

## **REVIEW OF VARIANCE ANALYSIS IN UNIT PRICE OR LUMP-SUM BASIS CONTRACTS FOR A CONSTRUCTION PROJECT**

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### **Abstract:**

*Project cost control became a critical issue for the construction projects under global recession. There are various methods for cost controlling according to types of contracts. Crucial difference in principal is between Lump-sum and Unit-Price basis contracts.*

*According to my past construction projects experience, usually a project can be completed on time, with acceptable safety, security, health and environmental conditions and in acceptable quality. But cost variance has been always encountered in projects because of a lot heterogeneous construction conditions.*

*Effects of two difference type of contract as unit price and lump-sum basis have been reviewed in this study.*

*Planned profit had been defined according to the cost report in the beginning of the project that was carried out in Bucharest.*

*But the contractor paid more money at the end of the project in spite of quantities of some items were increased under unit price basis contract. Because unit prices of the work items were defined mistakenly without making a comprehensive study.*

*Furthermore, at the end of the project actual overhead costs increased because of additional fixed and time related costs those could not estimate by the contractor.*

*In condition of lump-sum basis contract, as a result of some increased or new appeared job items have not been paid by the client because of the contract spirit, gross income has been changed to lose money.*

*As is understood, the contractor could not evaluate comprehensively all the contract documents, especially structural drawings have not been reviewed and made calculation precisely.*

**Key words:** Cost Analysis, Earned Value Analysis, Lump-sum basis, Unit-price basis

### **Introduction**

Nowadays cost controlling plays a role at construction projects under heterogeneous construction costs and financial circumstances in the world.

Recently, the world economy sank into recession and project cost control became a critical issue for the developers as well as the construction companies in managing construction projects.

Furthermore, growing globalization minded constructors under easy international travelling, internet possibilities and cheapening of material transportation all over the world have been caused significantly increasing of competition.

Construction companies who have broad vision have been started to apply cost control methods defined according to type of the contract.

There are variable methods for construction cost controlling according to types of contract. Most important principal difference is between Lump sum / Fixed Price and Unit Price contracts. The other types of contract have similar comparison techniques for cost controlling.

According to past construction projects experience, a project can be completed on time, with acceptable safety, security, health and environmental conditions and in acceptable quality.

But cost variance is always encountered in projects because of a lot of construction variables.

In parallel with cost variance, time variance appears time to time depend variable construction conditions.

In order to clarify what is the effect of two difference type of contract, the review of variance analysis has been presented in this study.

In other words, profitability of the project has been searched for two types of the contract.

This study gives a cost variance analysis regarding a structural works of a sport club in Bucharest that had been completed in the past with comparison between lump-sum and unit price basis contracts.

### A) UNIT PRICE BASIS CONTRACT

It was a unit price basis contract and in the beginning of the project, 13,27% gross profit (2.199.177 EURO of gross income) had been planned according to the project budget as shown in table.1.

The contractor could receive payment for all quantities of the work items he performed because of Unit Price Basis contract conditions. Generally contractor has less responsibility on the quantities with unit price basis contracts than lump-sum basis.

In spite of under this more easy contract condition, the contractor paid an amount of 1.039.420 EURO more money to total work items because of mistakenly established unit prices of the work items.

This was crucial mistake, shown the contractor couldn't evaluate properly unit price of activities. All the items must be precisely evaluated by unit cost. For example, it isn't same man-hour making foundation formwork and columns or beams formwork.

If you estimate same cost your calculation affects the cost negatively, or you should make estimation by using a weighted average method.

If we turn the case study, total gross income has decreased to 1.225.700 EURO shown in Table.2 (6,50% of gross profit) in spite of increasing of work item quantities.

<b>N CONSTRUCTION COMPANY</b>		
<b>CLUB TULIP BUILDING</b>		
<b>STRUCTURAL WORKS</b>		
<b>BUCHAREST / ROMANIA</b>		
<b>Type of The Contract: UNIT PRICE BASIS</b>		
<b>PROFIT AND LOSS STATEMENT OF THE PROJECT</b>		
<b>(PLANNED REVENUE, COST and OVERHEAD)</b>		
<b>ADVANCE PAYMENT : 1.656.698 EURO</b>		
<b>DURATION OF THE PROJECT : 5 MONTHS</b>		
<b>PLANNED REVENUE :</b>	<b>16.566.975</b>	<b>EURO</b>
<b>TOTAL PLANNED DIRECT COST :</b>	<b>13.297.103</b>	<b>EURO</b>
<b>TOTAL PLANNED OVERHEAD (5 Months) :</b>	<b>1.070.695</b>	<b>EURO</b>
<b>(FIXED OVEERHEAD :</b>	<b>500.313</b>	<b>EURO)</b>
<b>(TIME RELATED OVERHEAD :</b>	<b>570.382</b>	<b>EURO)</b>
<b>TOTAL PLANNED COST (DIRECT + OVERHEAD):</b> <b>(16.565.040 + 1.070.695)</b>	<b>14.367.798</b>	<b>EURO</b>
<b>NET PLANNED INCOME (16.566.975 - 14.367.798)</b>	<b>2.199.177</b>	<b>EURO</b>
<b>RATE OF GROSS PROFIT ( 2.199.177 / 16.566.975 )</b>	<b>13,27%</b>	

Table.1: Planned profit and loss statement of the project

<b>N CONSTRUCTION COMPANY</b>		
<b>CLUB TULIP BUILDING</b>		
<b>STRUCTURAL WORKS</b>		
<b>BUCHAREST / ROMANIA</b>		
<b>Type of The Contract: UNIT PRICE BASIS</b>		
<b>PROFIT AND LOSS STATEMENT OF THE PROJECT</b>		
<b>(ACTUAL REVENUE, ACTUAL COST and PLANNED OVERHEAD)</b>		
<b>ADVANCE PAYMENT : 1.656.698 EURO</b>		
<b>DURATION OF THE PROJECT : 5 MONTHS</b>		
<b>ACTUAL REVENUE :</b>	<b>18.861.435</b>	<b>EURO</b>
<b>TOTAL ACTUAL DIRECT COST :</b>	<b>16.565.040</b>	<b>EURO</b>
<b>TOTAL ACTUAL OVERHEAD (5 Months) :</b>	<b>1.070.695</b>	<b>EURO</b>
<b>(FIXED OVERHEAD : 500.313 EURO)</b>		
<b>(TIME RELATED OVERHEAD : 570.382 EURO)</b>		
<b>TOTAL COST (DIRECT + OVERHEAD) :</b>		
<b>(16.565.040 + 1.070.695)</b>	<b>17.635.735</b>	<b>EURO</b>
<b>NET INCOME (18.861.435 - 17.635.735)</b>	<b>1.225.700</b>	<b>EURO</b>
<b>RATE OF GROSS PROFIT ( 1.225.700 / 18.861.43</b>	<b>6,50%</b>	

**Table.2: Actual profit and loss statement of the project (Unit Price basis)**

Furthermore, at the end of the project actual overhead costs increased from 1.070.695 EURO to 1.213.855 EURO because of additional fixed and time related costs those could not estimate by the contractor.

Overhead is another issue that isn't related directly operation on the site, but it is always supportive service to the site performance. Overhead has a wide volume of site responsibilities, if one of them doesn't proceed properly, all site works will be affected. As understood it was crucial issue and in order to establish well collaboration overhead items should be well organized.

Planned and actual overheads in total and monthly basis are given in table.3. Overheads are defined according to project characteristics, scale, features, type of construction, work schedule and condition of location.

Cost management department or cost engineer should prepare overheads according to their past experience, data, or receiving realistic knowledge from literature, or other companies, managers etc.

Also unit prices must be realistic and updated, otherwise the contractor enter in a position like explain in this study regarding extra overhead.

N CONSTRUCTION COMPANY  
CLUB TULIP BUILDING STRUCTURAL WORKS  
ACTUAL MONTHLY OVERHEAD  
BUCHAREST / ROMANIA

ITEM NR.	OVERHEAD FEES	TOTAL BUDGET	BUDGET OF 1. MONTH	BUDGET OF 2. MONTH	BUDGET OF 3. MONTH	ACTUAL COST OF 1. MONTH	BUDGET OF 1. MONTH	BUDGET OF 2. MONTH	BUDGET OF 3. MONTH	ACTUAL COST OF 1. MONTH	BUDGET OF 1. MONTH	ACTUAL COST OF 1. MONTH	BUDGET OF 1. MONTH	ACTUAL COST OF 1. MONTH	ACTUAL TOTAL
1	SALARIES FOR ANS ACCOMMODATION (Romania Visa working and residential permit flight tickets for Turkish and Moldovan workers)	392.829	119.000	108.000	118.000	56.910	56.910	85.000	56.910	72.000	56.607	56.000	56.607	56.000	423.000
2	MACHINERIES AND EQUIPMENT RENTAL EXPENSES	67.500	22.000	17.000	19.000	13.500	13.500	15.400	9.000	13.500	6.000	6.000	6.000	8.300	79.800
3	WAREHOUSE, DORMITORY BUILDINGS WITH CENTRAL HEATING SYSTEM, WC BUILDING	91.926	35.000	30.000	33.000	17.872	17.872	19.600	4.326	4.900	4.326	4.326	4.326	3.850	99.850
4	FUEL OIL, GASOLINE	23.000	4.800	4.800	5.100	4.604	4.604	4.960	4.604	5.460	4.604	4.604	4.604	5.500	25.510
5	LETTERS OF GUARANTEE EXPENSES	202.992	75.000	41.870	45.000	11.603	11.603	13.500	11.603	13.500	11.603	11.603	11.603	13.500	212.950
6	INSURANCE PREMIUMS	9.660	1.912	2.700	2.250	1.912	1.912	2.100	1.912	2.400	1.912	1.912	1.912	1.800	11.250
7	ELECTRIC AND WATER CONSUMPTION	6.000	750	750	600	750	750	700	750	875	750	750	750	650	3.275
8	COMMUNICATION EXPENSES	3.750	1.200	1.200	1.000	1.200	1.200	1.130	1.200	1.400	1.200	1.200	1.200	1.020	5.100
9	HAIRDRESS	9.000	3.200	3.200	1.000	3.200	3.200	3.200	3.200	3.200	3.200	3.200	3.200	3.200	9.200
10	QUALITY CONTROL	14.000	5.912	4.912	4.000	4.912	4.912	4.900	4.912	5.000	4.912	4.912	4.912	5.000	14.500
11	EQUIPMENT AND TOOLS	5.100	3.000	4.100	2.100	4.100	4.100	2.100	4.100	2.100	4.100	4.100	4.100	2.100	9.000
12	BANK COMMISSIONS	22.000	7.412	6.900	6.700	4.712	4.712	5.400	4.712	3.980	2.412	2.412	2.412	1.725	26.305
13	GENERAL TRANSPORTATION	7.500	1.500	1.500	1.250	1.500	1.500	1.250	1.500	1.250	1.500	1.500	1.500	1.250	6.250
14	CAR RENTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	GUEST HOUSE RENTS	3.500	700	700	850	700	700	900	700	1.100	700	700	700	650	4.350
16	MAINTENANCE	2.500	500	500	500	500	500	600	500	725	500	500	500	450	3.175
17	CUSTOM CLEARANCE EXPENSES	2.550	1.550	2.350	700	500	500	562	500	3.750	1.000	1.000	1.000	3.240	3.610
18	NOTARY	5.000	1.000	1.750	2.400	1.000	1.000	3.750	1.000	3.750	1.000	1.000	1.000	3.240	14.920
19	CONSULTANCY	9.044	5.809	7.600	4.500	2.309	3.08	1.650	3.08	550	309	309	309	280	14.580
20	MOBILIZATION EXPENSES	750	150	150	450	150	150	100	150	230	150	150	150	459	1.599
21	TRAVEL EXPENSES	2.500	500	500	400	500	500	450	500	375	500	500	500	230	1.800
22	STATIONARY EXPENSES	4.250	3.200	3.900	3.900	3.900	3.900	3.45	3.900	450	500	500	500	560	7.900
23	WORK AND RESIDENCE PERMITS (MATERIALS, ETC)	2.600	500	650	700	500	500	345	500	450	500	500	500	560	2.706
24	CONSUMABLES (BEVERAGES, CLEANING MATERIALS, ETC)	2.000	400	350	600	400	400	780	400	670	400	400	400	1.150	3.950
25	SITE PANNELS	8.500	5.600	2.850	2.500	2.000	2.000	400	400	340	50	50	50	150	8.000
26	IT NETWORK	5.244	3.000	2.050	2.000	56	56	400	56	340	56	56	56	150	5.540
27	TELEPHONE NETWORK SYSTEM	5.244	2.050	3.000	3.000	250	250	200	56	200	56	56	56	100	6.850
28	OFFICE EQUIPMENT (Photocopy, fax machines etc)	19.270	15.335	15.900	750	235	235	450	235	470	235	235	235	100	17.670
29	SECURITY	33.500	6.700	7.500	6.700	6.700	6.700	1.250	6.700	450	6.700	6.700	6.700	7.500	37.000
30	ELECTRICAL MATERIALS (PANNELS, CABLES)	14.000	10.000	12.500	3.000	4.000	1.250	1.250	4.000	450	4.000	4.000	4.000	17.200	
31	WATER PUMPS AND TANKS	5.100	5.100	6.500	560	560	560	230	560	560	560	560	560	7.000	19.200
32	SIGHT LIGHTENING	16.154	3.471	6.100	3.400	4.71	4.71	1.900	4.71	2.345	4.71	4.71	4.71	16.526	
33	WORK SAFETY AND SECURITY	150	30	125	75	30	30	30	30	125	30	30	30	369	
34	FINES	0	0	0	0	0	0	0	0	0	0	0	0	0	
35	TRANSLATION	9.471	294	294	200	294	294	455	294	450	294	294	294	16.500	
36	FINAL CLEANING OF COMPLETED WORKS	10.000	2.000	2.000	1.900	2.000	2.000	1.900	2.000	2.000	2.000	2.000	2.000	3.650	
37	SITE CLEANING, THROWING DEBRIS	5.100	3.100	3.200	3.200	3.200	3.200	3.200	3.200	3.200	3.200	3.200	3.200	12.700	
38	HEATING	1.070.695	365.946	262.516	289.185	174.201	217.570	151.402	185.485	116.630	134.065	1.213.855			
39	TOTAL (EURO)	1.070.695	365.946	262.516	289.185	174.201	217.570	151.402	185.485	116.630	134.065	1.213.855			

Table.3: Planned and actual overhead (realized total and monthly)

**COMPARISON BETWEEN PLANNED AND ACTUAL OVERHEAD**

	PLANNED OVERHEAD	ACTUAL OVERHEAD	DIFFERENCE	RATE OF INCREASING
FIXED COST	500.312	537.968	37.656	7,53%
TIME RELATED	570.382	675.887	105.505	18,50%
<b>TOTAL (EURO)</b>	<b>1.070.695</b>	<b>1.213.855</b>		

**Table.4: Comparison study between planned and actual overhead**

As shown above table.4, cost variance of time related overhead increased in 18,50 %, as more than fixed overhead. As a result of this table, fixed overhead has not been predicted properly by the contractor, also same situation is exist for fixed cost but not as much as time related overhead.

Together with actual overheads, total gross income has decreased to 1.082.540 EURO with 5,74 % gross profit rate as in table.3.

Finally gross profit rate has down from 13,27 % to 5,74 % and 1.128.482 EURO has been lost by the contractor under unit price basis contract as shown in table.5.

<b>N CONSTRUCTION COMPANY</b>		
<b>CLUB TULIP BUILDING</b>		
<b>STRUCTURAL WORKS</b>		
<b>BUCHAREST / ROMANIA</b>		
<b>Type of The Contract: UNIT PRICE BASIS</b>		
<b>PROFIT AND LOSS STATEMENT OF THE PROJECT</b>		
<b>(ACTUAL REVENUE, ACTUAL COST and ACTUAL OVERHEAD)</b>		
<b>ADVANCE PAYMENT : 1.656.698 EURO</b>		
<b>DURATION OF THE PROJECT : 5 MONTHS</b>		
<b>ACTUAL REVENUE :</b>	<b>18.861.435</b>	<b>EURO</b>
<b>TOTAL ACTUAL DIRECT COST :</b>	<b>16.565.040</b>	<b>EURO</b>
<b>TOTAL ACTUAL OVERHEAD (5 Months) :</b>	<b>1.213.855</b>	<b>EURO</b>
(FIXED OVERHEAD : 537.968 EURO)		
(TIME RELATED OVERHEAD : 675.887 EURO)		
<b>TOTAL COST (DIRECT + OVERHEAD) :</b>	<b>17.778.895</b>	<b>EURO</b>
(16.565.040 + 1.213.855)		
<b>NET INCOME (18.861.435 - 17.635.735)</b>	<b>1.082.540</b>	<b>EURO</b>
<b>RATE OF GROSS PROFIT ( 1.082.540 / 18.861.435)</b>	<b>5,74%</b>	

**Table.5: Actual revenue, cost and overhead**

## B) LUMP-SUM BASIS CONTRACT

Variance analysis as a comparison study has been prepared according to lump-sum basis contract.

In condition of lump-sum basis contract, as a result of some increased or new appeared job items have not been paid by the client because of the contract spirit, gross income has been converted to lose money as 969.360 EURO (- 5,82% of gross loss rate) as you see in table.6.

Besides, in considering increased overhead, loss of money has been reached to 1.112.420 EURO (- 6,67% of gross loss rate) as seen in table.7.

Bidding department of the contractor must review all the bid documents in highly precise level and they must keep their mind that how can find grey areas in the tender stage in order to prepare price during the construction period.

As a result of mistakenly signed contract BOQ, the contractor has been lost an amount of 2.586.460 EURO.

As is understood, the contractor could not evaluate comprehensively all the contract document, especially structural drawings have not been reviewed and made calculation precisely.

<b>N CONSTRUCTION COMPANY</b>		
<b>CLUB TULIP BUILDING</b>		
<b>STRUCTURAL WORKS</b>		
<b>BUCHAREST / ROMANIA</b>		
<b>Type of The Contract: LUMP-SUM BASIS</b>		
<b>PROFIT AND LOSS STATEMENT OF THE PROJECT</b>		
<b>(ACTUAL REVENUE, ACTUAL COST and PLANNED OVERHEAD)</b>		
<b>ADVANCE PAYMENT : 1.656.698 EURO</b>		
<b>DURATION OF THE PROJECT : 5 MONTHS</b>		
<b>ACTUAL REVENUE :</b>	<b>16.666.475</b>	<b>EURO</b>
<b>TOTAL ACTUAL DIRECT COST :</b>	<b>16.565.040</b>	<b>EURO</b>
<b>TOTAL ACTUAL OVERHEAD (5 Months) :</b>	<b>1.070.695</b>	<b>EURO</b>
<b>(FIXED OVEERHEAD :</b>	<b>500.313</b>	<b>EURO)</b>
<b>(TIME RELATED OVERHEAD :</b>	<b>570.382</b>	<b>EURO)</b>
<b>TOTAL COST (DIRECT + OVERHEAD) :</b>	<b>17.635.735</b>	<b>EURO</b>
<b>(16.565.040 + 1.070.695)</b>		
<b>GROSS LOSS (16.666.475 - 17.635.735)</b>	<b>-969.260</b>	<b>EURO</b>
<b>RATE OF GROSS LOSS (969.260 / 16.666.475)</b>	<b>-5,82%</b>	

Table.6: Actual revenue and cost and planned overhead (Lump-sum basis)

<b>N CONSTRUCTION COMPANY</b>			
<b>CLUB TULIP BUILDING</b>			
<b>STRUCTURAL WORKS</b>			
<b>BUCHAREST / ROMANIA</b>			
<b>Type of The Contract: LUMP-SUM BASIS</b>			
<b>PROFIT AND LOSS STATEMENT OF THE PROJECT</b>			
<b>(ACTUAL REVENUE, ACTUAL COST and ACTUAL OVERHEAD)</b>			
<b>ADVANCE PAYMENT : 1.659.698 EURO</b>			
<b>DURATION OF THE PROJECT : 3 MONTHS</b>			
<b>ACTUAL REVENUE :</b>		<b>16.666.475</b>	<b>EURO</b>
<b>TOTAL ACTUAL DIRECT COST :</b>		<b>16.966.040</b>	<b>EURO</b>
<b>TOTAL ACTUAL OVERHEAD (3 Months) :</b>		<b>1.213.866</b>	<b>EURO</b>
<b>(FIXED OVERHEAD :</b>	<b>537.968</b>	<b>EURO)</b>	
<b>(TIME RELATED OVERHEAD :</b>	<b>675.897</b>	<b>EURO)</b>	
<b>TOTAL COST (DIRECT + OVERHEAD) :</b>			
	<b>(16.966.040 + 1.213.866)</b>	<b>17.779.906</b>	<b>EURO</b>
<b>GROSS LOSS (16.666.475 - 17.779.906)</b>		<b>-1.112.420</b>	<b>EURO</b>
<b>RATE OF GROSS LOSS (969.260 / 16.666.475)</b>		<b>-6,67%</b>	

Table.7: Actual revenue and cost and actual overhead (Lump-sum basis)

There are a lot of increased quantities of work items in Superstructural Works in spite of no any design change.

The contractor should revise one's opinions of bidding department of whoever is responsible for bidding.

As a result of mistakenly signed contract BOQ, the contractor lost an amount of 2.586.460 EURO.

In table 8, an evaluation is given on reasons of increased quantities under lump-sum basis contract conditions.



N CONSTRUCTION COMPANY  
 CLUB TULIP BUILDING  
 STRUCTURAL WORKS  
 BUCHAREST / ROMANIA  
 AN EVALUATION STUDY UNDER LUMP-SUM BASIS CONTRACT RELATED INCREASED QUANTITIES AND THEIR REASONS

No.	Description	Unit	Contractual Quantity	Actual Quantity	Difference of Quantity	Evaluation according to the contract type
<b>INFRASTRUCTURE</b>						
1	Mechanical excavation & disposal	m3	44.000,00	44.000,00	0,00	All these increased quantities have been coming from design revision of the foundation works. The contractor performed this extra works by change orders approved from the client. All extra cost was received by the contractor.
2	Stabilized filling material (including transportation & compacted)	m3	3.265,00	3.695,00	430,00	
3	Crushed Stone Fill 6-7 mm & Compaction	m3	1.680,00	1.925,00	245,00	
4	Lean concrete C8/10 h=10 cm	m3	365,00	475,00	90,00	
5	R. Concrete, C16/20 (foundation)	m3	3.945,00	4.020,00	75,00	
6	R. Concrete, C20/25	m3	8.050,00	8.075,00	25,00	
7	Formwork	m3	71.575,00	71.665,00	90,00	
8	Rebar	Ton	2.480,00	2.525,00	45,00	
9	Water Insulation by 1 layer of 3 mm thick bituminous membrane (Mat Foundation & Wall)	m2	2.700,00	3.050,00	350,00	
10	Insulation Protection by Brickwall, 12,5 cm thick	m2	3.200,00	3.550,00	350,00	
11	Polyethylene layer	m2	5.150,00	5.200,00	50,00	
				0,00	0,00	
<b>SUPERSTRUCTURE</b>						
				0,00	0,00	Increased quantities have been coming from wrong quantity calculations and inadequate design evaluation in the tender period. Complementary R.C. Concrete and Steel elements were not taken into consideration in the calculation and corrected in BOQ. Finally the contractor can never ask extra payment for this extra quantity of works under LUMP-SUM CONTRACT PRINCIPAL.
1	R. Concrete, C32/40	m3	9.376,00	11.050,00	1.674,00	
2	Formwork	m2	76.800,00	83.100,00	6.300,00	
3	Rebar	Ton	2.950,00	3.050,00	100,00	
4	Steel construction	Ton	1.065,000	1.595,000	530,00	
6	Brick wall width 25 cm	m3	890,00	1.246,00	356,00	

**Table.8: An evaluation study under lump-sum basis contract related quantity deviations**

You can see keeping planned cost performance in table 10 and shown in figure 1 and CPI is given in figure 2. for unit basis contract.

N CONSTRUCTION COMPANY  
 CLUB TULIP BUILDING  
 STRUCTURAL WORKS  
 BUCHAREST / ROMANIA  
 EARNED VALUE ANALYSIS (UNIT PRICE BASIS)

	1. month	2. month	3. month	4. month	5. month
Planned Value (PV)	2.588K	3.698K	3.516K	2.044K	1.450K
Actual Cost (AC)	2.360K	4.546K	3.872K	2.221K	3.566K
Earned Value (EV)	2.000K	4.018K	3.720K	2.221K	3.566K
Cost Performance Index (CPI)	84,75%	88,39%	96,07%	100,00%	100,00%
Schedule Performance Index (SPI)	77,28%	108,65%	105,80%	108,66%	245,93%
	1. month	2. month	3. month	4. month	5. month
Cost Performance Index (CPI)	84,75%	88,39%	96,07%	100,00%	100,00%
	1. month	2. month	3. month	4. month	5. month
Schedule Performance Index (SPI)	77,28%	108,65%	105,80%	108,66%	245,93%

**Table.10: Earned value analysis in unit price basis**

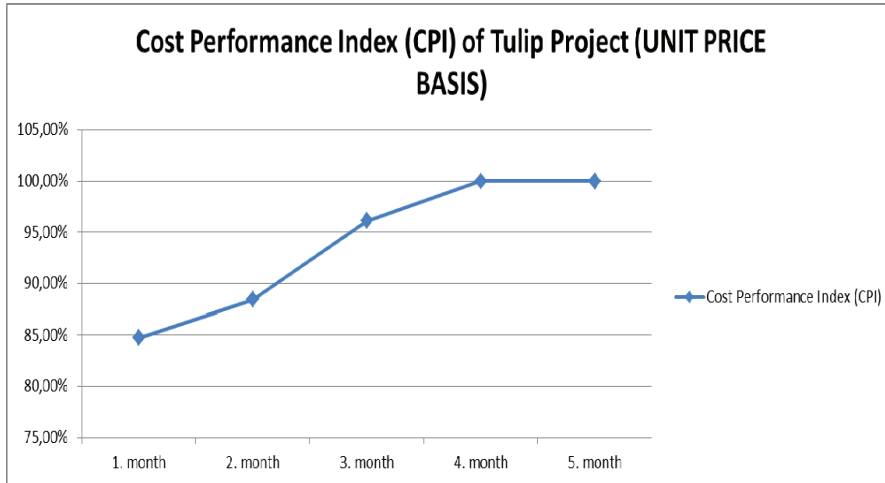


Figure.1 Cost performance index (CPI) in Unit price basis

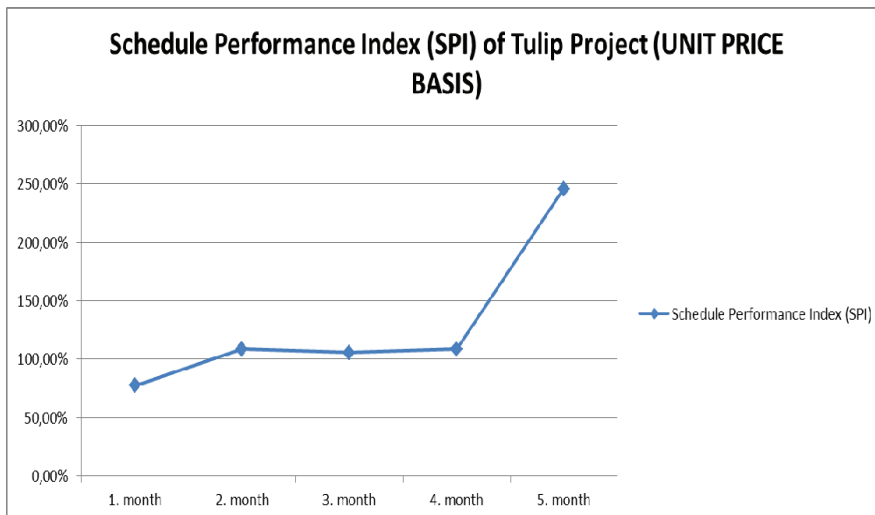


Figure.2: Schedule performance index (SPI) in unit price basis

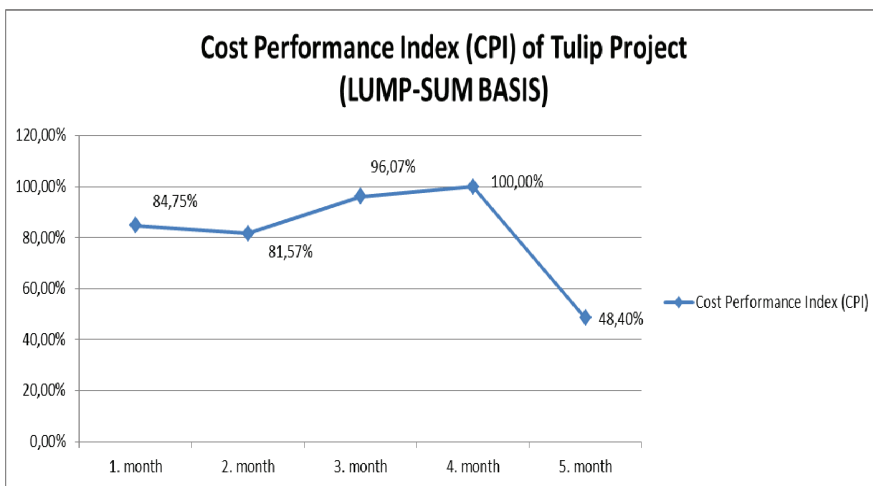
Also keeping planned cost performance for lump-sum basis contract is given in table 11 and shown in figure 3. SPI is given in figure 4. As seen cost performance has sharp fall, because the contractor could encounter some quantity of works couldn't have been paid him. Also client and supervisor paid all the quantities what contractor performed. They became aware of some part of works not paid according to lump-sum basis.

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 EARNED VALUE ANALYSIS**

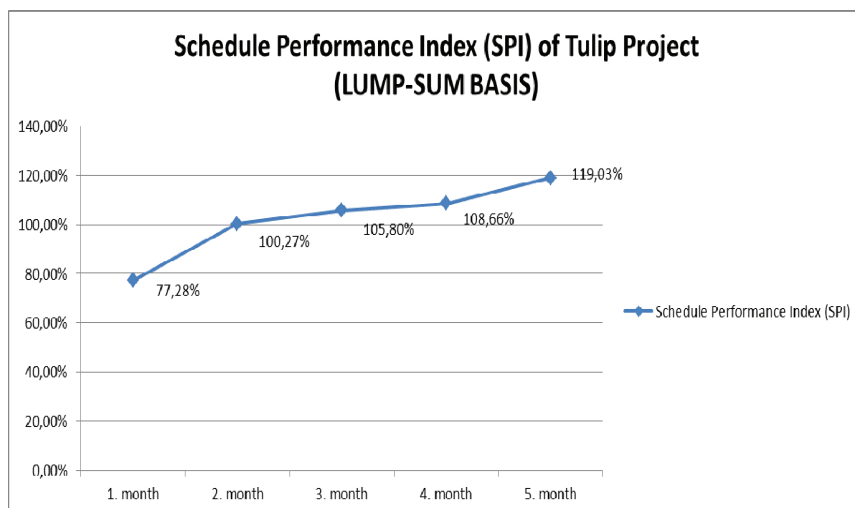
**(LUMP-SU BASIS)**

	1. month	2. month	3. month	4. month	5. month
Planned Value (PV)	2.588K	3.698K	3.516K	2.044K	1.450K
Actual Cost (AC)	2.360K	4.546K	3.872K	2.221K	3.566K
Earned Value (EV)	2.000K	3.708K	3.720K	2.221K	1.726K
Cost Performance Index (CPI)	84,75%	81,57%	96,07%	100,00%	48,40%
Schedule Performance Index (SPI)	77,28%	100,27%	105,80%	108,66%	119,03%
	1. month	2. month	3. month	4. month	5. month
Cost Performance Index (CPI)	84,75%	81,57%	96,07%	100,00%	48,40%
	1. month	2. month	3. month	4. month	5. month
Schedule Performance Index (SPI)	77,28%	100,27%	105,80%	108,66%	119,03%

**Table.11: Earned value analysis in lump-sum basis**



**Figure.3: Cost performance index (CPI) in lump-sum basis**



**Figure.4: Schedule performance index (SPI) in lump-sum basis**

#### **CASH FLOW EVALUATION**

According to planned cash flow financial statement of the construction company is just one month in red as amount of 265.000 EURO, but in actual financial situation is red for three months as an amount of 500.000 EURO under Unit Price basis contract.

For lump-sum basis contract, actual financial situation is red for three months around changing between 420.000 – 500.000 EURO. But final balance sheet of the project is dramatically in red as amount of 1.112.420 EURO.

#### **CONCLUSION**

Project management should select right methods to make cost controlling upon his/her abilities, culture, and organization level, of course project team structure. If his management style creates chaos during the construction he should relinquish all the methods and continue his own pure variance style.

Companies have 2<sup>nd</sup> degree organization and documentation can use variance analysis methods from starting simplest one.

In order to apply in effective way of *Earned Value Analysis*, company should have deep organization and talented team cost control is a n ordinary work style for them.

Construction management is mostly experience basis method, because of construction process has been progressing by organization, managing of human.

I am thinking that experiences of construction project management should not be retained in manager's, director's, engineer's mind, should be given to other colleagues in order to contribute and make improvement their management skills.

Crucial point is if negative resulted experiences and taken precautions against them and related proposals widely transfer to other people who direct projects, they start to think about on this issue, compare and correlate their experience.

Surely some managers can do some correction, or changing methods, highlighting some points to their cost control applications coming from this theme.

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