A Composite Construction Progress VarianceAnalysis- An Approach to Estimate and Report Schedule Delays and Progress Percentage Variance in a Single Dashboard

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Abstract

Background/Objectives: To develop a composite progress delay analysis for Construction projects with integration between schedule delays and Progress percentage variance and to present in single dashboard

Methods: Composite method of analysing delays from project schedule and variance of percent of Value of Work Done (VoWD) to total value from Progress Measurement System and indicating them in a single dashboard

Results/Findings: Can be implemented at construction industryespecially for the process plant construction projects.

Conclusion/Application: Composite Construction Progress Delay Analysis in every monthor week in part of construction progress calculation' can be implemented in construction industries which helps Client organization to implement corrective action on time

Keywords: **Value of Work Done (VoWD)** - a quantitative project performance value which is calculated based on the Earned Value Method (EVM)

1. Introduction

Currently in the Construction industry generally schedules are being prepared based on the planner's experience or the Equipment manufacturer's tentative time line indication which may not be perfect. The Project schedule generally prepared and finalized in various levels L1 to L5 or even to more detailed levels. Time and cost are twoessentials for the Owner or Contractor to keep control over the project. Any delay during the project execution is to be analyzed properly and immediately to avoid any consequences in future. There may be time over run which takes more time to complete the project or may be cost overrun which may lead to over cost to complete the project. In this paper, the time part variance will be dealt and a method to analyze the delay must be implemented.

The project scheduledelay analysis is often important to the employer and the contractor. This has made it quite imperative for owners to analyze project delays for purposes of making right decisions on right time. Existing delay analysis techniques (DATs) for helping this decision-making have been helpful but have not succeeded in bringing back the project. Developing a good knowledge of these techniques is of paramount importance in understanding the real causes of the delay or variance and the actions required to bring the project back to track. This paper seeks to develop a composite method of delay analysis via: an evaluation of the most common available DATs, a review of the key relevant issues often not addressed by the techniques, and the

necessary improvements needs. The evaluation confirmed that the various techniques yield different analysis results for the same delay claims scenario, mainly due to their unique application procedures. The issues that are often ignored in the analysis but would also affect overall project completion.

A typical construction project will suffer from high risks associated with schedule delays, since time is of theessence of the construction contract. AScheduleprepared for a project relies on the performance of owners,designers, contractors, subcontractors, and suppliers, as well as the Project Management Team (PMT). A single event that deviates from theplan may or candelay the project completion. Delay in construction can have several consequences in a project, such as

- Late completion
- Lost productivity
- Consequential damages
- Increased cost
- Delayed production
- Delayed revenue generation.

Therefore, arresting delay immediately will help to overcome above issues. Identifying the event of delay, consequential impacts, impact on progress, impact on duration etc. are to be immediately highlighted to management to initiate the corrective actions before it reaches to the irreversible condition. For this purpose, a suitable method is required which can suffice above requirements. There are many Delay Analysis Techniques (DAT) available in the Construction Industry and will have to be reviewed for suitability.

Each delay analysis method adopts a different approach to identify delayimpacts and may yield different results. The most sophisticated delay analysis method using the highest level of detail does notguarantee success. In the next section each of the available methods are to be checked and evaluated for suitability for the purpose stated above.

2. Present method being followed in the industry

The objective of delay analysis is to calculate the project delay and actions required to correct the lags. Questions that need to be answered here often include

- what was supposed to happen?
- what did happen?
- what were the variances?
- how did they affect the project schedule?
- What are the corrective actions?
- How those corrective actions to be implemented and when?

The various DATs have varying capabilities in providing sound answers to these questions. Thetechniques can be grouped under schedule delay analyzing techniques and Progress percent variance analyzing techniques. They have been reported by different authors in the literature using different names. Nuhu Braimah[1] summarized most common available techniques like "as-planned vs. As-built", "impacted as-planned", "as-planned but for","collapsed as-built", "window analysis", and "time impact analysis".

2.1 As-Planned vs. As-Built

In this method, all delaying activities of the project are depicted on the as-built schedule. The difference between the as-planned and as-built completion dates are tabulated and the reasons for the delay are noted. The critical path is determined in both as-planned schedule and in the as-built schedule. Bar chart representation made for the both schedule and the net effect is reflected. The approach of Stumpf [2], indicates the delay and allocates responsibility between the owner and the contractor for the delays.

Advantages:

- Easy to understand as simply represented by bar chart schedule

Limitations:

- it does not scrutinize types of delay and this makes it easy for it to be manipulated
- it ignores the dynamic nature of the critical path and any changes in schedule logic or relationship
- no attempt is made to determine delay wise impact on project completion. All delays, including delays on non-critical path, were summed up and their net effect calculated.

2.2 Impacted As-Planned

This method measures the impact of the delays on the as-planned CPM schedule. Thevarious delays are formulated as activities and added to the as-planned network in a chronologicalorder showing the effect of each delay at a time and demonstrating how the project is being delayed due to this. The amount of delay equals the difference in completion dates between the schedules before and after the impacts.

Advantages:

- The technique can be used for analysis of delay during and after project completion.

Limitations:

- It uses fixed as-planned schedule to analyze delays out of context and time
- The original baseline schedule may not be a realistic model on which whole analysis is made as baseline
- It has the potential of failing to consider the delays of all parties ("i.e.", being one-sided);

2.3. As-Planned But for

This method is injecting the as-planned schedules with all the delays of a party (either Owner or Contractor) toform an adjusted schedule. The completion date of this adjusted as-planned schedule compared withthe actual completion date gives the amount of delay for which the other party is responsible. A contractor using this method would identify and add all non-excusable delays to the as-plannedschedule, whereas the owner would add all excusable delays.

Advantages:

- This can be performed quickly because there is no need to consider actual progress of the work.

Limitations:

- It does not consider any changes in the critical path schedule during the project [3];
- It assumes that the planned construction sequence remains valid during the projectduration [4];
- Owner's point of view and contractor's point of view may yield different results leading to disputes

2.4. Collapsed As-Built

This method is a form of "but for" which does not use the as-planned as a baselineschedule, but rather uses the as-built schedule. Itinvolves removing the delays of each party from the as-built network so that the resulting schedule willgive the completion date of the project [5,2].

Advantages:

- Main advantage of this technique is that it is based onactual events on the project which is making this technique of more credibility [4].

Limitations:

- In collapsing the schedule, the analyst is typically forced to insert after-the-fact logic ties whichmay not reflect the thinking of the executor during actual performance [4];
- The removal of the delays from the schedule could result in an unrealistic as-built but-forschedule
- It ignores the circumstances at the time of the delay and the dynamic nature of the critical path;
- The identification of the as-built critical path requires great deal of effort on judgement andschedule manipulation [6];
- The use of as-built information to prepare the as-built schedule is subjective [7].

2.5. "Window" Analysis

This technique involves interim assessment of delay on updated schedules at specific periods of theproject. This is similar to the "snapshot technique" described by Alkass [2] and "contemporaneousperiod analysis" described by Schumacher [8]. First, the total project duration is divided into severalsmaller time periods which may be called as windows or snapshots.

This will be usually based on different phases or major changes in planning or major projectmilestones [9,10]. The schedule within each window is updated to reflect the actual durations andsequence at the time of the delay while the remaining as-planned schedule beyond the window periodis maintained as it was.

Analyses are performed to determine the critical path and new completion date. Thisnew completion date is compared with the as-planned completion date prior to this analysis to give theamount of delay during that window period.

Advantages:

- It divides a complicated network into amanageable one andconsiders the dynamic nature of the critical path.
- This method offersa very effective approach to analyzing delays and the more snapshots or windows used the better theaccuracy of the results.

Limitations:

- It is time consuming and costly to operate and demands complete project records, whichare generally not available;
- Differences in the time periods (or "windows") can produce different results [11];
- Periodic updates require the analyst to perform a highlylaborious analysis of project records to create updates

2.6. Time Impact Analysis

This technique is a variant of the window technique described above, with the difference being thatthe time impact technique concentrates on a specific delay or delaying event but not on time periods or windowscontaining delays or delaying events [3].

The schedule is then updated at this delay period and the effect of the delay is analyzed to establish anew completion date. The difference between the new completion date and the date prior to theexercise gives the delay caused by that specific impact.

Advantages:

- It is an effective technique because the delays are analyzed using real time CPM. It is also applicable to use during the project and after completion.

Limitations:

- It may not be practical or realistic to use if there are an overwhelming number of delaying events [10];
- Periodic updates require highlylaborious analysis of project records to creates updates;
- The analysis requires intensive effort and is time consuming.

2.7. Discussions on the Different DATs

Availability and accuracy of project records have a major influence on the suitability of a techniquesince the various techniques employ different programming information sources. If a good as-plannednetwork program exists but has not been updated with progress due to lack of as-built records, etc.,then impacted as-planned analysis may be appropriate [10]. Conversely, where there are good as-builtrecords but no as-planned program or the as-planned program is not adequately prepared, thenthe collapsed as-built method may be appropriate [2].

The time of performing delay analysis is an important factor, since some techniques (e.g., timeimpact analysis, impacted as-planned) are suitable for performing forward or contemporaneousassessment (termed "prospective analysis"), whilst others (e.g., collapsed as-built) can only be used forhindsight assessment (retrospective analysis) [8,12]. The following table shows summary of various DATs in broader classification.

Table-1: Various Delay Analysis Techniques

S No	Technique	Retrospective	Perspective	Dynamic	Static	Theoretical	Actual
1	As Built but for	X		X		X	
2	As Planned but for		X	X		X	
3	As planned Impacted		X	X		X	
4	As planned Vs. As Built	X			X		X
5	Time Impacted Analysis		X	X			X
6	Window Analysis	X		X			X

Perspective analysis indicated to the future (Forward) and used to determine likely impact to the project completion. Retrospective analysis refers to what happened (backward) in the past and uses it to determine the impact on the project completion. Dynamic nature is calculating schedule impacts on every iterations and instances whereas static one does not require any calculation. Theoretical method use planned schedule where as Actual methods considers as built schedule for the delay analyses.

All available methods are partially useful only after completion of the project and to settle the claims of either Owner or the Contractor. The only source to drive the project management is the Schedule and Project Progress S Curves. Project Schedule generally being prepared in MS Project or in Primavera or in simple Excelbar chart etc. in which ever the way it was prepared, this may not be much easier for the team to understand and pick the takeaways to use it to drive the Project. Likewise, Project Progress S Curve is also a such too complicated only with which none of the team member can conclude anything and hence no corrective actions can be done. That is why an integrated tool of schedule Delay analysis/Progress variance analysis is required.

3. Proposed Method to Project Construction Variance Analysis
3.1. Key Project Control Terminologies

Project

A project is a unique venture with a beginning and an end, undertaken by people to meet established goals with defined constraints of time, resources, and quality

WBS (Work Breakdown Structure)

A hierarchical approach to defining project work components. The WBS can be presented as a tree diagram, organizational chart, or outline.

Lead time and lag time

The more complex precedence relationships are called lead and lag times. Lead time is the time required by one task before another task can begin. Lag time exists when a task must start a certain period after another task

Actual Duration (AD)

The elapsed time from the Project Start Date (PSD) to the Actual Phase End Date (APED) for completed phases, using PEVA. Note: PMI defines Actual Duration (AD) as the time in calendar units between the actual start date of the schedule activity and either the data date of the project schedule if the schedule activity is in progress, or the actual finish date if the schedule activity is complete. (PMI, 2004)

Critical Path Method (CPM)

A schedule network analysis technique used to determine the scheduling flexibility (the amount of float) on various network paths in the project schedule network, and to determine the minimum total project duration. (PMI, 2004, p. 357)

Forecast Duration (FD)

The estimated time from the Project Start Date (PSD) to the Forecast Phase End Date (FPED) for a phase that has not been completed. Forecast Duration (FD) = Planned Duration (PD) divided by the SPIP for the previous completed phase. (Bower, 2006a)

Planned Duration (PD)

The elapsed time from the Project Start Date (PSD) to the Planned Phase End Date (PPED) expressed as calendar days.

Planned Value (PV)

The authorized budget assigned to the scheduled work to be accomplished for a schedule activity or work breakdown structure component. (PMI, 2004)

S-Curve

Graphic display of cumulative costs, labor hours, percentage of work, or other quantities, plotted against time. Used to depict Planned Value, Earned Value and Actual Cost of the project work. (PMI, 2005)

Schedule Variance (SV)

A measure of schedule performance on a project. It is the algebraic difference between the earned value (EV) and the planned value (PV). SV = EV minus PV.(PMI, 2004)

3.2. Definitions

Planned Value (PV)

This is the baseline for analysis, cumulated planned man-hours related to their time of incurrence. Hence this can be expressed as below,

> Planned Value (PV) = (BMHWS) Budgeted Man-hours of Work Scheduled

Earned Value (EV)

This is the measure of physical progress of works expressed by cumulated planned cost of works done related to time. This can be expressed as below,

Earned Value (EV) = (BMHWP) Budgeted Man-hours of Work Performed

Actual Value (AV)

Cumulated man-hours consumed for works done related to time. This can be expressed as below,

Actual Value (AV) = (AMHWP) Actual Man-hours of Work Performed

Duration (T)

Duration (T) = Total Project duration

Budgeted Value at Completion (BVAC)

Total planned cost of the whole project, it equals BMHWSat the planned finish. This can be expressed as below,

Budgeted Value at Completion (BVAC) = (TBMH) Total budgeted Man
hours of the whole project

Planned Percentage (PP)

A measure of performance and this can be calculated as below

Planned Percentage (PP) = Planned Value (PV) /Budgeted value at
Completion (BVC)

Value Variance (VV)

A measure of deviation between planned and actual man-hours of works done until the date of recording progress. If negative, it indicates that the project is over man-hour consuming. This can be expressed as below,

Value Variance (VV) = Difference between Earned Value (PV) and Actual Value (AV) equals
To AV-EV =   AV-EV = AMHWP-BMHWP

% of Value Variance (%VV)

To capture the scale of deviation, it is often expressed as a fraction of the budgeted Man-hours of works performed. This can be calculated as below,

% of Value Variance (%VV) = VV/EV
=Value Variance/Earned Value
=Value Variance/ (BMHWP) Budgeted Man- hours of Work
Performed

Schedule Variance (SV)

A measure of deviation between the actual progress and the planned progress. Though it is interpreted as time deviation, it is expressed in man-hour units.

In other words, it is the difference between the planned man-hour of works that have been done and planned man-hour of works that should have been done by the reporting date. If negative, it indicates a delay.

This can be calculated as below,

> Schedule Variance (SV) =Earned Value (EV) - Planned Value (PV)
>
> = Difference between budgeted and man-hours for　　　　　Work Scheduled and performed
>
> = BMHWP-BMHWS

% of Schedule Variance (%SV)

To address any distortion caused by the relative value of activities, it is expressed as a fraction. This can be calculated as below,

> % of Schedule Variance (%SV) = SV/PV
>
> = Schedule variance/Planned Value
>
> = Schedule Variance/ (BMHWS) Budgeted
>
> Man-hours of Work Scheduled

3.3. Estimating the % VOWD and the Variance

3.3.1 Calculation of Planned Progress and Actual Progress or percent of VoWD

Here in this section, we can use some simple formulas which can be used in the construction project. Initial estimate of Total Man-hours required for completing the project. This can be illustrated in simple form as below for a project which is having 'm' number of least breakable activities.

$$Y^{(0)}=X^{(0)}_1 H^{(0)}_1+X^{(0)}_2 H^{(0)}_2+X^{(0)}_3 H^{(0)}_3+\ldots\ldots\ldots+X^{(0)}_m H^{(0)}_m \ldots\ldots\ldots\ldots\ldots\ldots\ldots [1]$$

As explained earlier this is simple total of multiples of all activities and their respective man-hours required for unit quantity. This can be even simplified as below.

$$Y^{(0)}=\Sigma (X^{(0)}_i H^{(0)}_i)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots[2]$$

Where,

$Y^{(0)}$= Initial estimate of the Man-hours required to complete the project

$X^{(0)}_i$　= All Executable Scope Quantity of particular activity

$H^{(0)}_i$　= Estimated Man-hours to complete one unit quantity of the respective activity

Initial estimate of Progress or Percent of VoWD to the Total Value of the Project for i^{th} month

$$P^{(0)}_i = \Sigma \, (x_i / X^{(0)}_i)(H^{(0)}_i / Y^{(0)}_i) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{[3]}$$

Where,

$P^{(0)}_i$ = Progress for i^{th} month

x_i = Executed Quantity in i^{th} month of a particular activity

$X^{(0)}$ = Scope Quantity of activity

$H^{(0)}$ = Estimated Man-hours to complete one unit quantity of the respective activity

$Y^{(0)}$ = Initial estimate of Total Man-hours required the complete the project

From the above estimate it is clear that in i^{th} period project reaches progress of $P^{(0)}_i$ by executing the quantity x_i in each of the breakable activities. This equation (3) is being conventionally used for all construction projects of process industries. Now we can proceed for the corrections required for progress derivation.

In the initial stage of the project, generally, the scope quantities will be estimated, or pre-matured quantities only being considered and upon growth, the actual scope quantities may be made available. There for it is important to update the scope quantities in the system once in a month or on some regular intervals. Like scope quantity updation, the considered unit man-hour also required to be revisited to calibrate with respect to the technology implemented and the construction methodologies adopted.

This Actual Percent VoWD to Total Estimate at Completion Value (Actual Progress) and the Planned Percent VoWD to Total Estimate at Completion Value (Planned Progress) are being used to monitor the Project.

3.3.2 Calculation of Progress Percent Variance

Progress Variance $PVi = P^i_{(P)} - P^i_{(A)}$ $\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots$.[4]

Vi = Progress Variance for ith month

$P^i_{(P)}$ = Planned Progress till ith month

$P^i_{(A)}$ = Actual Progress till ith month

Higher the variance contributes more to corrective action and paves way to bring back the project on tract. Along with this if we project the schedule delay due to this, it will help management to implement corrective actions.

3.3.3 Calculation of Duration Variance

Duration forecasting

EVM can also be used to predict the final duration of projects. This is done analogue to forecasting the EVAC. The oldest method calculated the Independent Estimate At Completion (IEAC(t)). This estimate exists of the time that has already elapsed (Actual Time, AT) and the duration of what the remaining work is estimated to take (Estimate To Complete, ETC(t)). The time that is expected to complete the project is calculated by adjusting

the work remaining (Estimate To Complete, ETC) for the work rate that is expected on the remaining of the project. ETC(t) is also referred to as Planned Duration of Work Remaining (PDWR) and can be calculated as follows:

$$ETC(t) = (BAV – EV)/ \text{Work Rate}$$

The Independent Estimate at Completion (IEAC(t)) can be derived as follows:

$$IEAC(t) = AT + ETC(t)$$

From the above formula we can calculate the Expected duration at Completion and if we reduce the planned duration from this, we can get duration variance.

Duration Variance

Duration Variance $DV^a_i = IEAC(t)_i – T^a_{(o)i}$ …………………………………..………..………[5]

DV^a_i = Duration Variance of activity 'a' for 'i' th month

$IEAC(t)_i$ = Estimated Duration at completion of activity 'a' for 'i' th month

$T^a_{(o)I}$ = Original Duration of activity 'a' for 'i' th month

4 Dashboard for Management/Project Management Team

Management need certain data to assess overall health and performance of the project and the threats for the project which may delay the project completion. These data must include the following as a minimum, might include:

- Overall Schedule position with forecast
- The overall project progress figure against planned till date
- Activity wise executed quantities against planned and over all scope quantities
- Activity wise %variance
- The number of days behind or ahead against the plan
- Status of the Critical path
- Status of Key milestones
- Events or activities which are delaying the project

These data elements should provide a sound overview of project health for all level of the team members who are all contributing to the project.

All the above requirements are captured in the following dashboard to represent at one go. A sample project with some date considered for representation and at the end of 5th month, the following dashboard was represented.

Sample dashboard

S No	Activity	UoM	Scope	Planned	Completed	Balance	Schedule	Progress Planned	Progress Achieved	Progress Variance	Planned Duration	Forecast Duration	Duration Variance
1	Concreting	CUM	12000	9100	7500	4500		22.52%	18.56%	3.96%	6.00	7.07	1.07
2	Structural Steel Fabrication	MT	4000	3200	2705	1295		12.67%	10.71%	1.96%	6.00	6.91	0.91
3	Structureal Steel Erection	MT	4000	2700	1400	2600		8.46%	4.39%	4.07%	4.00	4.93	0.93
4	Piping Fabrication	ID	12000	10700	5500	6500		1.24%	0.64%	0.60%	6.00	6.95	0.95
5	Piping Erection	IM	35000			35000		0.00%	0.00%	0.00%	7.00	7.00	0.00
6	Tankage Fabrication	MT	2000	1850	1400	600		12.21%	9.24%	2.97%	6.00	6.96	0.96
7	Tankage Erection	MT	2000	1040	700	1300		6.86%	4.62%	2.24%	5.00	5.97	0.97
8	Equipment Erection	Mt	4500			4500		0.00%	0.00%	0.00%	6.00	6.00	0.00
9	Electrical Works	MTR	1500			1500		0.00%	0.00%	0.00%	6.00	6.00	0.00
10	Instrumentation Works	MTR	3000			3000		0.00%	0.00%	0.00%	6.00	6.00	0.00
11	Painting	SQ.MTR	3000			3000		0.00%	0.00%	0.00%	6.00	6.00	0.00
12	Precommisioning and commissioning	LS	1			1		0.00%	0.00%	0.00%	8.00	8.00	0.00
	Legend: Plan, Actual, Forecast, Data Date, Critical Path, RFSU							63.95%	48.15%	15.81%	16.00	17.00	1.00

Figure: Sample dashboard for the project at the end of 5th month

Upon further drilling to next detailed level the Project Management Team can land in to the following sheet

S No	Activity	Scope	UoM	Unit Man-hour	Total Man-hour	Weigtage	Quantity Cummulative till end of M5 — Planned	Actual	Variance	% VoWD for the Day — Planned	Actual	% VoWD Cummulative till end of M5 — Planned	Actual	Variance	% VoWD Cummulative Activity wise till end of M5 — Planned	Actual	Variance
1	Concreting	12000	CUM	75	900000	29.7%	9100	7500	1600	0.25%	0.20%	22.52%	18.56%	3.96%	75.83%	62.50%	13.33%
2	Structural Steel Fabrication	4000	MT	120	480000	15.8%	3200	2705	495	0.79%	0.30%	12.67%	10.71%	1.96%	80.00%	67.63%	12.38%
3	Structureal Steel Erection	4000	MT	95	380000	12.5%	2700	1400	1300	0.63%	0.16%	8.46%	4.39%	4.07%	67.50%	35.00%	32.50%
4	Piping Fabrication	12000	ID	3.5	42000	1.4%	10700	5500	5200	0.02%	0.02%	1.24%	0.64%	0.60%	89.17%	45.83%	43.33%
5	Piping Erection	35000	IM	4.5	157500	5.2%				0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
6	Tankage Fabrication	2000	MT	200	400000	13.2%	1850	1400	450	0.33%	0.26%	12.21%	9.24%	2.97%	92.50%	70.00%	22.50%
7	Tankage Erection	2000	MT	200	400000	13.2%	1040	700	340	0.26%	0.20%	6.86%	4.62%	2.24%	52.00%	35.00%	17.00%
8	Equipment Erection	4500	MTR	50	225000	7.4%				0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
9	Electrical Cable Laying	1500	MTR	1	1500	0.0%				0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
10	Instrumentation Cable Laying	3000	MTR	1	3000	0.1%				0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
11	Painting	14000	SQ.MTR	3	42000	1.4%				0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
12	Precommissioning	1	LS	3000	3000	0.1%				0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Total				3031000	100.0%				2.28%	1.13%	63.95%	48.15%	15.81%	63.95%	48.15%	15.81%

Figure: Sample dashboard for the project at the end of 5th month -quantitative analysis

Project duration variance and progress variance from the above dashboard will help management where to act and how to recover the delay happened and how to bring back the project on track.

5. Conclusion

The delay already happened in the project are indicated not discourage project team from future efforts. This dashboard provides an opportunity to point to the relevantlessons that can be derived from it and help to initiate the actions to recover the delay.

The following guidelines to be kept in mind while initiating the corrective actions:

- Plan before implementing the corrective actions
- Activities in the critical path and their delay are prioritized first in the order of higher weightage and longer delay
- Aim should be on both actions such as minimizing delay and increasing project progress
- Set up the necessary processes to calculate and inform the risk.
- Project trade-offs to be evaluated properly when making decisions
- Use the duration instead of the time on task to estimate schedule.
- Ensure and communicate regular about the progress, even if it seems invisible.
- Require that users participate in design and implementation of your project

These recommendations, along with solid project management, can reduce the riskof delayed project completion. Further this can be extended to cost control aspects

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