

# Performance Assessment of ongoing Construction projects under Town Development Fund, Nepal

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## Abstract

Problems related to performances of the construction projects appear through different directions. Most of the projects fail either in time performance or in cost performance or both. So, progress assessment of ongoing project is most.

In this research, the performance indices (Cost performance index, CPI and Scheduled Performance Index, SPI) of the ongoing construction projects funded by German government-owned development bank KfW (Kreditanstalt für Wiederaufbau) through Town Development Fund (TDF) were calculated to find out the variance in planned and actual physical and financial parameters.

Using Earned Value Analysis method, it was observed that though the projects were within stipulated budget, the time overrun is severe. The mean planned duration for the projects under study is 15.2 months with standard deviation of 1.03 months for 75 percent work completion (with standard deviation of 30 percent) while the mean actual duration for the projects were 24.70 months with Standard Deviation of 11.64 months for 53 percent work complete in average (with 43 percent standard deviation). Time overrun seems to be critical.

**Keywords:** Time Performance, Cost Performance, Earned Value Analysis, standard deviation, percent

## Introduction

### Background

A good construction practice of any construction project refers that it is free from defects, right things at right time and the continuous improvement of the project. It is measured with the time, cost, quality and safety of the project. The productivity as well as the satisfaction yield in quality aspect project is also the major part of construction. The profitability of any organization depends with the performance of construction (Chiluwal & Mishra, 2017).

The peer view on Nepalese construction industry reveals

that the time overrun is the most common yet most complicated problem being faced these days.

Town Development Fund (TDF) with its aims to alleviate economic and social poverty in urban sectors through long term finances in social infrastructure and revenue generating projects has completed 206 Projects under town development program (TDP) Phase I program, 271 Projects under TDP Phase II Program and 126 Projects under TDP Phase III Program. It Supports Municipalities, Water Users and Sanitation Committees of Small Town Water Supply and Sanitation Project (STWSSSP), Hospital and Health Centres through long term financing on social infrastructure and

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income generating Projects in the form of Loan, soft loan and grant within strict financial rule and regulations (Town Development Fund, 2016). TDF, in financial support with German Development Bank, Kreditanstalt für Wiederaufbau (KfW) is currently doing several infrastructure projects that includes bus-parks, municipality buildings and Parks. All of the on-going projects of TDF has faced time over-run.

**Statement of the Problem**

Being versatile and complex in nature, there exists lot of uncertainties in the construction projects. Several research on earned value analysis and delay effects has revealed the fact that construction industry is relatively “under-performer”. The Variation in construction task starting time and duration can impact overall productivity performance. Because of construction delays, it is often difficult to analyse the ultimate liability in delay claims. The original schedule (as planned) is usually known, and, likewise, the actual schedule (as built) is known. What is unknown is the appropriate schedule when all allowable adjustments to the schedule are taken into account. This schedule is often called the adjusted schedule (Kraiem & Diekmann, 1987). The construction of almost all projects in Nepal that has already been constructed and the ongoing projects funded under TDF financing has suffered time overrun. It is obvious that the time over-run in construction imparts adverse effect on the stakeholders. The major stakeholders involved in the ongoing projects of TDF are the municipalities, TDF and the contractors (Also). It is essential to assess the progress as the relation of performance and its impact on profitability in case of Nepali hydropower projects have been established (Chiluwal & Mishra, 2018).

**Research Objectives**

The overall objective of this research is to analyse performance of ongoing Construction projects in terms of CPI and SPI funded by Town Development Fund.

**Literature Review**

**Projects performance indices**

Cost performance index (CPI) and Scheduled performance index (SPI) are most commonly used performance indicators in construction industry as those indicators are directly linked to the cost and time of the projects. Nassar & K (2009), in addition to traditionally used CPI and SPI, has identifies eight performance indices and presents a methodology to measure the overall performance index. Following are the list of those performance indices:

1. Cost performance index (CPI): Measure of the cost efficiency of the Project;

$CPI = \text{Budgeted cost of Work performed (BCWP)} / \text{Actual Cost}$

of work performed (ACWP)

2. Schedule performance index (SPI): Measure of the Schedule efficiency of the Project;

$SPI = \text{Budgeted cost of Work Scheduled (BCWS)} / \text{Actual Cost of work Scheduled (ACWS)}$

3. Billing performance index (BPI): The assumption here is that the project is a lump sum contract and that billing is based on the physical progress earned. The BPI is given by following expression.

$BPI = \text{Billed Revenue of Work Performed (BRWP)} / \text{Earned Revenue of Work Performed (ERWP)}$

4. Profitability performance index (PPI): It is a measure of how profitable the project is to date.

$PPI = \text{Earned Revenue of Work Performed (ERWP)} / \text{Actual Cost of work performed (ACWP)}$

5. Safety performance index (SPI): It is a measure of how safe the site activities are carried out without lost time incidents. (This index is proposed in his model)

$SPI = LTI \times C / M$

Where,

LTI = Number of Lost Time Incidents to date  
 M = Total man-hours expended to date; and  
 C = is a constant (200,000) which represents 100 employees working for a full year (100 x 2,000).

6. Quality performance index (QPI): It is a measure of consistency in the application of the Project Standards and Procedures as well as the compliance of the delivered product with the project specifications. Non-consistency in the application of project processes will lead to rework, poor quality audits and high number of Non Conformance Reports (NCRs).

$QPI = \text{Total Direct and Indirect cost of rework performed in the field} / \text{Total Field Construction phase cost.}$

7. Team satisfaction index (TSI): It is a measure of how satisfied the project team is.

$TSI = \sum W_i \times R_i = W_1 \times R_1 + W_2 \times R_2 + W_3 \times R_3 + \dots + W_{12} \times R_{12}$

(i goes from 1 to 12)

Where,

W's = Relative weights for the various areas of concern.

$\sum_{i=1}^{12} W_i = 1.$

R's = Ratings for the areas of concern on a scale from 1 to 10, 10 being the highest.

8. Client satisfaction index (CSI): Meeting the expectations of the project owner (client) is the only way to ensure that a contracting company will continue to have repeat business. the Client Satisfaction Index (CSI) evaluates the satisfaction of the Client's needs in a global sense.
9.  $CSI = \sum W_i \times R_i = W_1 \times R_1 + W_2 \times R_2 + W_3 \times R_3 + \dots + W_{12} \times R_{12}$

(i goes from 1 to 12)

Where,

W's = Relative weights for the twelve areas of concern.

R's = Ratings for the areas of concern on a scale from 1 to 10, 10 being the highest.

Based on discussions carried out by the author with many client organizations and construction project owners, 12 areas of concern were identified as follow:

### Town Development Fund

The TDF is the only financial autonomous intermediary in Nepal with agreed policy, rules and regulations that finances urban infrastructure projects long term. Over the last 20 years, the TDF has implemented a wide range of urban infrastructure projects which were financed by grants, soft loans and loans with the support of the Government of Nepal (GoN), German Technical and Financial Cooperation (GTZ/KfW), World Bank (IDA) and Asian Development Bank (ADB) (Town Development Fund, February 2009).

Ramanujam, et al. ( 2012) Stated that the GoN established the Town Panchayat Development Board in 1987 through an agreement with the Federal Republic of Germany. Later the Town Development Fund Board (TDFB) was formed in 1989 under the Ministry of Physical Planning and Works. TDF, in its current form as an autonomous Board, was established in 1997 through the Town Development Fund Act. It is further stated in their report that till date TDF has received a grant from GTZ, an IDA loan in 1987, four grants from KfW and two loans from ADB. All these resources were provided as a mix of loan: grant to the borrowers, except for one KfW project that disbursed only a grant.

### Projects done by Town Development Fund

TDF, in financial support with KfW has done 206 Projects under TDP Phase I program, 271 Projects under TDP Phase

II Program and 126 Projects under TDP Phase III Program.

### Earned Value Analysis

Cullen (2014) has defined Earned Value Analysis (EVA) as an industry standard method of measuring a project's progress at any given point in time, forecasting its completion date and final cost, and analysing variances in the schedule and budget as the project proceeds. It compares the planned amount of work with what has actually been completed, to determine if the cost, schedule, and work accomplished are progressing in accordance with the plan. Haughey (2015).EVA is an approach where the project plan, actual work, and work completed value is monitored to see if a project is on track. Earned Value shows how much of the budget and time should have been spent, considering the amount of work done so far. Even several factors have been found by Chiluwal and Mishra(2018) in case of Hydropower projects of Nepal.

Cullen (2014) further stated that Earned Value Management measures progress against a baseline. It involves calculating three key values for each activity in the WBS:

- The Planned Value (PV), (formerly known as the budgeted cost of work scheduled or BCWS)—that portion of the approved cost estimate planned to be spent on the given activity during a given period.
- The Actual Cost (AC), (formerly known as the actual cost of work performed or ACWP)—the total of the costs incurred in accomplishing work on the activity in a given period. This Actual Cost must correspond to whatever was budgeted for the Planned Value and the Earned Value (e.g. all labor, material, equipment, and indirect costs).
- The Earned Value (EV), (formerly known as the budget cost of work performed or BCWP)—the value of the work actually completed.

The most commonly used measures are the cost variance:

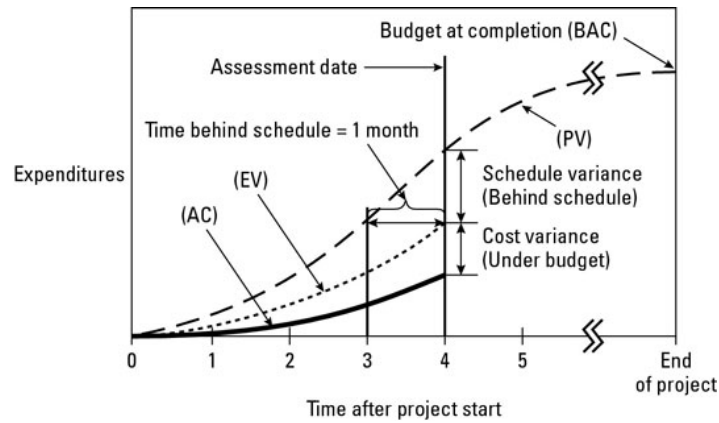
$$\text{Cost Variance (CV)} = \text{EV} - \text{AC}$$

and the schedule variance:

$$\text{Schedule Variance (SV)} = \text{EV} - \text{PV}$$

These two values can be converted to efficiency indicators to reflect the cost and schedule performance of the project. The most commonly used cost-efficiency indicator is the cost performance index (CPI).

CPI = EV / AC. It is presented in figure 1.



**Figure 1. Earned Value Analysis-Graph**  
 (Source: [https://www.wbdg.org/resources/value\\_analysis.php](https://www.wbdg.org/resources/value_analysis.php))

## Methodology

This is a Survey Research or Cross sectional descriptive type of study which identifies the current status of progress of the projects undertaken in this study. Furthermore, this study explores the factors affecting the performance of the project as perceived by the respondents i.e. clients, consultants and contractors. This research has been designed to conduct study of all under-construction infrastructure projects funded by KfW via TDF followed by a questionnaire survey and examination of records from concerned representatives of clients, consultant and contractors within the research area. The perceived delay causing events were ranked using relative importance index based on degree of severity and frequency of occurrence. The relative importance of delay factors has been quantified by the relative importance index method. The ranking of the factors and groups were demonstrated according to their importance level on delay. Conclusions on objectives of the study were extracted after analysing the results.

In this research, both qualitative and quantitative approach is used since the data collected were analysed and presented with proportions and means according to the nature of the data.

## Study Area and Population

All under-construction Projects under TDF funding has been considered under study. There were altogether 10

projects of under construction by the TDF (funded by KfW). They were:

- Pokhara Shopping Complex at Srijana Chowk-Pokhara
- Office cum Shopping Complex-Byas Municipality
- Birgunj Bus Park-Birgunj
- Birendranagar Bus Park-Birendranagar
- Reinstatement of Municipal Building-Nepalgunj
- Bheemdatt Bus Park-Bheemdutt Municipality
- Biratnagar Bus Terminal-Biratnagar
- Nepalgunj Bus Park-Nepalgunj
- Improvement of Meena Bazar and Drainage-Birgunj
- Butwal Bus Terminal-Butwal

## Data Collection

Secondary data has been collected using Performa from the various publications, journals, TDF's previous reports, Government records and from other necessary sources Supported by key informant interview and observation.

## Data Processing and Analysis

The data collected was coded and entered in MS Excel. To minimize the error during data entry, the validation & consolidation command was applied. Data checking was done using filter command in MS Excel. Data was exported to SPSS (Version 20) to undergo simple descriptive analysis.

Definitions and abbreviations used in finding out performance indicators are listed hereunder:

Table 1. Project Performance definitions

Particulars	Abbrev.	Description	Formula/Value
Budget at Completion	BAC	Baseline project cost	
Actual Cost/Actual Cost of Work performed	AC (ACWP)	Total costs incurred in completing work during a given period	
Earned Value/Budgeted cost of Work performed	EV (BCWP)	Physical work completed during a given period	
Planned Value/Budgeted cost of Work Scheduled	PV (BCWS)	Physical work scheduled for completion during a given period	
Cost Variance	CV	Cost overrun during a given period	EV-AC
Cost Performance Index	CPI	Cost efficiency ratio	EV/AC
Schedule Variance	SV	Schedule slipped during a given period	EV-PV
Schedule Performance Index	SPI	Schedule efficiency ratio	EV/PV
Estimate to Completion	ETC	Expected additional cost needed	EAC-AC
Estimate at Completion	EAC	Expected total cost	BAC/CPI
Variance at Completion	VAC	Estimated cost overrun at end of project	BAC-EAC
Status	n/a	Average of CPI and SPI	(CPI+SPI)/2
		<b>Status color key:</b>	
		GREEN = On track	1
		YELLOW = Slightly behind schedule/ budget	0.85 but <1.0
		RED = Needs immediate attention	<0.85

## Results and Discussion

This part consists of results and discussion after processing and analyzing the data which were obtained from primary and secondary sources.

**Project Plans and Actual Performance**

**Table 2. Project Performance definitions**

Project Title		Contract Amount (In Million NRs)	Planned	Actuals	EOT I (Months)	EOT II (Months)
Project Title	Shopping Complex	57.00	Start Date 20-Nov-14	Start Date 20-Nov-14	6	4
	Office cum Shopping Complex	91.50	Completion 14-Jan-16	Finish 9-Nov-16	12	
	Bus Park	177.35	Duration (Months) 15	Duration (Months) 27		
	Bus Park	68.28	% Complete 100%	% Complete 35%		
	Reinstatement of Municipal building	31.20	Planned Value (PV) 57.0	Earned Value (EV) 57.00	6	18
	Bus Park	82.78	Start Date 15-Aug-16	Start Date 15-Aug-16		
	Bus Terminal	84.70	Completion 8-Nov-17	Finish 8-Nov-17		
	Bus Park	149.40	Duration (Months) 15	Duration (Months) 15		
	Improvement of meena bazar and drainage	27.69	% Complete 42%	% Complete 5%		
	Bus Terminal	65.31	Planned Value (PV) 38.43	Earned Value (EV) 4.58	6	7
	Bus Terminal	65.31	Start Date 5-Feb-15	Start Date 5-Feb-15	7	18

All Projects under study have followed the procedures set by Public Procurement Monitoring office of Nepal (PPMO). The Contractors have submitted the program using critical path method after commencement of works. The Earned value analysis has been performed to find out the cost performance index and Schedule performance index. The planned and actual dates, initial contract amount, Planned value (PV), Earned Value (EV), Actual value (AV), actual work completion date, Extension of time provided for the projects have been collected from the TDF and is tabulated table 1.

The Table 2 reveals that the contract amount for Birgunj Bus Park has highest value totalling NRs 177 million followed by Nepalgunj Bus Park (NRs 149.4 Million) and so on. Reinstatement of Municipal building at Nepalgunj is the project with least contract amount of NRs 31.20 Million. According to the planned start date and finish date, 5 out of 10 projects had to be completed 20 February, 2017. Similarly 2 out of 10 projects had to be completed more

than 70% and remaining projects had to be completed about 40% as on date. However, 4 projects had been completed with time extensions (2 times for all completed projects) and the percentage completion of the remaining projects are around 30% for the remaining projects which indicates the slow progress as compared to the planned duration.

For the Earned value analysis, the planned value is far more than the earned value which shows the slow progress of the work. Furthermore, the earned values for the projects (except two projects) are more than the actual value which indicates that the projects are within budget. The detailed Earned Value Analysis (EVA) based table 2 has been presented on table 3. Cost variance, Schedule Variance, Cost performance index, Schedule performance Index, Estimated cost to complete, estimated cost at complete and variance at completion has been calculated and discussed in the subsequent section.

Table 3.Earned Value Analysis

Status	Average Index	Forecast				Performance Index			Schedule	Cost		Actual	Earned	Budget		Item Description
		VAC	VAC (%)	EAC	ETC	SPI	CPI	SV (%)	SV	CV	CV (%)	AC	EV	PV	Overall BAC	
GREEN								-47%	(283)							
GREEN	1.44	27	47%	30	0	1.00	1.88	0%	0	47%	27	30.31	57.00	57.00	57.00	Pokhara Shopping Complex at Srijana Chowk
RED	0.27	(127)	-139%	219	208	0.12	0.42	-88%	(34)	-17%	(6)	10.93	4.58	38.43	91.50	Office cum Shopping Complex-Byas Municipality
GREEN	1.22	92	52%	85	55	0.35	2.08	-65%	(115)	18%	32	29.82	62.07	177.35	177.35	Birgunj Bus Park
GREEN	1.58	41	59%	28	14	0.69	2.46	-31%	(15)	41%	20	13.86	34.14	49.31	68.28	Birendranagar Bus Park
GREEN	1.13	7	21%	25	0	1.00	1.27	0%	0	21%	7	24.6	31.20	31.20	31.20	Reinstatement of Municipal building-Nepalgunj
RED	0.78	20	24%	63	56	0.23	1.32	-77%	(27)	6%	2	6.26	8.28	35.69	82.78	Bheemdatt Bus Park
RED	0.44	(48)	-57%	133	127	0.25	0.64	-75%	(13)	-14%	(2)	6.66	4.24	16.75	84.70	Biratnagar Bus Terminal
YELLOW	0.95	57	38%	92	74	0.28	1.62	-72%	(78)	11%	11	18.44	29.88	108.23	149.40	Nepalgunj Bus Park
GREEN												23.85	27.69	27.69	27.69	Improvement of meena bazar and drainage-Birgunj
GREEN	1.22	20	30%	46	0	1.00	1.44	0%	0	30%	20	45.5	65.31	65.31	65.31	Butwal Bus Terminal

Project Name



### Analysis of individual Projects under Study

The peer review of the individual projects reflects the following impression:

#### Pokhara Shopping Complex at Srijana Chowk

The Actual Cost incurred is less than Earned Value. The Cost variance is therefore positive and Cost performance Index is greater than unity. This means that the project is under Budget. However if there are positive or negative variations in individual items, those individual items are not dealt in this research.

The Planned Value is equal to the Earned Value and hence there is no schedule variance and the schedule performance index is equal to unity. This implies that the project is neither behind nor ahead of the schedule. It is very important to note here that though the SPI is unity in this project, the time has been extended two times (10 Months). Upon document review, it was found that the additional work had been provided in the total scope of work changing the overall Budgeted cost and time

#### Office cum Shopping Complex-Byas Municipality

The Actual Cost incurred is 10.93 million against earned value of 4.58 million. The Cost variance is therefore negative and Cost performance Index is less than unity (0.42). This means that the project has undergone severe cost overrun. It indicates that if these trends will go in the same pattern, the forecasted amount will be 219 million against budgeted value of 91 million. Since the variance as a whole had reached above 25%, the variation order must have to be passed through Councils of Ministers according to the sub clause 2.6 of the public procurement Act 2063 (First revision 2073) cited in sub-heading 2.10 of this study. In case of positive or negative variations in individual items, those individual items are not dealt in this research.

The Earned Value is less than the planned Value and hence the schedule variance is negative making schedule performance index less than unity (0.12). This implies that the project is far behind the schedule. Since the project has just started, the time extension to date has not been granted. However from the calculated SPI, CPI and average Index in the table 3, it is clear that immediate attention is needed by the management.

#### Birgunj Bus Park

The Actual Cost incurred is 29.82 million against earned value of 62.07 million. The Cost variance is therefore positive and Cost performance Index is greater than unity (2.08). This means that the project as a whole is within Budget. Since CPI is excessive high, it may be easily concluded that

the estimation has been done and/or the value quoted by the contractor is excessively on safe side, or there is also a chance that the initial approved scope within certain activities has been decreased drastically. In any case too high or low CPI value indicates that the case is not normal. However if there are positive or negative variations in individual items, those individual items are not dealt in this research.

The Earned Value is less than Planned Value and hence there is negative schedule variance and the schedule performance index is less than unity (0.35). Till date only 35% completed against planned value of 100%. This implies that the project is far behind schedule. 12 months' time has already been extended. The time has been extended in accordance with the Section 56 of Public Procurement Act (PPA) of PPMO which states that states that if the period of procurement contract is to be inevitably extended due to force majeure, failure of the Public Entity to make available the materials to be made available by it or other reasonable causes, the competent authority may extend the period on the prescribed grounds upon submission of application by the person obtaining procurement contract as cited in sub-heading 2.9 of this study. It is found that that the major cause of Schedule variance is the devastating earthquake that occurs on 25<sup>th</sup> April 2015 and due to the affect of Blockade. Both reasons were considered and declared as force majeure by the Employer and hence time extension has been done in accordance with section 56 of PPA.

#### Birendranagar Bus Park

The Actual Cost incurred is 13.86 million against earned value of 34.14 million. The Cost variance is therefore positive and Cost performance Index is greater than unity (2.46). This means that the project as a whole is within Budget. Since CPI is excessive high, it may be easily concluded that the estimation has been done and/or the value quoted by the contractor is excessively on safe side, or there is also a chance that the initial approved scope within certain activities has been decreased drastically. In any case too high or low CPI value indicates that the case is not normal. However if there are positive or negative variations in individual items, those individual items are not dealt in this research.

Since Earned Value is less than Planned Value, there is negative schedule variance and the schedule performance index is less than unity (0.69). Till date 50% work has been completed against planned value of 72%. This implies that the project is behind schedule. 12 months' time has already been extended. No time extension has been provided yet as the planned completion date has not crossed till date. (This data was collected on February 2017 where the planned completion date of this project was July 2017).

### **Reinstatement of Municipal building-Nepalgunj**

The Actual Cost incurred is 24.6 million against earned value of 31.20 million. The Cost variance is therefore positive and Cost performance Index is greater than unity (1.27). This means that the project as a whole is within Budget. Since CPI is high, it may be easily concluded that the estimation has been done and/or the value quoted by the contractor is excessively on safe side, or there is also a chance that the initial approved scope within certain activities has been decreased drastically. In any case too high or low CPI value indicates that the case is not normal. However if there are positive or negative variations in individual items, those individual items are not dealt in this research.

Since Earned Value is equal to the Planned Value, there is no schedule variance and the schedule performance index is unity. This implies that the project is neither behind nor ahead of the schedule. No time extension has been provided yet as the planned completion date has not crossed till date.

### **Bheemdatt Bus Park**

The Actual Cost incurred is 6.26 million against earned value of 8.28 million. The Cost variance is therefore positive and Cost performance Index is more than unity (1.34). The project as a whole is in Budget. If there are positive or negative variations in individual items, those individual items are not dealt in this research.

The Earned Value is less than Planned Value and hence there is negative schedule variance and the schedule performance index is less than unity (0.23). Till date only 10% completed against planned value of 43%. This implies that the project is far behind schedule. No time extension has been provided yet as the planned completion date has not crossed till date. (*This data was collected on February 2017 where the planned completion date of this project was November 2017*).

### **Biratnagar Bus Terminal**

The Actual Cost incurred is 6.66 million against earned value of 4.24 million. The Cost variance is therefore negative and Cost performance Index is less than unity (0.64). The project as a whole has undergone cost overrun. Only 5% works has been completed against planned value of 20%. The Budgeted cost of Biratnagar Bus Park is 84.70 million. Since the project is at its initial stage no variations order were prepared till date. If there are positive or negative variations in individual items, those individual items are not dealt in this research.

The Earned Value is less than Planned Value and hence there is negative schedule variance and the schedule performance index is less than unity (0.23). Till date only

5% completed against planned value of 20%. This implies that the project is far behind schedule. No time extension has been provided yet as the planned completion date has not crossed till date. (*This data was collected on February 2017 where the planned completion date of this project was February 2018*).

### **Nepalgunj Bus Park**

The Actual Cost incurred is 18.44 million against earned value of 29.88 million. The Cost variance is therefore positive and Cost performance Index is greater than unity (1.62). This means that the project as a whole is within Budget. Since CPI is excessive high, it may be easily concluded that the estimation has been done and/or the value quoted by the contractor is on safe side, or there is also a chance that the initial approved scope within certain activities has been decreased drastically. In any case too high or low CPI value indicates that the case is not normal. However if there are positive or negative variations in individual items, those individual items are not dealt in this research.

The Earned Value is far less than Planned Value and hence there is negative schedule variance and the schedule performance index is less than unity (0.28). Till date only 20% completed against planned value of 72%. This implies that the project is far behind schedule. No time has been extended yet as the planned completion date has not been elapsed till collection of this data. If the same trends continues, time extension has to be done in accordance with the Section 56 of Public Procurement Act (PPA) of PPMO which states that states that if the period of procurement contract is to be inevitably extended due to force majeure, failure of the Public Entity to make available the materials to be made available by it or other reasonable causes, the competent authority may extend the period on the prescribed grounds upon submission of application by the person obtaining procurement contract as cited in sub-heading 2.9 of this study. It is found that that the major cause of Schedule variance is due to the affect of Blockade which can be considered as force majeure.

### **Improvement of meena bazar and drainage- Birgunj**

The Actual Cost incurred is 23.85 million against earned value of 27.69 million. The Cost variance is therefore positive and Cost performance Index is greater than unity (1.62). This means that the project as a whole is within Budget. Since CPI is excessive high, it may be easily concluded that the estimation has been done and/or the value quoted by the contractor is excessively on safe side, or there is also a chance that the initial approved scope within certain activities has been decreased drastically. In any case too high or low CPI value indicates that the case is not normal. However if there are positive or negative variations in individual items, those individual items are not dealt in this research.

The project has already been completed. 6 months' on the first EoT and 18 Months on the second EoT has been granted totalling 24 months. The initial duration provided to the contractor during project commencement was 15 months and it took 39 month to complete the work. Further to the documents available, it is revealed that local issues and shortage of materials are the main cause for this extension of time which means that the conditions are beyond the contractor's jurisdiction. The time has been extended in accordance with the Section 56 of Public Procurement Act (PPA) of PPMO which states that states that if the period of procurement contract is to be inevitably extended due to force majeure, failure of the Public Entity to make available the materials to be made available by it or other reasonable causes, the competent authority may extend the period on the prescribed grounds upon submission of application by the person obtaining procurement contract as cited in sub-heading 2.9 of this study.

### Butwal Bus Terminal

The Actual Cost incurred is 45.50 million against earned value of 65.31 million. The Cost variance is therefore positive and Cost performance Index is greater than unity (1.44). The project has already been completed. This means that the project as a whole completed within Budget. Since CPI is high, it may be easily concluded that the estimation has been done and/or the value quoted by the contractor is excessively on safe side, or there is also a chance that the initial approved scope within certain activities has been decreased drastically. In any case too high or low CPI value indicates that the case is not normal. However if there are positive or negative variations in individual items, those individual items are not dealt in this research.

The project has already been completed. 7 months' on the first EoT and 18 Months on the second EoT has been granted totalling 25 months. The initial duration provided to the contractor during project commencement was 18 months and it took 43 month to complete the work. Further to the documents available, it is revealed that local issues and shortage of materials are the main cause for this extension of time which means that the conditions are beyond the contractor's jurisdiction. The time has been extended in accordance with the Section 56 of Public Procurement Act (PPA) of PPMO which states that states that if the period of procurement contract is to be inevitably extended due to force majeure, failure of the Public Entity to make available the materials to be made available by it or other reasonable causes, the competent authority may extend the period on the prescribed grounds upon submission of application by the person obtaining procurement contract.

In Particular, cost performance index of 8 out of 10 projects are all positive indicating that the projects are within the Budget. Despite of the price escalation and increasing price

of resource each year, the CPI of the projects are within budget. The reason may be one or all of the followings:

- Public entities, especially Government owned entities have to follow the Public procurement act and Public procurement regulation strictly. In PPA, it has been clearly delineated the process that have to be adapted in case of variations (*Cited in sub Heading 2.9 of this study*). As such, there is a common trend that public entities generally prepare cost estimates of the project keeping themselves in some higher side. In addition, provisions are made for physical escalation and price escalations also in the estimate. After approval of estimates, the quantity calculated in Bill of Quantity are generally on the safer side which compels the contractors' to bid in accordance with that quantity. During implementation, however, real quantities may differ from that originally quoted in bill of quantities.
- The Government owned public entities, in general, have to execute the works in close coordination with the public. Several stakeholders are involved in the project. The interests of the stakeholders may conflict which results in the avoidance as well as additions of some of the quantities that were not previously foreseen.

Similarly, the comparative study of the projects under study shows that Schedule Variance (SV) of 6 out of 10 projects are negative which indicates that the projects are behind the schedule and that for remaining 4 out of 10 projects are 'zero' indicating that projects are neither behind nor ahead of the approved schedule. In no case, it is observed that the projects were/are completed in time. Time overrun seems serious issues among the government undertaking projects. The reason may be one or all of the followings:

- Unlike the provisions made for cost variation, there are no such hard and fast rules set for time extension. And it cannot be. In-fact, there are several factors causing time overrun and those factors are not within the control of the Employers and Contractors. For example, commotion, riots, blockades, Nepal Bandh, Force majeure etc.
- Ideal time for completion of the project were awarded during contract agreement. Hurdles that may come in between are not generally considered.
- According to the PPA and PPR, if the contractor submits, the claims for extension of time with the validated and proven reasons, the project manager has to extend the time based on those grounds.
- The Government owned public entities, in general, have to execute the works in close coordination with the public. Several stakeholders are involved in the project. The interests of the stakeholders may conflict which results in the delay of the construction projects.

The average index has been calculated as an average of SPI

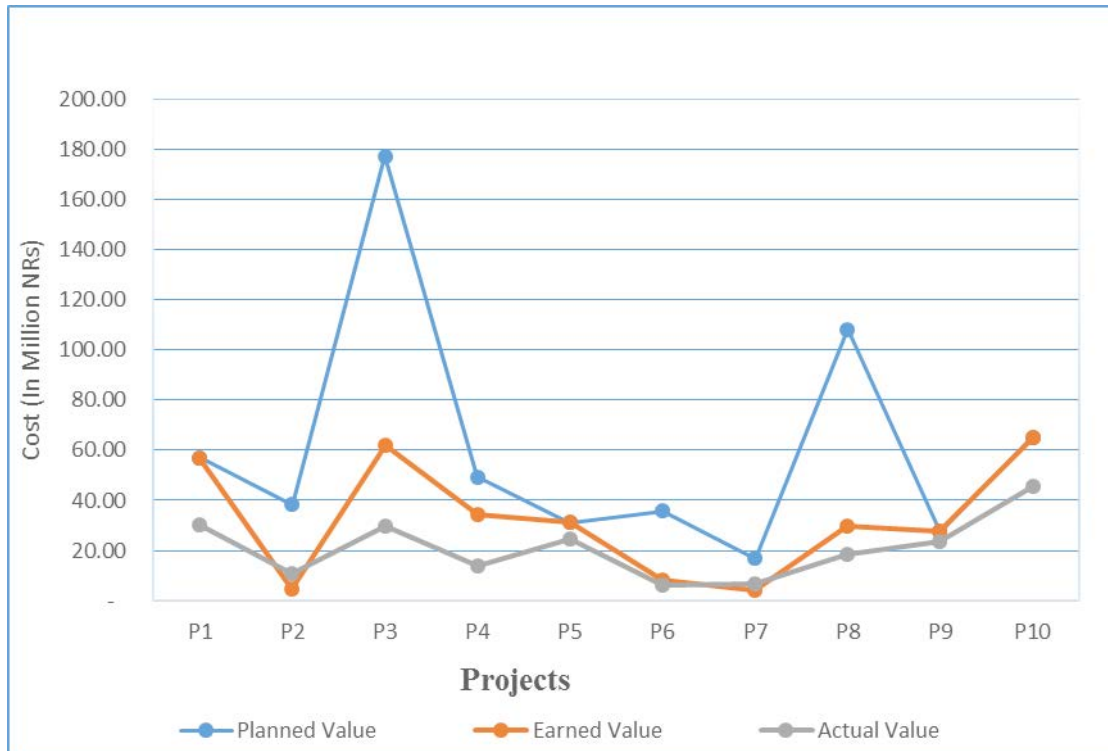


Figure 2. Earned Value Chart

and CPI. The projects having average index less than 0.85 has been considered as a project that needs immediate attention, those projects having index between 1 to 0.85 has been considered as slightly behind Schedule/Budget and the projects with average index 1 has been considered as the project on track. Following table 3, it was found that the projects Office cum shopping complex at Byas Municipality, Bheemdatt Bus Park and Biratnagar Bus terminal needs immediate attention as the average index of those projects are less than 0.85. Nepalgunj Bus Park is slightly behind the Schedule while the remaining projects are on track. It is to be noted here that though almost all projects are farther behind the Schedule, the average index seems deficient to address each indices closely.

Though the average index is still greater than unity. For each individual projects the table provided 3 has given the clear picture.

The mean planned duration for the projects under study is 15.2 Months with standard deviation of 1.03 Months for 75 percent work completion (with standard deviation of 30 percent) while the mean actual duration for those projects were 24.70 Months with Standard Deviation of 11.64 Months for 53 percent work complete in average (with 43 percent standard deviation). The result shows that all of the projects under study lies farther behind the planned schedule. The factors for the project under-performance were found almost common in all projects. The factors mentioned by the Client and the consultant as per the verbal communication is listed hereunder:

- Political Instability
- Scarcity of the Materials
- Changes/Variations in Design/Drawings /Documents
- Land Disputes
- Internal Disputes
- Strikes
- Border Blockade
- Natural Disasters

### Conclusion

Time overrun and cost overrun are critical consequences that are usually imparted due to poor project performance functions in construction of public projects. This research has been conducted to find out deviation of the Actual date of completion from planned date using earned value analysis method, perceived view on the factors affecting the performance and their effects in ongoing projects under TDF funding, perceived view on the effect of those factors on the projects and analysis of the time extended on the projects under study.

The study revealed that the cost performance index (CPI) of 8 out of 10 projects is all positive indicating that the projects are within the Budget. Despite of the price escalation and increasing price of resource each year, the CPI of the projects are within budget. The CPI of pokhara shopping complex at Srijana chowk is greater than unity which indicates that the project is under budget. Similarly, CPI of Birgunj Bus-park is greater than unity (2.08) and hence the project as a whole is within Budget. Same is the case with

Biratnagar Bus-park also. Cost performance Index is greater than unity (2.46) indicating that the project as a whole is within Budget. Since CPI is excessive high, it may be easily concluded that the estimation has been done and/or the value quoted by the contractor is excessively on safe side, or there is also a chance that the initial approved scope within certain activities has been decreased drastically. Similarly, CPI of Reinstatement of Municipal building in Nepalgunj, Bheemdatt Bus-park, Nepalgunj Bus-park, Improvement of meena Bazaar in Birgunj and Butwal Bus terminal are 1.27, 1.32, 1.62, 1.16 and 1.44 respectively also greater than unit (1.27) which shows the project is within Budget. CPI of office cum shopping complex at Byas municipality is observed less than unity (0.42). The project has undergone severe cost overrun. Only 5% has been completed and therefore the variation order has not been raised till date. However, if this trend continues, the cost overrun will exceed 25% and the variation order must have to be passed through Councils of Ministers. Despite of the price escalation and increasing price of resource each year, the CPI of the projects are within budget. Public entities, especially Government owned entities have common trend to prepare cost estimates of the project keeping themselves in some higher side so as to avoid the cost variation as far as possible.

It is revealed that the Scheduled performance index (SPI) of Office cum Shopping Complex in Byas Municipality, Birgunj Bus Park, Birendranagar Bus Park, Bheemdatt Bus Park, Biratnagar Bus Terminal and Nepalgunj Bus Park are 0.12, 0.35, 0.69, 0.23, 0.25 and 0.28 respectively. The SPI with values less than unit indicates the time overrun in the projects. 6 out of 10 projects have passed through time overrun. Similarly, Pokhara Shopping Complex at Srijana Chowk, Reinstatement of Municipal building in Nepalgunj, Improvement of meena bazar and drainage in Birgunj and Butwal Bus Terminal are 1.00 each which signifies that the projects are neither behind nor ahead of the schedule. In no case, it is observed that the projects were/are completed in time. Time overrun seems serious issue among the government undertaking projects. The severe times overrun in the projects under study were actually due to the reason that Ideal time for completion of the project were awarded during contract agreement. Hurdles that may come in between has not been considered.

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