Management of the cost overrun of Baghdad University projects using Earned Value Management (EVM) and Value Engineering (VE)

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***Abstract*— Actual costs of projects in Iraq might be higher than those depicted by budgets. In many cases, numerous projects endure distress and possible profit loss because of disorganized cost and schedule tracking practices as well as inaccurate data collection and estimates. When costs generally exceed the allocated funding, construction companies must consider the predictability of project costs in developing their Capital Improvement Program.**

This research aims to discuss the feasibility the earned value management (EVM) in managing the project's cost overrun. EVM allows the monitoring of the construction progress, performs forecasting on the project, uncovers problems occurring on-site, and responds to other project issues as soon as possible. This research also presents a case study to supplement the application of the EVM system. In the case study, value engineering technique is used to determine the best alternative which should not affect the building thermal efficiency. Computerized thermal performance modeling using Ecotect Analysis program is employed to visualize the building model, run the analyses, and perform comparisons. Two models are presented; model A represent the project in its original plans and model B represent the project after implicating the suggested alterations in terms of cost control together with keeping the thermal efficiency in its acceptable levels. Results show that case B is better and more cost effective than case A, and the duration of project cost adheres to the budget of the project according to EVM.

Most importantly, this study is conducted not to advocate better means of improving project costs, but to obtain better estimates of such expenditures.

Keywords:* *cost overrun ; Earned Value Management (EVM) ; Value Engineering (VE) ; Ecotect Analysis program; thermal efficincy

I. INTRODUCTION

Project cost allocation is of paramount importance to all management decisions. In general, this concept refers to an investment decision that is concerned with what portion of the total budget must be allocated to each project and how the funding requirements can be satisfied throughout the development of projects, while maximizing the total reward.

One of the main functions of project management is to forecast and track costs through which cost overruns can be avoided. Cost overrun occurs in projects when the project planning and design, the feasibility of construction and the estimated costs are inexact [1]. Unsatisfactory planning and poor execution can cause problems in the project schedule that could translate into added contingencies in the contractor pricing and/or contractor's claim. A poorly defined scope of work can lead to extra cost incurred by the owner. The insufficient understanding of the owner's perceptions and the design issues of each party should have been discussed and decided on. The different perceptions are often consolidated when parties must incur significant cost and loss of valuable time. Construction is perhaps the most easily understood area, in which the design professionals can influence the project costs [2]. In particular, the designers' lack of understanding of construction procedures and techniques can profoundly affect the construction feasibility and costs. Poorly coordinated designs, plans, and specifications usually lead to a contractor's claim during construction because of conflicting information that, when clarified, impels the contractor to deviate from the intended performance that was formulated during the process of preparing his bid. Reliable cost estimates are essential for the realization of effective project control and management of cash flows at the company level. Cost overruns are commonly caused by inaccurate cost estimates. The bids for subcontracts or the actual costs are often higher than anticipated. These cost overruns are either due to incorrect estimates or the changes in the conditions of the marketplace.

Based on the discussion above, this study aims to solve the problem of cost overruns in the projects. Earned value management (EVM) is used to measure the cost overruns in the projects, determine the cost after improvement, and identify the most highly effective solution.

II. EARNED VALUE MANAGEMENT (EVM)

Project management essentially aims to guarantee that the project satisfies the technical objectives and is completed on schedule and within the budget. These particular conditions can be achieved with a well-organized project control system. Such a system requires adopting a systemic approach, which could enable the management to make informed decisions regarding the reallocation of project resources and to schedule adjustments based on the current project status.

EVM is a project management technique, which facilitates project control and supports the forecasting of the final project cost [3]; [4]. This technique has been used in estimating the cost and time for project completion, identifying the cost and scheduling effects of known problems, accurately portraying of the cost status of a project, tracing problems to their sources, rendering the schedule status of a project, providing timely information on projects, and identifying problem areas not previously recognized [5].

EVM provides early indications of the expected project results based on project performance and highlights the possible need for corrective action. This technique allows the project manager and team to adjust their strategies and make trade-offs based on project objectives, actual project performance, and trends, as well as the environment in which the project is being conducted [6].

EVM is based on three basic variables, namely, planned value (PV) or budgeted cost of work scheduled, actual cost (AC) or the actual cost of work performed, and earned value (EV) or the budgeted cost of the work performed. From these variables, four indexes can be defined: cost variance (CV = EV−AC), schedule variance (SV = EV−PV), cost performance index (CPI = EV / AC), and schedule performance index (SPI = EV / PV). When CV<0 and CPI<1, over costs exist, and when SV<0 and SPI<1, the project is delayed. Meanwhile, the positive SV and CV values imply that the project is ahead of the planned schedule and is within the budget, respectively. The above mentioned variables and variances can be represented graphically (Fig.1), which assists the project managers monitor the project evolution and progress. The graphical representation of PV is the project cost baseline [7].

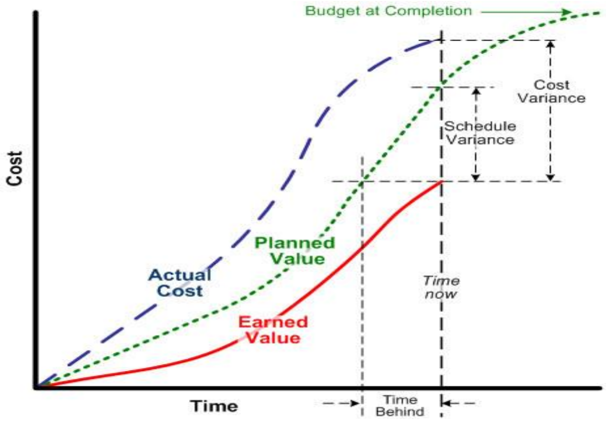

Figure1. EVM

Numerous EVM software programs that incorporate other widely used project management programs (e.g., Primavera Microsoft Project and Project Server, Cobra, and Open Plan) have been recently developed to facilitate analyses.

III. UNIVERSITY OF BAGHDAD (UOB)

In 1958, the Iraqi Government hired the Architects Collaboration International, formed by Walter Gropius, to design and plan the entire campus of UOB. The project was beset with financial and political difficulties for several years, which hampered a timely completion [8].

The aim of achieving an efficient architectural environment was fulfilled by analyzing the micro climate effects on the campus buildings (e.g., perfect orientation, sun radians on façade, effect of materials on the thermal balance of buildings, solar gain throw windows, daylight, wind effect, etc.). Studying such effects allowed the contractors to address specific requirements toward the realization of the best environmental design treatments, which could then be applied to derive the highly effective solutions that could satisfy the main functional requirements [9]. The academic buildings were oriented toward the northwest in several degrees to establish the environmental response in the campus. Exterior sunscreens were also placed in the buildings to control the sun radians that fall on the southern, eastern, and western façades. Concrete blocks were the material used for the main building to address the required insulation and time lag.

The above conditions granted UOB with a unique architectural type in Baghdad City, in particular, and in Iraq, in general.

The campus of UOB is generally and widely considered a vital organization, which continuously grows and expands according to its academic and social needs. Such a continuous improvement provides the institution with novel designs and plans, which should be responsive to its resolute growth. Accordingly, the modern-day design strategies allow UOB to be more optimized and sustainable [9].

Many new colleges had to be established within the campus of UOB with the riverside (as the location). The plans presented for these colleges, which aimed at continuity of the architectural type, were mainly inspired by the original designs of the older buildings, particularly the design of façades.

IV. CASE STUDY

The need to construct new facilities in the UOB campus has drawn considerable efforts to conduct full visibility studies and full planning for these buildings.

The owner of the UOB simply used the primary plans as basis and referred the project to a construction firms because of time shortage. The contract type was Bill of Quantities (BOQ), and the estimated project cost was $4,016,514.

In case that suggestions were made to expand building capacity during the construction process, This situation required increasing the cost estimate as indicated by the Primavera, which was used to schedule and estimate the project time and cost.

The results of the Primavera revealed that in May 2013, the project estimated cost was $4,130,437, and 47% of the project was finished. This condition implied that the project exceeded the estimated cost as shown in Table (I).This problem could be resolved by making some changes in the contract without affecting the cost or building efficiency. In this event, the current research uses the Value Engineering (VE) procedure to acquire the best solutions and results. VE begins by questioning the worth of each feature, and subsequently uses creative techniques to generate the same worth, but at lower cost [10]. The procedures of VE could be used during the construction stages as shown in Fig.2.

TABLE I. COST OVERRUN

Activity ID	Activity Name	Original Duration	Actual Duration	Remaining Duration	Schedule % Complete	Start	Finish	Resou	Budgeted Total Cost	Total Float	Actual Total Cost	Earned Value Cost	Budget At Completion	Planned Value Cost	Estimate At Completion Cost	Actual Cost
20GA-4	College of Language	537	353	184	47.2%	13-Oct-11 A	22-Jan-14		$3,789,431	-104	$2,516,801	$2,240,671	$3,789,431	$1,788,541	$4,130,437	$2,516,801
20GA-4.1	**Civil Works**	537	353	184	47.2%	13-Oct-11 A	22-Jan-14		$3,789,431	-104	$2,516,801	$2,240,671	$3,789,431	$1,788,541	$4,130,437	$2,516,801
20GA	Settlement and layout of th	24	24	0	100%	13-Oct-11 A	05-Feb-12	Settlem	$8,197		$8,197	$8,197	$8,197	$8,197	$8,197	$8,197
20GA1.1	Excavation&Clordeen	20	20	0	100%	06-Feb-12 A	04-Mar-12	Excava	$50,700		$91,140	$50,700	$50,700	$50,700	$91,140	$91,140
20GA1.2	SubBase Foundation	30	35	0	100%	05-Mar-12 A	22-Apr-12 A	Sub Ba	$42,083		$85,875	$42,083	$42,083	$42,083	$85,875	$85,875
20GA1.3	Blinding	45	45	0	100%	23-Apr-12 A	24-Jun-12 A	Blindin	$64,000		$64,000	$64,000	$64,000	$64,000	$64,000	$64,000
20GA1.4	Con. Foundation	80	80	0	100%	25-Jun-12 A	14-Oct-12 A	T.B, St	$858,880		$958,880	$858,880	$858,880	$858,880	$958,880	$958,880
20GA1.5	Pedstal	36	33	0	100%	18-Sep-12 A	01-Nov-12	Pedsta	$35,200		$28,865	$35,200	$35,200	$35,200	$28,865	$28,865
20GA1.6	Columns GF	60	41	0	100%	04-Oct-12 A	02-Dec-12	Columr	$88,000		$62,656	$88,000	$88,000	$88,000	$62,656	$62,656
20GA1.7	Beams&Slabs&Stairs GF	60	54	0	100%	11-Dec-12 A	24-Feb-13	Stairs (	$347,096		$371,176	$347,096	$347,096	$347,096	$371,176	$371,176
20GA1.8	Columns FF	60	58	0	90%	29-Jan-13 A	19-Apr-13 A	Colomr	$88,000		$62,656	$88,000	$88,000	$79,200	$62,656	$62,656
20GA1.9	Beams&Slabs&Stairs FF	60	37	0	25%	20-Mar-13 A	11-May-13	Stairs F	$424,840		$505,336	$424,840	$424,840	$106,210	$505,336	$505,336
20GA2	Sub Base G Floor	30	30	0	100%	03-Dec-12 A	13-Jan-13 A	Sub ba	$42,975		$42,975	$42,975	$42,975	$42,975	$42,975	$42,975
20GA2.1	Con. G Floor	30	39	0	50%	05-Jan-13 A	28-Feb-13	Con. G	$132,000		$132,000	$132,000	$132,000	$66,000	$132,000	$132,000
20GA2.13	Louvers	90	0	90	0%	13-May-13	13-Sep-13	Founda	$150,410	-75	$0	$0	$150,410	$0	$150,410	$0
20GA2.3	Building Bricks	67	29	54	0%	01-Apr-13 A	24-Jul-13	Buildin	$293,500	-104	$103,045	$58,700	$293,500	$0	$402,721	$103,045
20GA2.4	Gypsum Plastering	90	0	90	0%	15-May-13	18-Sep-13	whitne	$278,500	-104	$0	$0	$278,500	$0	$278,500	$0
20GA2.5	Ceramic	60	0	60	0%	21-Aug-13	13-Nov-13	Cerami	$28,600	-104	$0	$0	$28,600	$0	$28,600	$0
20GA2.6	Sound Insulation	45	0	45	0%	20-Aug-13	22-Oct-13	Sound	$13,650	-88	$0	$0	$13,650	$0	$13,650	$0
20GA2.7	Mosaic Tiles	75	0	75	0%	04-Jun-13	17-Sep-13	Mosaic	$227,500	-103	$0	$0	$227,500	$0	$227,500	$0
20GA2.8	Exterior finishing	60	0	60	0%	19-Aug-13	10-Nov-13	Rock,	$93,000	-75	$0	$0	$93,000	$0	$93,000	$0
20GA2.9	False ceilling	40	0	40	0%	06-Nov-13	01-Jan-14	Fallceil	$142,000	-104	$0	$0	$142,000	$0	$142,000	$0
20GA3	Doors&Windows	44	0	44	0%	12-Jun-13	13-Aug-13	Door, \	$216,100	-78	$0	$0	$216,100	$0	$216,100	$0
20GA3.1	Paints	45	0	45	0%	02-Oct-13	04-Dec-13	Paints	$48,000	-104	$0	$0	$48,000	$0	$48,000	$0
20GA3.2	Roofing	30	0	30	0%	12-May-13	20-Jun-13	Roofin	$108,000	2	$0	$0	$108,000	$0	$108,000	$0
20GA3.3	Walkways	55	0	55	0%	09-Sep-13	24-Nov-13	walkin	$8,200	-75	$0	$0	$8,200	$0	$8,200	$0
20GA3.4	Clean the Site	44	0	44	0%	21-Nov-13	22-Jan-14	Clean	$0	-104	$0	$0	$0	$0	$0	$0

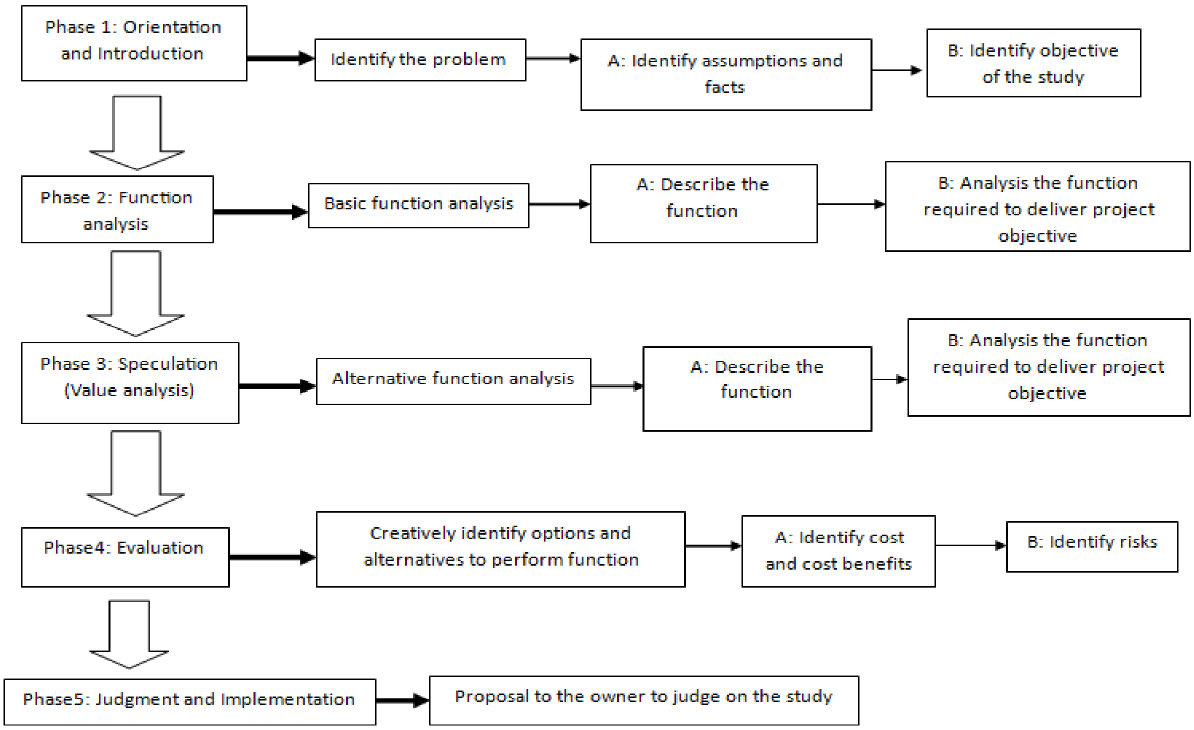

Figure2. Stages of VE

PHASE 1: Orientation and Introduction

The building and design processes of the project must be thoroughly explored, and should consider the entire life cycle and beyond. Analysis of the components of a building can lead to a quick conclusion that the load bearing structure has a life cycle of 50 years and more. In façade technology, a generation cycle is significantly less than 30 years, whereas in technical building services, the cycle is even shorter. Consequently, buildings should be designed in a manner that the individual components could be removed and replaced more easily as dictated by their varying service life cycles [11].

Due to the unexpected increase in the initial cost of the construction of the case study project, the contract (BOQ) must be revisited. Moreover, some of the façade elements must be removed or changed to on the building's initial cost in parallel with changing the specification of other elements to keep the required thermal balance in the building.

Several variables affect the thermal behavior of any building. One of these variables is solar gain, which is caused by direct and indirect solar radiations.

Accordingly, this study presumed evaluating the louvers and the glass specifications, which supposedly represent more than 65% of the façade elements by visualizing the building components, running the required analysis and examining the thermal effects of louvers and the glass of the building.

This study analyzes the thermal behavior of the building by utilizing the Ecotect 2011 program in the implementation. This software is a widely used building design and environmental analysis tool that offers several analysis functions to demonstrate how buildings operate thermally. Ecotect allows for the 3D modeling of buildings by considering numerous variables, such as geographical location, building design and materials, ventilation and lighting system, and so on.

This study assumes two cases.

Case A: The building has single glazed windows and vertical and horizontal louvers, which are considered non-thermal element during the analysis.

Case B: The building has double glazed window without vertical and horizontal louvers.

All parameters were fixed for the entire analysis, except the glass properties in cases A and B. The analysis was run through an entire year, but the data for comparison were taken only from the average and hot months of the year according to the Iraq_ Baghdad data weather files (April, May, June, July, August, September, October, and November) from 10 am to 5 pm.

The analysis results for the solar gain in the building are presented in watts.

PHASE 2: Function Analysis

A: Description of the function

Louvers and sun breakers: Shading design for the exclusion of the solar input is a geometrical task. External shading devices are the most effective tools for controlling sun penetration. Three basic categories of shading devices are enumerated below [12].

(a) Vertical devices (e.g., vertical louvers or projecting fins). These devices are characterized by horizontal shadow angles (HSA), and their shading mask is of a sectoral shape (Fig. 3).

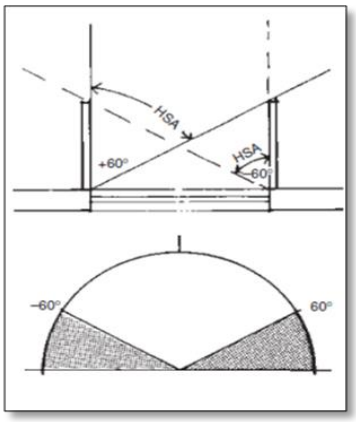

Figure 3. Plan of a pair of vertical devices with their shading mask

These devices may be symmetrical, with identical performances from left to right, or asymmetrical. These devices are most effective when the sun is toward one side of the direction faced by the window. We may distinguish the "solar HSA" from "device HSA" as the required performance at a given time.

(b) Horizontal devices (e.g., projecting eaves, a horizontal canopy or awning, or horizontal louvers and slats). These devices are characterized by a vertical shadow angle (VSA). One large or several small elements may exhibit the same performance and comparable vertical shadow angle. The shading mask of these devices, which is of a segmental shape, is constructed by using the shadow angle protractor. These devices are most effective when the sun is near-opposite to the window considered. Fig. 4 shows a canopy with a "device VSA" of 60°.

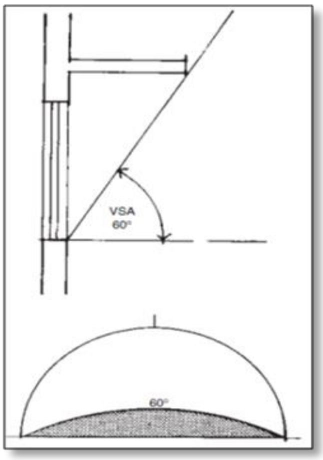

Figure 4. A horizontal device (a canopy) and shading mask

(c) Egg-crate devices (e.g., concrete grille-blocks and metal grilles). These devices, which produce complex shading masks, are a combination of the above two devices, and cannot be characterized by a single angle (Fig.5).

B: *Analysis the function required*

The types of louver used in the “case study building” indicated in Fig. 6 are a combination of horizontal and vertical concrete louvers, which are distributed on the inner and outer façades, except on the western façade.

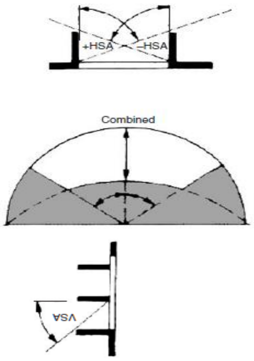

Figure 5. Egg-crate device and its shading masks

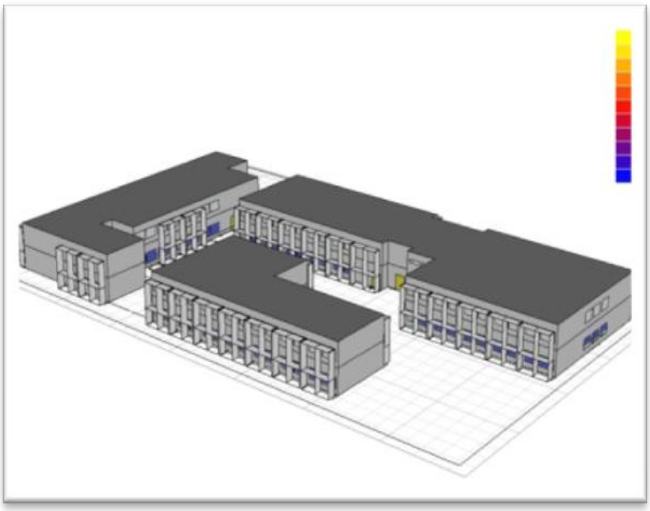

Figure 6. Direct gain in single glaze with horizontal and vertical louvers

PHASE 3: Speculation Analysis (value analysis)

A: Description of the function

Double glaze: Window technology has been developed to satisfy all the needs of the present day. The technology has significantly reduced window-related energy use. Low-energy and multi-glazed windows are now standards in many markets. Moreover, “good windows,” which are commonly believed to be expensive, are often considered as good investment according to their running cost.

Multi-layered glazing has also been increasingly used under different climate conditions to reduce heat gain/loss through the transparent parts of the building envelope. In the existing building stock, buildings with good wall insulation do not always incorporate windows with two or more layers of glazing, and vice versa.

The transparency of glass to solar radiation is limited. Therefore, for every layer of glazing incorporated into a façade, a certain proportion of the solar energy, which falls on the exterior of the façade (incident radiation), is prevented from penetrating the interior space. This reduction in solar gain may be beneficial in warm climates because it reduces the risk of overheating of the interior space.

Moreover, N. Mingottia, T. Chenvidyakarnc, A.W. Woodsa [13] posited that in warm climates with strong solar radiation, double glazing minimizes both the convective and radiative components of heat transfer across the façade, leading to a smaller heat gain from the exterior ambient to the room connected to the façade.

The results of previous studies have guaranteed that double glazed windows may be a good substitute for heavy concrete louvers because these save some of the initial cost estimate of the project and save a percentage of the predicted running cost of conditioning the building.

B: *Analysis of the function:*

The efficiency of the alternative replacement of louvers could be validated by applying the proposed double glazed windows under the same conditions and properties. Case B examines the building that uses double glass without vertical and horizontal louvers (Fig.7).

Figure 7. Direct gain in double glazed windows

PHASE 4: Evaluation of results:

4.1 Cost evaluation

In this stage, the louvers are analyzed based on costs, which include wages, cost of materials, profit, and other costs (Table II). Unit cost is expressed in US dollar ($).

The foundation cost for the louver is $333 × 113 = $37768; hence, the total cost of louvers is $150,000.

The glass is analyzed based on costs, including wages, cost of materials, profit, and other costs.

According to the contract, the tendered cost of glass is ($70)/m2 and the amount is 1100 m2. After negotiation with the construction contract company, the double glazed glass is priced at $100/m2. Table (III) illustrates the price.

TABLE II. NUMBER AND PRICES OF LOUVERS

No.	Type of louver	Length (m)	Width (m)	Thickness (m)	No. of Lovers	Lover price $	Total price $
1	Vertical louver1	2.5	1.5	0.12	152	208	31616
2	Vertical louver2	3.5	1.5	0.12	152	267	40584
3	Horizontal louver	5.7	1.5	0.12	96	417	40034
SUM							112235

TABLE III. GLASS PRICE

No.	Glaze type	Glass price $	Amounts m2	Total price $
1	Single glazed glass	70	1100	77 000
2	Double glazed glass	100	1100	110 000

4.2 Louver evaluation

By analyzing the building in case A, we have determined that the direct gain attained is up to 68000 Watt as shown in (Fig.8). The U-Value of the glass used for calculations is 6 w/m2.k, which is fixed by aluminum frames with no thermal brake. The results of the direct gain are applicable for the entire building based on the response of elements to any thermal effect, except the louvers, which are excluded from the definition of a thermal element because these are detached from the main masses of the building.

4.3 Glass evaluation

By exploring case B, we realize that the direct gain reaches up to 55800 Watt as illustrated in (Fig. 9). The U-Value of the double glazed glass used for calculations is 2.7 w/m2.k, which is fixed by aluminum frames with no thermal brake.

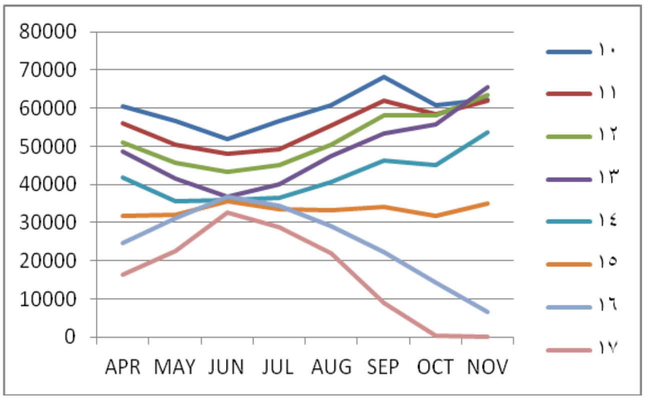

Figure 8. Profile of direct gain in single glazed glass derived by considering the louvers as a non-thermal element

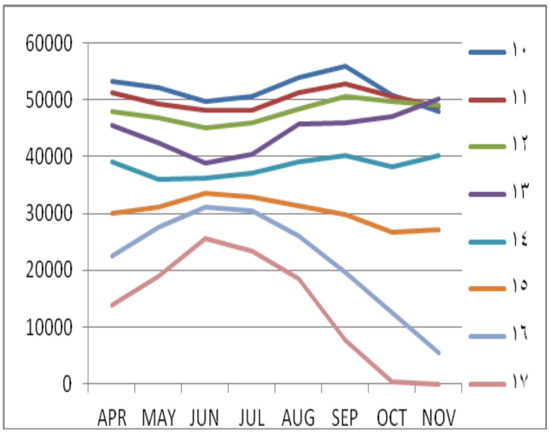

Figure 9. Profile of direct gain in double glazed window

PHASE 5: Judgment and implementation

Project management is essentially an important task and decisions related to details such as the steps of the project design in colorations cost estimates coupled with the project control system, construction and avoiding cost overrun.

This study determined how the EVM system can efficiently be used in improving project cost and providing guidelines for the effective implementation of the system, and it helps discuss and explain the early warning signs. The result of the cost analysis reveals that removing the louvers saves $150,000 and removing the single glaze glass saves $77 000. The double glaze glass cost $110 000, so an additional amount of $33,000 is needed for the double glazed glass. This amount can be obtained from louvers cost savings, thereby we could save around $117, 000 to achieve the needed expansion for the building (Table IV).

And so, a reliable cost estimates are essential for effective project control and the management of cash flows within the project and at the company level.

TABLE IV. COST AFTER MANAGING

Activity ID	Activity Name	Original Duration	Actual Duration	Remaining Duration	Schedule % Complete	Start	Finish	Resour	Budgeted Total Cost	Total Float	Actual Total Cost	Earned Value Cost	Budget At Completion	Planned Value Cost	Estimate At Completion Cost	Actual Cost
20GA-4	College of Languac	537	353	184	48.71%	13-Oct-11 A	22-Jan-14		$3,672,021	-104	$2,516,801	$2,240,671	$3,672,021	$1,788,541	$4,013,027	$2,516,801
20GA-4.1	**Civil Works**	537	353	184	48.71%	13-Oct-11 A	22-Jan-14		$3,672,021	-104	$2,516,801	$2,240,671	$3,672,021	$1,788,541	$4,013,027	$2,516,801
20GA	Settlement and layout of	24	24	0	100%	13-Oct-11 A	05-Feb-12	Settlem	$8,197		$8,197	$8,197	$8,197	$8,197	$8,197	$8,197
20GA1.1	Excavation&Clordeen	20	20	0	100%	06-Feb-12 A	04-Mar-12	Excava	$50,700		$91,140	$50,700	$50,700	$50,700	$91,140	$91,140
20GA1.2	SubBase Foundation	30	35	0	100%	05-Mar-12 A	22-Apr-12	Sub Ba	$42,083		$85,875	$42,083	$42,083	$42,083	$85,875	$85,875
20GA1.3	Blinding	45	45	0	100%	23-Apr-12 A	24-Jun-12	Blindin	$64,000		$64,000	$64,000	$64,000	$64,000	$64,000	$64,000
20GA1.4	Con. Foundation	80	80	0	100%	25-Jun-12 A	14-Oct-12	T.B, St	$858,880		$958,880	$858,880	$858,880	$858,880	$958,880	$958,880
20GA1.5	Pedstal	36	33	0	100%	18-Sep-12 A	01-Nov-12	Pedsta	$35,200		$28,865	$35,200	$35,200	$35,200	$28,865	$28,865
20GA1.6	Columns GF	60	41	0	100%	04-Oct-12 A	02-Dec-12	Columr	$88,000		$62,656	$88,000	$88,000	$88,000	$62,656	$62,656
20GA1.7	Beams&Slabs&Stairs GF	60	54	0	100%	11-Dec-12 A	24-Feb-13	Stairs (	$347,096		$371,176	$347,096	$347,096	$347,096	$371,176	$371,176
20GA1.8	Columns FF	60	58	0	90%	29-Jan-13 A	19-Apr-13	Colomr	$88,000		$62,656	$88,000	$88,000	$79,200	$62,656	$62,656
20GA1.9	Beams&Slabs&Stairs FF	60	37	0	25%	20-Mar-13 A	11-May-13	Stairs F	$424,840		$505,336	$424,840	$424,840	$106,210	$505,336	$505,336
20GA2	Sub Base G Floor	30	30	0	100%	03-Dec-12 A	13-Jan-13	Sub ba	$42,975		$42,975	$42,975	$42,975	$42,975	$42,975	$42,975
20GA2.1	Con. G Floor	30	39	0	50%	05-Jan-13 A	28-Feb-13	Con. G	$132,000		$132,000	$132,000	$132,000	$66,000	$132,000	$132,000
20GA2.3	Building Bricks	67	29	54	0%	01-Apr-13 A	24-Jul-13	Buildin	$293,500	-104	$103,045	$58,700	$293,500	$0	$402,721	$103,045
20GA2.4	Gypsum Plastering	90	0	90	0%	15-May-13	18-Sep-13	whitne	$278,500	-104	$0	$0	$278,500	$0	$278,500	$0
20GA2.5	Ceramic	60	0	60	0%	21-Aug-13	13-Nov-13	Cerami	$28,600	-104	$0	$0	$28,600	$0	$28,600	$0
20GA2.6	Sound Insulation	45	0	45	0%	20-Aug-13	22-Oct-13	Sound	$13,650	-88	$0	$0	$13,650	$0	$13,650	$0
20GA2.7	Mosaic Tiles	75	0	75	0%	04-Jun-13	17-Sep-13	Mosaic	$227,500	-103	$0	$0	$227,500	$0	$227,500	$0
20GA2.8	Exterior finishing	60	0	60	0%	12-May-13	01-Aug-13	Rock,	$93,000	-4	$0	$0	$93,000	$0	$93,000	$0
20GA2.9	False ceiling	40	0	40	0%	06-Nov-13	01-Jan-14	Fallceil	$142,000	-104	$0	$0	$142,000	$0	$142,000	$0
20GA3	Doors&Windows	44	0	44	0%	12-Jun-13	13-Aug-13	Door, \	$249,100	-78	$0	$0	$249,100	$0	$249,100	$0
20GA3.1	Paints	45	0	45	0%	02-Oct-13	04-Dec-13	Paints	$48,000	-104	$0	$0	$48,000	$0	$48,000	$0
20GA3.2	Roofing	30	0	30	0%	12-May-13	20-Jun-13	Roofin	$108,000	2	$0	$0	$108,000	$0	$108,000	$0
20GA3.3	Walkways	55	0	55	0%	02-Jun-13	15-Aug-13	walkin	$8,200	-4	$0	$0	$8,200	$0	$8,200	$0
20GA3.4	Clean the Site	44	0	44	0%	21-Nov-13	22-Jan-14	Clean	$0	-104	$0	$0	$0	$0	$0	$0

According to EVM, the cost is retained, and the duration is the same, which is required for the double glazed windows with saving the duration required for the louvers.

The results of the energy analysis showed that the probable project outcome can be determined in advance with reasonable forecasting accuracy.

As we see the study shows that the results of the direct gain obtained by the Ecotect software demonstrate that energy gain in case B is 18 % less than that in case A, which had the highest gain in September. That's conform the building performance could be improved with the use of double glass, which lowered the thermal gain for the whole building even without louvers. This observation implies that double glazed glass acts as a collaborative component with the whole building envelope, but we should admit that our suggestion to remove the existing louvers might alter the façade but not the general building type.

V. CONCLUSIONS

There is great concern for cost overruns in majority of public construction projects that are implemented in Iraq; there is a lot of debate on how to minimize this problem. The main objective of this study was to implement EVM and VE systems to solve and prevent the cost overruns in Baghdad university projects. The results of this study showed that:

1. EVM system can efficiently be used in analyzing and improving project cost.
2. Reliable cost estimates is essential for managing the cash flows and project control.
3. Project outcome might be determined in advance with reasonable accuracy.
4. EVM system can be used in detecting projects cost overruns and schedule slippages.
5. The use of double glazed glass can effectively lower the thermal gain in buildings.
6. Iraqi Law on contracts must be improved toward allowing clients to apply VE if their projects are challenged by certain problems.

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