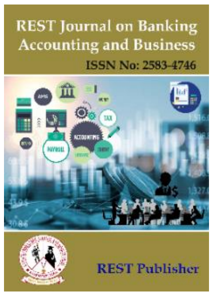
REST Journal on Banking, Accounting and Business
Vol: 3(3), September 2024
REST Publisher; ISSN: 2583 4746
Website: http://restpublisher.com/journals/jbab/
DOI: https://doi.org/10.46632/jbab/3/3/6



A Project Model to Evaluate the Feasibility of the Cognizant Flow Source

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Abstract: *This work discussed a project being steered in Cognizant, India for the design, development and implementation of Cognizant Flowsource. Flowsource is an AI-powered, incorporated full-stack platform that accompanies in the succeeding generation of engineering. The IT solution allows quicker innovation by integrating generative AI hooked on vital phases of the software development lifecycle (SDLC), allowing developers to concentrate on rich features and incomparable user experiences (cognizant.com). Initially the researcher applied the Critical Path Method (CPM) to evaluate the feasibility of the project and this was complemented later by developing a Project Evaluation Review Technique (PERT) model. The work also presented costs calculations to determine the applicability of the project. The research reports how the Flowsource development project is being managed by the operations department of the company and suggests alternative manners of solving problems identified in the development of the IT solution.*

Keywords: *Project management, cost accounting, decision-making, Artificial Intelligence.*

1. INTRODUCTION

This paper discusses a project being conducted in Cognizant, India, regarding the design, development and implementation of Cognizant Flow source, an AI-powered, incorporated full-stack platform that accompanies in the succeeding generation of engineering. Flow source allows quicker innovation by integrating generative AI hooked on vital phases of the software development lifecycle (SDLC), allowing developers to concentrate on rich features and incomparable user experiences (cognizant.com). The work reports how the Flow source development project is being managed by the operations managers of the company and suggests alternative manners of solving problems identified in the development of the IT solution. One of Cognizant's key markets is to make software for application developers such as Flow source which is dealt with in this paper. Cognizant is large fast-growing organization that in the last few years has completed a number of such projects for the development of products like Sky grade, Neuro IT Operations, and Neuro AI successfully. Because of increasing demand for such products from application developers in the Indian market and globally, the company has decided to launch a Flow source which combines advanced features such as Artificial Intelligence (AI). The company management thinks that the product will attract new customers, increase profits, and keep the firm competitive. Nevertheless, before taking the final step of making the product, management has asked the operations managers to evaluate the feasibility of the package.

2. FORMULATION OF THE PROBLEM AND LIMITATIONS

The aim of this paper is to examine the process that Cognizant IT developers will take to assert the feasibility of the product. Management thinks that a number of activities must be undertaken to enable them to come to a final decision of launching, or not, the IT solution. The company wishes to see these activities organised in such a way that allows to make the best use of time. This work examines the activities needed to complete the IT solution development project, sets precedence relationships between these activities, structures network diagrams, makes forward and backward passes, calculates floats, and identifies the critical path(s) of the project. Further, it makes activity tables and plans these activities to start at the earliest dates. Also, it attempts to restructure the project to shorten its duration. Then, it suggests alternative solutions by incorporating uncertainty into the model. Finally, the issue of costs is explained fully with examples

Definitions

As per Diao (2024) the following definitions are important for anyone that deals with the implementation of a new project:

- In Activity-on-arrow (AOA) networks the project activities are represented as arrows, at the end of which are nodes representing events, the starts and finishes of the activities.
- In Activity-on-node (AON) networks the nodes represent activities and the arcs indicate the precedence relationships between them.
- A precedence relationship determines a sequence for undertaking activities. It specifies that an activity cannot start until a preceding activity has been completed.
- A dummy activity is used to allow representation of certain precedence relationships which would otherwise be difficult to represent.
- The activity's total flow is calculated as the maximum time available minus the duration of the activity. The flee float is the amount by which the activity may 'slip', without affecting subsequent activities.
- Critical path is the longest chain of activities which determines the expected duration of the project.

3. RESEARCH DESIGN

A cross-sectional descriptive study was conducted within a community in the Malappuram district of Kerala. The sample included all adult women in Malappuram District who were familiar with financial products. Information was gathered from eligible and willing participants using a systematically designed, interviewer-administered questionnaire that had been pre-tested. The questionnaire collected socio-demographic data, including age, gender, occupation, education, marital status, and socioeconomic status. The second section of the questionnaire assessed respondents' awareness and satisfaction with financial products, while the third section evaluated their level of financial knowledge. Responses were measured using a 3-point scale. The questionnaire content was reviewed for validity, and necessary modifications were made before it was administered to the public. The collected data was analysed using SPSS Software version 25.0.

The problem situation

The researcher working as a consultant in the facility of an operations manager has decided the tasks and time estimates. This data is gathered in table 1. The activities identified are fifteen and the researcher has been given a single estimate for each activity. In order to plan strategically it is in the interest of the company to know the critical path of the project. To achieve this the researcher decided to conduct a study and calculate the expected completion date.

TABLE 1. Activity Data for the Project

Tasks and Times			
Activity	Description	Activity Times(weeks)	Predecessors
A	Market Research	8	-
B	R&D	17	-
C	Engineering	11	B
D	Prototype Design	12	C
E	Costing	3	C
F	Testing	6	D
G	Market Survey	4	A,D
H	Market Analysis	4	G
I	Quality Assurance	2	A, D
J	Financial Analysis	3	E, F, H
K	Supplier Analysis	3	E
L	Patent Search	2	B
M	Internal Assessment	2	A
N	Reporting	3	I, J, K, L
O	Decision Making	3	M

The existing theories

To solve the problem, the researcher has initially made use of on the Critical Path Method (CPM). CPM defines precedence relationships, sets the duration of each activity, uses network diagrams to arrange the activities, finds the earliest and latest completion dates, calculates flows, and identifies critical paths (Babu, 2024). One individual characteristic which distinguishes CPM from other methods it that it 'is based on the assumption that project activity times can be estimated and do not vary' (Pinciroli, 224). Because of this fact CPM is more appropriate when some previous estimations about the project's duration times are available, possibly taken from similar projects. Its weakness is that it does not consider uncertainty about time. Still an advantage is that CPM provides for restructuring of the activities to shorten completion dates (Mykytyuk, 2024). The researcher used Gantt charts to illustrate the link between the activities and their earliest and latest times. Gantt charts (or working charts) apart of letting us plan the activities, show 'if the critical path activities are on schedule and assist us to monitor progress' (Shiferaw, 2024). To explore alternative solutions in calculating expected time before closing my essay the researcher employed the Program Evaluation and Review Technique (PERT). PERT resembles CPM in all other things but differs in estimating expected dates. Here, instead of one estimate for each activity, 'three estimates are used. The aim is to incorporate uncertainty into the network model' (Hanifi, 2024). Pert contains,

A. **optimistic time**: the shorter time in which the activity can be completed, if all goes well,
B. **most likely time**: the probable time required to perform the activity, and finally one has
C. **pessimistic time**: the longest estimated time required to perform an activity'.

Through the use of statistical methods, the mean, variance, and the normal distribution, PERT is able to calculate with precision the probability of completing the project within the due date. For this reason, in real life situations PERT is always preferred to CPM (Krajewski and Ritzman, 1996).

CPM Model Analysis and Findings:

The network for the problem is presented in Figure 1. Figure 1 illustrates the precedence relationships, the duration of the activities, earliest and latest completion dates, and the floats needed to identify the critical path. The thick arrow lines in the network diagram represents the critical path. To arrive at these findings, the researcher has performed the following tasks:

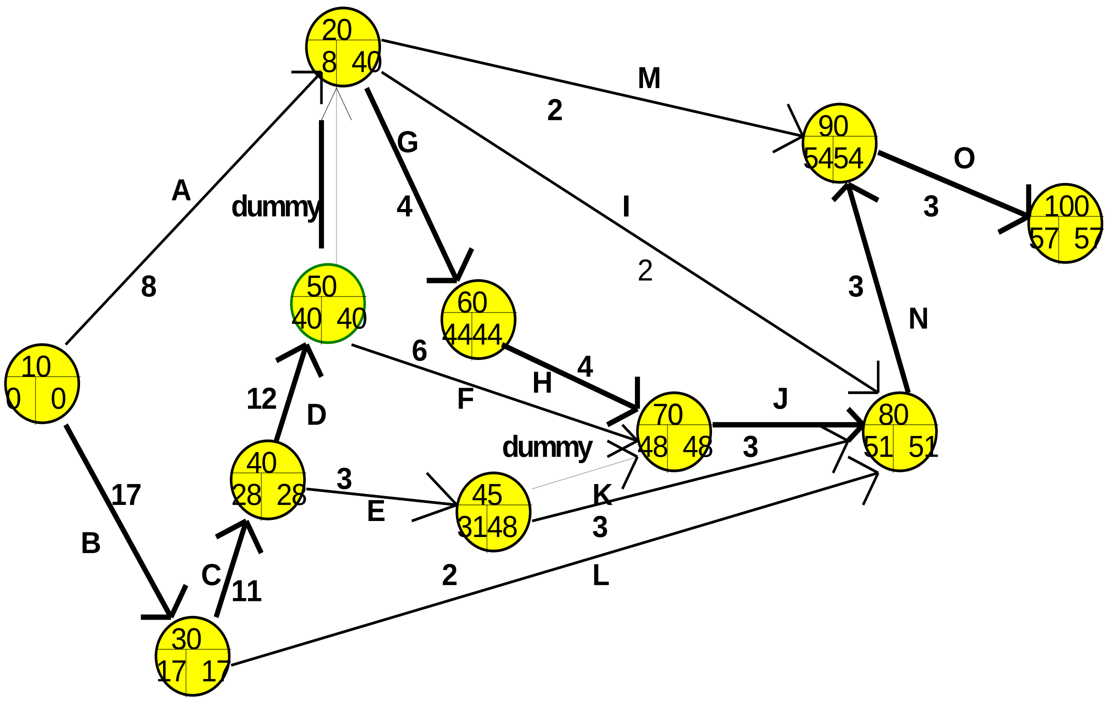

FIGURE 1. Network Diagram for evaluation of software feasibility

To draw the network, the researcher has put the activities as arrows in the order of precedence with events represented as nodes. Activities A and B have no predecessors and can be drawn immediately. Activity A starts from node 10 and ends to node 20. Equally, B begins in event 10 and finishes in event 30. But activity C starts from 30 as it must wait for B to end. Its arrow goes to node 40. Similarly, activity D depends on completion of C.

It begins from 40 and goes to 50. Representation of activities F and G is more involved. This because while F depends only on D, G depends on both A and D. Activity F goes from 50 to 70. But to start G one needs to join events 50 where D finishes and 20 the end of A through a dummy activity. The researcher has done that and activity G can be structured and the relationship between F, G, A, and D is now clear. G goes from 20 to 60. Further, activity E starts from 40 and ends to 45. The drawing of activity I is again complex. Once more, to start I, activities A and D must finish. One can join it with A but to show the relationship between D and I the previous dummy is needed. Now activity I is straightforward. It goes from 20 to 80. The presentation of activities K and J is again complicated. K needs E but J needs F, H, and E. Activity K goes from 45 to 80. But to show the relation of J and E another dummy activity is required. The researcher has drawn this dummy from 45 to 70. Now one can draw J which goes from 70 to 80. The rest is simple. M goes from 20 to 90; N waits for completion of J, K, L, and I, and then goes from 80 to 90. The network is closed by activity O which goes from 90 to 100. Next, the researcher has put the duration of each activity next to the arrows. This will enable the project to calculate forward and backward passes. The forward pass for node 20 is 8 weeks, the duration of activity A. For node 30 is 17 weeks, - the duration of B. To calculate the forward pass for 40 the project adds the duration of B and C (17+ 11=28). Event 50 is found by adding the time for B, C, and D (17+28+12=40). Event 45 is 31 weeks and event 60 is 44 weeks. To determine the earliest event for node 70 the researcher has taken the longest path which is B, C, D, G, and H, that is 48 weeks. Through this procedure one can calculate the remaining earliest completion dates. When the researcher has finished, she entered all forward passes to the left quadrants of the corresponding events. To find the later event time the researcher reversed the procedure. For example, to calculate the latest time for node 90 one has to subtract the duration of activity O, 3 weeks, from 57 (57-3=54). This process is repeated for all latest dates. Note that nodes 30, 20, and 10 require three calculations each. Here again the longest path is entered. As an instance, for node 20 this road is O, N, J, H, and G (57-3-3-3-4-4=40). This path is preferred to paths O, M and O, N, I, which have lesser completion. In this manner one can find the rest of the backward passes. Finally, the researcher has put these latest times to the right quadrants of the events. Note that the dummy activities have 0 duration. Expected dates, and early start, late start, early finish, late finish dates are given in Table 2.

Next, the researcher has calculated the floats. The total float is given by:

Total Float = TL successor - TE predecessor - Duration

Where:

TI = latest event time

TE = earlier event time

The total floats for our problem are presented in Table 8.A. Afterwards, the Flee Floats are obtained by

TABLE 2. Activity Data Table

Nodes	**Activity Descriptions**	**Drn**	**Start** E L	**Finish** E L	**Float** TF FF
10-20	Market Research	8	0 32	8 40	32 0
10-30	R&D	17	0 0	17 17	0 0
30-40	Engineering	11	17 17	28 28	0 0
40-50	Prototype Design	12	28 28	40 40	0 0
40-45	Costing	3	28 45	31 48	17 0
50-70	Testing	6	40 42	46 48	2 2
20-60	Market survey	4	40 40	44 44	0 0
60-70	Market analysis	4	44 44	48 48	0 0
20-80	Quality assurance	2	40 49	42 51	9 9
70-80	Financial analysis	3	48 48	51 51	0 0
45-80	Supplier analysis	3	31 48	34 51	17 17
30-80	Patent search	2	17 49	19 51	32 32
20-90	Internal assessment	2	8 55	10 54	44 44

Expected completion time: 57 weeks

Critical Path: BCDGHJNO

The flee floats for the activities are presented in Table 8.A. To check the results for all dates and floats the researcher used CMOM software which is also used to check all other calculations. After finding the floats it is possible to identify the critical path. It passes from these activities that have 0 total floats. These are BCDGHJNO. The project takes 57 weeks. (See Table 2).

At this point, it is possible to shorten completion time by restructuring the network diagram. As an instance, one may observe that activity C, Engineering, is performed in three stages, 1) assembly of parts, 2) production stage, and 3) configuration software. If one assigns in each stage a lesser time the network can be reconstructed to give a shorter completion. Let us suppose that each of these sub-activities takes 3 weeks and observe the diagram in Figure 2. The reader can see that the restructured activities CA, CB, and CC is now part of the critical path. In this case its direction is

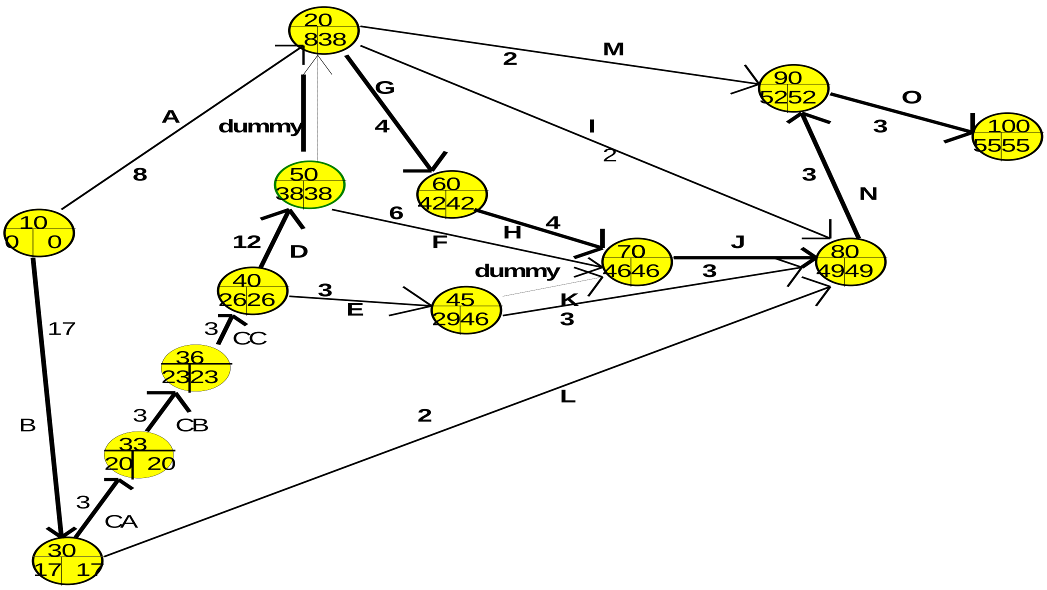

FIGURE 2. Restructured Network

still the same. But completion time is shortened by 2 weeks and is now 55 weeks. Of course, the earliest and latest times and the floats have changed. The results are illustrated in Table 3.

TABLE 3. Restructured Activity Data Table

Nodes	Activity description	Drn	Start	Finish	Float
			E L	E L	TF FF
20-Oct	Market Research	8	0 30	8 38	30 0
30-Oct	R&D	17	0 0	17 17	0 0
30-33	Assembly of parts	3	17 17	20 20	0 0
33-36	Production stage	3	20 20	23 23	0 0
36-40	Configuration	3	23 23	26 26	0 0
40-50	Prototype Design	12	26 26	38 38	0 0
40-45	Costing	3	26 43	29 46	17 0
50-70	Testing	6	38 40	44 46	2 2
20-60	Market Survey	4	38 38	42 42	0 0
60-70	Market Analysis	4	42 42	46 46	0 0
20-80	Quality Assurance	2	38 47	40 49	9 9
70-80	Financial Analysis	3	46 46	49 49	0 0
45-80	Supplier Analysis	3	29 46	32 49	17 17
30-80	Patent search	3	17 47	19 49	30 30
20-90	Internal Assessment	3	8 50	10 52	42 42
80-90	Reporting	3	49 49	52 52	0 0
90-100	Decision Making	3	52 52	55 55	0 0

Expected completion time: 55 weeks

Critical Path: B, CA, CB, CC, D, G, H, J, N, O

The next task was to schedule the activities for earlier start. A Gantt chart has been employed here presented in Figure 3. This pictures the floats and earlier start earlier finish dates. The critical path activities are all on schedule. Activity A starts at the beginning of week 1 and ends at the end of week 8. It has 30 weeks of total flow. Activity E starts at the beginning of week 26 and its early finish is at the end of week 29, a total flow of 17 weeks. F begins at 38 and finish is scheduled for end of week 44. Its total flow is for 2 weeks to week 46. In the same manner the researcher scheduled the remaining activities. Gantt charts are useful as they allow us to consider several options. For example, some activities may contend for the same scarce resources to carry them out (Taherdoost, 2024). One can solve this by using the flee flow to

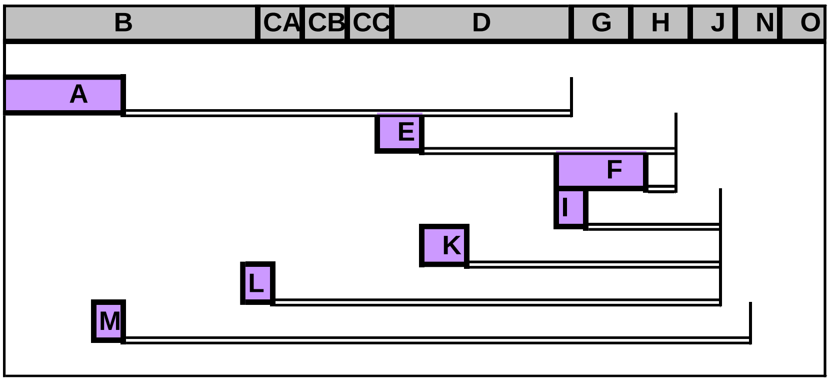

FIGURE 3. Gantt chart - earlier start schedule

Postpone some activities or to delay others. In the end by updating these charts one can monitor the progress achieved at certain dates.

ALTERNATIVE SOLUTION THROUGH A PERT MODEL

PERT is used when instead of using a single estimate one has 3 different estimates (Kocaoglu, 2024).

TABLE 4. Activity Data for the Project - PERT method

		Time Estimates			
		Most			Immediate
Activity	**Description**	**Optimistic**	**Likely**	**Pessimistic**	**Predecessors**
A	Market Research	5	7	10	-
B	R&D	12	18	25	-
C	Engineering	6	9	12	B
D	Prototype Design	8	12	15	C
E	Costing	2	3	4	C
F	Testing	3	5	8	D
G	Market Survey	2	4	7	A, D
H	Market Analysis	2	3	4	G
I	Quality Assurance	1	2	3	A, D
J	Financial Analysis	3	3	4	E, F, H
K	Supplier Analysis	2	2	2	E
L	Patent Search	1	3	4	B
M	Internal Assessment	2	2	2	A
N	Reporting	3	3	3	I, J, K, L
O	Decision Making	1	2	3	M, N

For example, assume that the estimates in Table 4 are given from management in order to incorporate uncertainty. The researcher here has considered the initial 15 activities. PERT uses statistics to find expected completion. 'To estimate the probability that the activity will be completed in the scheduled amount of time, one has first to calculate the mean and variance of a probability distribution for each activity. The beta probability distribution is the most appropriate' (Tikhomirov, 2024). The mean of the beta distribution is obtained by

$$t_e = \alpha + 4m + b \ / 6 \quad (1)$$

while the variance for each activity is

$$\sigma^2 = (b - \alpha)^2 / 6 \qquad (2)$$

By applying equation 1 and 2 for each activity it is possible to find the all the means and variances.

To find the probability that the project will be completed within the due date, in this case 57 weeks, one needs to 'apply the normal distribution theory' (Silver, 1992, p.223). If the expected times and total variance for the project are found the method allows through the z - value (normal deviate) and by using the normal distribution tables to find the exact probability. This is given by

$$z = T - Te / \sigma^2 \qquad (3)$$

where T = due date
Te = earliest expected completion date
σ = variance

The results for the current problem are presented in Table 5. Furthermore, Table 6

TABLE 5. Activity Data Table - PERT method

Nodes	Activity Descriptions	Drn	Start	Finish	Float
			E L	E L	TF FF
20-Oct	Market Research	7.2	0 32	7.2 39	
30-Oct	R&D	2	18.2	18.2	0 0
30-40	Engineering	9	18.2	7.2 27.2	0 0
40-50	Prototype Design	11.8	39	39	0 0
40-45	Costing	27.2	3	27.2 43	30 46.2
50-70	Testing	27.2	43.2	5.2	39 41
20-60	Market survey	4.2	39 39	43.2	43.2
60-70	Market analysis	3	43.2 4	6.3 46.3	0 0
20-80	Quality assurance	2	39 47.3	41 49.3	8.3 8.3
70-80	Financial analysis	3.2	46.3 46.3	49.3 49.3	0 0
45-80	Supplier analysis	2	30 47.3	32 49.3	17.2 17.2
30-80	Patent search	2.8	18 46.5	28.3 28.3	21 49.3
20-90	Internal assessment	2	7 50.3	9 52.3	43.2 43.2
80-90	Reporting	3	49 49	52.3	52.3
90-100	Decision making	2	52.3 52.3	54.3 54.3	0 0

Expected completion time: 54.3 weeks
Variance of Critical path = 8
Standard Deviation = 2.828
Critical Path: BCDGHJNO
a summary analysis of completing the project in 57 weeks. This has a probability of 0.827. Actually, one can experiment with any value to find the probability of finishing the study in different due dates.

T = Project Due Date = 57
TE = Expected Completion Time = 54.33
$\Sigma\sigma^2$ = Variance on Critical Path = 8
$\Sigma\sigma^2$ = Standard Deviation = 2.828
$z = T - Te / \sigma^2$ = 0.943
Probability of Completion by Due Date: 0.827

Cost Calculations

Almost every project involves time-cost trade-offs. Cost analysis is based on the assumption that direct costs increase linearly as activity time is reduced from its normal time' (Krajewski and Ritzman, 1996). Decrease in duration saves money from indirect revenues and penalties incurred for late completion. One can obtain the crash cost units per time by the following equation:

CC UT = Crash cost - Normal cost / Normal time - Crash time .

This gives us the crash costs for each activity per given time (Gonzales-Lazo et al, 2024). To determine the minimum - cost schedule, one must start with the normal time schedule and crash activities along the critical path because the length of the critical path equals the length of the project. The objective is 'to arrive at a point where the increase in direct costs is less than the savings generated by shortening the project' (Weih and Gregus, 2024). To apply this to our project with the data given in Table 7, the results are given in summary in the next Table 8.

TABLE 6. Activity and Cost Data

Activity	Description	NT	NC	CT	CC
A	Market Research	8	1000	6	2000
B	R&D	17	1400	14	2000
C	Engineering	11	2000	7	2600
D	Prototype Design	12	1200	6	2000
E	Costing	3	900	1	1500
F	Testing	6	2500	3	3000
G	Market Survey	4	800	2	1500
H	Market Analysis	4	1000	1	1600
I	Quality Assurance	2	1100	1	1600
J	Financial Analysis	3	900	2	1500
K	Supplier Analysis	3	2000	1	2800
L	Patent Search	2	1100	1	2000
M	Internal Assessment	3	1200	1	1700
N	Reporting	3	1100	1	1600
O	Decision Making	3	1000	1	1500

Expected Completion Time (Normal): 57 weeks
Project Completion Time (Minimum): 34 weeks
Project Due Date: 42 weeks
Project Cost (Normal): 19200
Added Cost for Crash Due Date: 2400

To conclude PERT, CPM, and Cost Analysis are useful methods for planning and controlling projects in operations management.

4. CONCLUSION

This work aimed to discuss a project being led in Cognizant, India, about the design, development and implementation of Cognizant Flowsource, an AI-powered, merged full-stack platform that accompanies in the succeeding generation of engineering. Flowsource allows quicker innovation by integrating generative AI hooked on vital phases of the software development lifecycle (SDLC), allowing developers to concentrate on rich features and incomparable user experiences (cognizant.com). The work reports how the Flowsource development project is being managed by the operations managers of the company and suggests alternative manners of solving problems identified in the development of the IT solution. Both the CPM and PERT models build suggest alternative techniques to manage the project. However, at this point the researcher has to consider available resources and the cost involved in order to have the expected benefits. The work presents a useful reference to guide other scholars in project management calculations in order to improve the process of performing the task..

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