given activity if abnormal conditions prevail. This is generally denoted by t_p or b.
3. The most likely time estimate: This is the estimate of the time required to execute an activity under normal conditions. This is generally denoted by t_m or m.

The three time estimates are reduced to one time estimate (expected time, denoted by t_e) using the formula,

$$t_e = \frac{t_o + 4\,t_m + t_p}{6} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad \text{(i)}$$

In the vaccination project, for a block in Jaipur district, the three time estimates were estimated based on past experience, and one average or expected time estimate was calculated. This is shown in the Table 2 below:

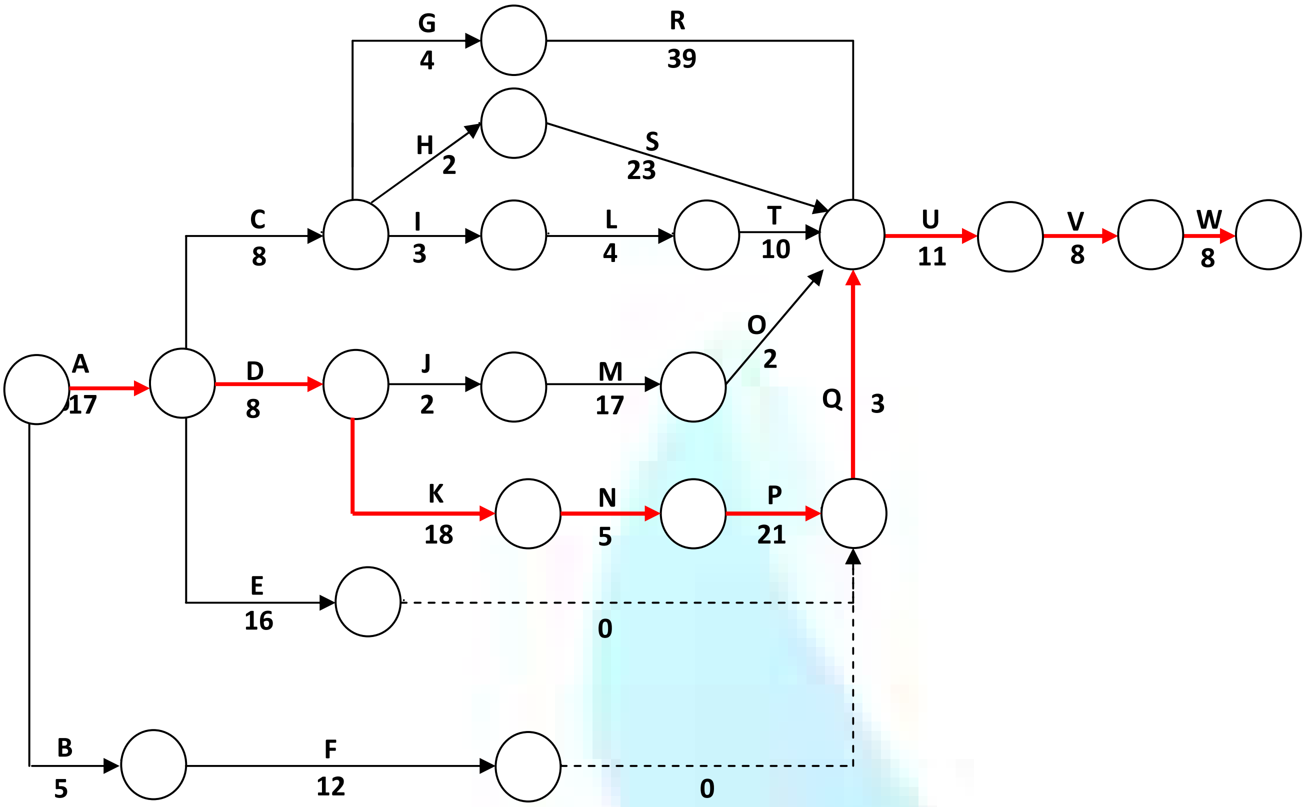
TABLE 2: PERT TIME ESTIMATES FOR VACCINATION PROGRAMME

			Time Estimates (days)			Expected time
ID	**Activity description**	**Predecessors**	**t_o**	**t_m**	**t_p**	**t_e ***
A	Survey the Population	-	7	15	35	**17**
B	Prepare policies and procedures	-	2	5	8	**5**
C	Get the vaccinators into position	A	4	7	15	**8**
D	Prepare estimates of vaccine, equipment, vehicles, etc. required	A	3	7	15	**8**
E	Procure vehicles on loan from other departments and put them into position	A	7	15	30	**16**
F	Get the forms printed	B	5	10	25	**12**
G	Plan public meetings	C	1	3	10	**4**
H	Plan strategy to enlist the cooperation of community leaders	C	1	2	3	**2**
I	Orient vaccinators with respect to the project, plans, jobs, etc.	C	2	3	3	**3**
J	Place order for vaccine	D	1	2	5	**2**
K	Call tenders for equipment	D	10	14	40	**18**
L	Assign population and post vaccinators.	I	1	3	10	**4**
M	Receive vaccine	J	10	15	30	**17**
N	Give contract for Equipment	K	1	4	10	**5**
O	Deliver vaccine at PHC	M	1	2	5	**2**
P	Receive Equipment	N	7	20	40	**21**
Q	Deliver equipment at PHC	P,E,F	1	3	5	**3**
R	Conduct public meetings	G	15	30	100	**39**
S	Motivate Community Leaders	H	10	20	50	**23**
T	Help vaccinators to develop rapport with the community	L	7	10	15	**10**
U	Vaccinate	R,S,T,O,Q	6	10	20	**11**
V	Review Performance	U	2	7	15	**8**
W	Prepare project report and submit it	V	2	7	20	**8**

*t_e estimates are to nearest integer.

The PERT analyst then tries to logically sequence the activities i.e. identifying the predecessor and successor activities. The sequential constraints and the associated network diagram for the vaccination programme is shown in Table 2 and Figure 1.

FIGURE 1 : NETWORK DIAGRAM FOR VACCINATION PROJECT



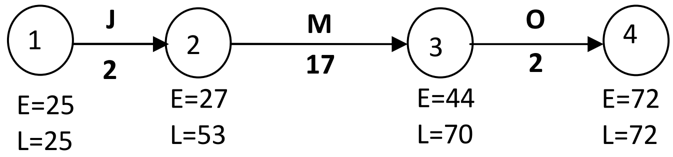
The critical path is shown through bold arrows i.e. A-D-K-N-P-Q-U-V-W and the total expected duration of the project comes out to be 99 days. Two time computations i.e. the Earliest Start (ES) and Latest Finish (LF) are shown on the network. The remaining two i.e. Earliest Finish (EF) and Latest Start (LS), Float or Slack are computed and shown in table below.

TABLE 3: PERT TIME COMPUTATIONS FOR THE VACCINATION PROGRAMME

ID	Activity description	Expected Time	Earliest Start (ES)	Earliest Finish (EF)	Latest Start (LS)	Latest Finish (LF)
A	Survey the Population	**17**	0	17	0	17
B	Prepare policies and procedures	**5**	0	5	52	**57**
C	Get the vaccinators into position	**8**	17	25	21	**29**
D	Prepare estimates of vaccine, equipment, vehicles, etc. required	**8**	17	25	17	**25**
E	Procure vehicles on loan from other departments and put them into position	**16**	17	33	53	**69**
F	Get the forms printed	**12**	5	17	57	**69**
G	Plan public meetings	**4**	25	29	29	**33**
H	Plan strategy to enlist the cooperation of community leaders	**2**	25	27	47	**49**
I	Orient vaccinators with respect to the project, plans, jobs, etc.	**3**	25	28	55	**58**
J	Place order for vaccine	**2**	25	27	51	**53**
K	Call tenders for equipment	**18**	25	43	25	**43**
L	Assign population and post vaccinators.	**4**	28	32	58	**62**
M	Receive vaccine	**17**	27	44	53	**70**
N	Give contract for Equipment	**5**	43	48	43	**48**
O	Deliver vaccine at PHC	**2**	44	46	70	**72**
P	Receive Equipment	**21**	48	69	48	**69**
Q	Deliver equipment at PHC	**3**	69	72	69	**72**
R	Conduct public meetings	**39**	29	68	33	**72**
S	Motivate Community Leaders	**23**	27	50	49	**72**
T	Help vaccinators to develop rapport with the community	**10**	32	42	62	**72**
U	Vaccinate	**11**	72	83	72	**83**
V	Review Performance	**8**	83	91	83	**91**
W	Prepare project report and submit it	**8**	91	99	91	**99**

Float or slack of an activity is the amount by which an activity could be rescheduled without increasing the project duration. For all critical activities float is zero, i.e. they could not be delayed. There are generally three measures of float which are generally used in computations. These are total float, free float and independent float. Let us consider the three measures of float in the case of a fragment of the network of the vaccination programme.

FIGURE 2 : PART OF NETWORK OF VACCINATION PROGRAMME



Total Float

The earliest tail and the latest head event times of an activity can be looked on as limits within which a non-critical activity can 'move' without increasing the project time.

For activity J:

The earliest possible starting time is day 25

The latest possible finishing time is day 53

∴ the total time available for the activity is 28 days

But the duration of activity is 2 days: i.e. the activity can 'move' by 26 days. Any greater movement will create a new critical path(s) and increase the project time. ∴ 26 days is the total float for activity J.

Free float

For activity M:

The total time available is 43 days

But the duration is 17 days

∴ the total float is 26 days

But if activity J uses its entire total float, then event 2 will not be reached until day 53.

In this case:

The available time for activity M is 17 days

But the duration of activity M is 17 days

So that if activity J uses its entire total float, then activity M has no float, hence the free float of J is zero, i.e. the amount of float which could be used without affecting subsequent activities. Similarly the free float of M is zero because if M uses its entire total float (of 26 days), then activity could only be finished at day 70, reducing the float of O to zero.

Independent Float

Independent float is the amount of float that can be used without affecting either subsequent or preceding activities. It is set to zero if it comes out to be negative.

Rules for calculating float

The ***total float*** is the difference between the L value for the head event and the E value of the tail event minus the duration.

The free float is the difference between the E value of the head event and the E value of the tail event minus the duration.

The independent float is the difference between the E value of the head event and the L value of the tail event minus the duration. (set to zero if negative). It indicates the time availability for an activity even if it has Late Start and Early Finish.

The calculation of float is illustrated for the vaccination programme case in the following Table 4:

TABLE 4: FLOAT TABLE FOR VACCINATION PROGRAMME

		Floats (days)			
Activity	**Duration**	**Total**	**Free**	**Independent**	**Remarks**
A	17	0	0	0	Critical
B	5	52	0	0	
C	8	4	0	0	
D	8	0	0	0	Critical
E	16	36	0	0	
F	12	52	0	-52(0)	
G	4	4	0	-4(0)	
H	2	22	0	-4(0)	
I	3	30	0	-4(0)	
J	2	26	0	0	
K	18	0	0	0	Critical
L	4	30	0	-30(0)	
M	17	26	0	-26(0)	
N	5	5	0	0	Critical
O	2	26	26	0	
P	21	0	0	0	Critical
Q	3	0	0	0	Critical
R	39	4	4	0	
S	23	22	22	0	
T	10	30	30	0	
U	11	0	0	0	Critical
V	8	0	0	0	Critical
W	8	0	0	0	Critical

Negative values of independent float signify that there is no independent float.

PROBABILITY OF COMPLETION BY SCHEDULED DATE

Suppose the Chief Medical Officer wants that the project to be completed within 90 days if possible. What should the Health Officer tell his CMO about the likelihood that the Vaccination Programme be completed within 90 days. PERT can help in answering this question and also estimate alternative Scheduled Completion Dates with 70 per cent, 80 per cent and 95 per cent assurance of completion so that the Chief Medical Officer can choose one which suits him most.

Let us first estimate the probability of completion of the vaccination project within 90 days. PERT uses Beta-distribution (a frequency distribution curve) and uses the formula for calculating the standard deviation based on the three time estimates t_p , t_o and t_m as shown below:

Standard Deviation of an activity (σ) = $\frac{t_p - t_o}{6}$ .... (ii)

The variance of the project is calculated by adding the variances of the activities lying on the crtitical path.

$\sigma_c = \sqrt{\sigma_1^2 + \sigma_2^2 + \cdots + \sigma_n^2}$... (iii)

Where $\sigma_1^2$is the variance of the first activity lying on the critical path, σ_2^2 is the variance of the second activity lying on the critical path and σ_n^2 is the variance of the last activity lying on the critical path.

The normal variate Z is calculated using the formula:

$z = \frac{T_s - T_e}{\sigma_c}$ .... (iv)

Let us apply the concept of PERT in our Vaccination case.

TABLE 5: VARIANCES OF ACTIVITIES ON THE CRITICAL PATH

	Time Estimates (days)			Expected time		
ID	**to**	**tm**	**tp**	**te ***	**Variance**	**Variances of Critical Activities**
A	7	15	35	17	21.78	**21.78**
B	2	5	8	5	1.00	
C	4	7	15	8	3.36	
D	3	7	15	8	4.00	**4.00**
E	7	15	30	16	14.69	
F	5	10	25	12	11.11	
G	1	3	10	4	2.25	
H	1	2	3	2	0.11	
I	2	3	3	3	0.03	
J	1	2	5	2	0.44	
K	10	14	40	18	25.00	**25.00**
L	1	3	10	4	2.25	
M	10	15	30	17	11.11	
N	1	4	10	5	2.25	**2.25**
O	1	2	5	2	0.44	
P	7	20	40	21	30.25	**30.25**
Q	1	3	5	3	0.44	**0.44**
R	15	30	100	39	200.69	
S	10	20	50	23	44.44	
T	7	10	15	10	1.78	
U	6	10	20	11	5.44	**5.44**
V	2	7	15	8	4.69	**4.69**
W	2	7	20	8	9.00	**9.00**
					Variance of the Critical Path	**102.86**

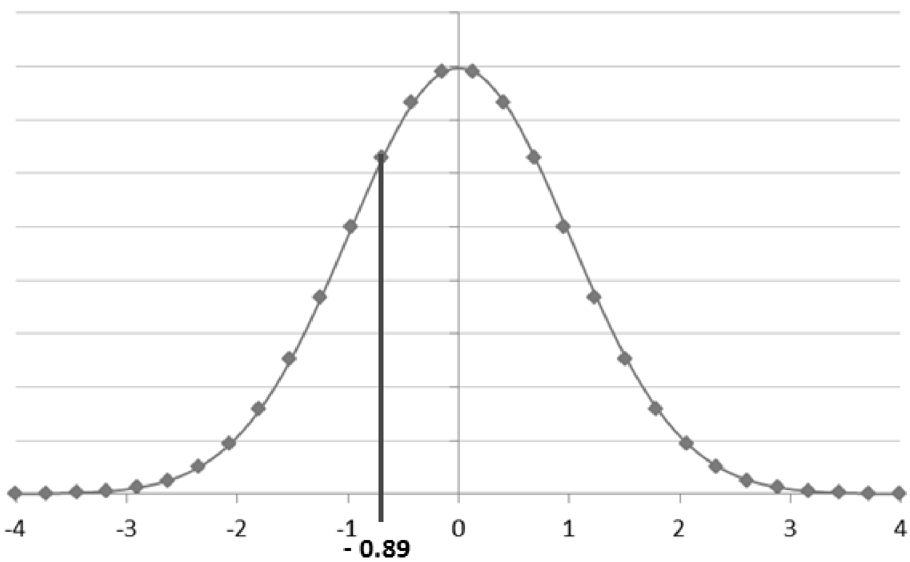
The variance of the critical path comes out to be **102.86** andthestandard deviation (σ_c) of the critical path comes out to be **10.14** . The normal variate corresponding to schedule completion time of 90 days come out as:

$$z = \frac{90 - 99}{10.14}$$

$$z = -0.89$$

The location of z on a beta-distribuion equated is shown below:

FIGURE 3: BETA DISTRIBUTION CURVE AND COMPUTATION OF DESIRED AREA



And the area corresponding to this (from normal distribution curve) 0.3133 or 31 % chance of being completed within 90 days.

Suppose we want to find that schedule completion times which have 70 %, 80% and 95% chance of being completed. In that case the values of z are 0.52 (for 70%), 0.84 (for 80%) and 1.65 (for 95%). The schedule completion days are:

- 99 + 10.14 (0.52) = 104.28 days (which has 70% chance that the project will be completed in this specified duration)
- 99 + 10.14 (0.84) = 107.5 days (which has 80% chance that the project will be completed in this specified duration)
- 99 + 10.14 (1.65) = 115.7 days (which has 95% chance that the project will be completed in this specified duration).

The methodology discussed is entirely based on time dimentions and the project completion time and the probability of its completion on time were calculated and a criteria for differential control of activities based on Critical Path was explored.

Project cost analysis involves understanding the use of resources and their deployment in various activities. The objective of project cost analysis or crashing is to find out the optimum duration of the project at minimum total cost. The procedure used in this is called as crashing or reducing the project duration and the effect on direct and indirect cost of the activities are taken into consideration.

CONCLUSION

The methodology of Programme Evaluation and Review Technique (PERT) is based on 'time'. It assumes that any project or programme is a conglomeration of many activities or jobs. These activities are interrelated and interdependent on certain dimentions. The accomplishment of all the activities will only lead to the completion of the project/programme. The basic philosophy underlying PERT/CPM is nothing new and much of this is known to us. PERT/CPM provides a scientific basis for such a project planning. It provides a powerful and logical scheme for the execution of activities and for planning of the resources required to execute the activities, to facilitate the total project completion within the optimum time through expending minimum resurces. It forces the project manager to think logically in the face of uncertainty, draws attention to various kinds of decisions to be made at different stages of the project. In the ultimate analysis, it is a scientific methodology that helps in implementation of projects within the constraints of time and resources.

REFERENCES

1. Arnold, Mary F., "Health Programme Implementation through PERT, Administrative and Educational Uses", American Public Health Association, Western Regional Office, San Fransisco, 1966, USA.
2. Aswathappa K., Shridhara Bhatt, 'Production & Operations Management', Second Revised Edition 2008,Reprint 2012, Himalaya Publishing House, Mumbai.
3. Bainbridge J., Sapirie S., "Health Project Management – A Manual of Procedures for Formulating and Implementing Health Projects", WHO, Geneva, 1974
4. Bedi Kanishka," Production & Operations Management", Third Impression 2008, Oxford University Press, New Delhi.
5. Chary S. N., "Theory and Problems in Production and Operations Management", Second Reprint 1996, Tata McGraw-Hill Publishing Company Limited, New Delhi.
6. Chase B.Richard, Jacobs Robert F., Acquilino J. Nicholas, "Operations Management for Competitive Advantage", tenth edition 2003, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Goel B.S.,"Production and Operations Management", Twenty Three Edition 2010, Pragati Prakashan, Meerut, India.
8. Jan Vissers and Roger Beech, "Health Operations Management", First published 2005, Routledge, New York, USA.
9. Krajewski J. Lee, Ritzman P. Larry, "Operations Management – Processes and Value Chains" 7th Edition (2006), Pearson Education, Delhi.
10. Mahajan M., "Industrial Engineering and Production Management", Second Revised edition 2002, Dhanpat Rai & Co. (P) Ltd., Delhi.
11. McLaughlin Daniel B., Hays Julie M., "Healthcare Operations Management",First Ed. 2008, Health Administration Press, Chicago, AUPHA Press, Washington, DC, USA.
12. Mukhopadhyay S.K., 'Production Planning and Control",Second Printing, Dec 2004, Prentice-Hall of India Private Limited, New Delhi.
13. Mulhemann Alan, Oakland John, Lockyer Keith, Sudhir Bodduluri, Katyayani Jasti, "Production & Operations Management" First Impression, Indian Subcontinent Adaptation, 2008, Pearson Education, Delhi.
14. Ozcan A. Yasar, "Quantitative Methods In Health Care Management Techniques and Applications", 2nd Edition 2009, John Wiley & Sons, USA.
15. Ramaiah J.T., "Health Programme Management Through PERT", First Edition 1979, Shakti Malik Abhinav Pulications, New Delhi.
16. Reddy Muni Nadha C., "Industrial Engineering and Management", First Edition 2002, New Age International (P) Ltd, New Delhi.
17. Ronen Boaz, Pliskin Joseph S., "Focused operations management for health services organizations", First Edition 2006, John Wiley & Sons, San Francisco, USA.
18. Sharma J.K. "Oprations Research – Theory and Applications", 4th Edition, 2009, Macmillan Publishers India Ltd, New Delhi.
19. Sharma J.K., "Operations Research – Problems and solutions", First edition 2002, Macmillan India Ltd., New Delhi.
20. Sharma S.D., "Operations Research", Fourteenth Edition Reprint 2005, Kedar Nath Ram Nath & Co, Meerut, India.
21. Taha A. Hamdy, "Operations Research – An Introduction", Eight Edition 2009, Pearson Education, Delhi.
22. Vohra N D., "Quantitative Techniques in Management", 4th Edition 2010, Tata McGraw-Hill Publishing Company Limited, New Delhi.

REQUEST FOR FEEDBACK

Dear Readers

At the very outset, International Journal of Research in Commerce, IT and Management (IJRCM) acknowledges & appreciates your efforts in showing interest in our present issue under your kind perusal.

I would like to request you to supply your critical comments and suggestions about the material published in this issue as well as on the journal as a whole, on our E-mail i.e. **infoijrcm@gmail.com** for further improvements in the interest of research.

If you have any queries please feel free to contact us on our E-mail **infoijrcm@gmail.com**.

I am sure that your feedback and deliberations would make future issues better – a result of our joint effort.

Looking forward an appropriate consideration.

With sincere regards

Thanking you profoundly

Academically yours

Sd/-

Co-ordinator

ABOUT THE JOURNAL

In this age of Commerce, Economics, Computer, I.T. & Management and cut throat competition, a group of intellectuals felt the need to have some platform, where young and budding managers and academicians could express their views and discuss the problems among their peers. This journal was conceived with this noble intention in view. This journal has been introduced to give an opportunity for expressing refined and innovative ideas in this field. It is our humble endeavour to provide a springboard to the upcoming specialists and give a chance to know about the latest in the sphere of research and knowledge. We have taken a small step and we hope that with the active co-operation of like-minded scholars, we shall be able to serve the society with our humble efforts.

Our Other Journals