Dirasat, Administrative Sciences, Volume **36**, No. **2**, 2009

Factors Affecting Controlling Governmental Projects in Jordan

Salim Moh'd Rawashdeh, Ghaleb Y. Abbasi and Nasser Ruhhal *

ABSTRACT

In this research the concept of Earned Value Management System (EVMS) as *the* tool to monitor and control projects was investigated. A model was developed to see the effects of independent variables such as the use of modern project management methodologies and government regulations on the dependent variables namely project cost and project duration. To assess the validity of the research assumptions a structured questionnaire was designed and distributed to 224 local contractors who participated in government tenders between the years 2004 through 2006. A survey was also conducted on a sample (44 projects) from local projects executed for the Jordanian government to evaluate their performance in terms of some key performance indices including the Cost Performance Index (CPI) and Schedule Performance Index (SPI). The analyses of survey showed that the projects total budget overrun was over $17 millions (25.5%) and the delays totaled to over 3000 working days (65%). Questionnaire results analysis led to suggesting a modification to government regulations to bring it up to the internationally recognized standards and to guarantee better control over public projects.

Keywords: Project Management, Control, Cost Performance Index (CPI), Schedule Performance Index (SPI), Earned Value Management System (EVMS).

1. INTRODUCTION

Governments are always under an ongoing and increasing pressure to justify spending and to avoid costly project overruns. To be able to do this, Governments must acquire a policy to monitor and control its projects whether contracted or performed by its own departments. Earned Value Management System (EVMS) principles provide the effective grounds for a successful monitor and control programme. The concept of Earned Value (EV) provides a way that is effective and efficient in measuring the project progress in terms of meeting scope, budget and schedule requirements against corresponding baselines. It also provides project managers and other stakeholders with insight into the project health and alerts them to potential problem to take appropriate actions before the problems exaggerate and it is too late to correct them.

Currently, there are no requirements for contractors in Jordan, when performing public projects, to report project progress in a proper standard fashion. Governmental organizations do not have any standards to present to contractors to adhere to, so contractors do not feel obliged to report projects performance data in a manner that could enable decision makers to take and implement a sound decision on the continuation of a project or at the worst scenario cancellation of a project at its early stages if indicators imply that this project will be a failure if pursued any further.

2. PROBLEM DEFINITION

Construction industry is one of the most important industries in Jordan as it provided 9% of the Gross Domestic Product (GDP) in year 2006; it also provided jobs for 17% of the Jordanian workforce amongst which is more than 7000 engineers (Jawad and Abu-Alethem, 2007). Considering the public sector activities, in years 2004 through year 2006 the amount spent on public projects owned by the Ministry of Public Works and Housing was $918.6 million, and the cost of projects executed for Greater Amman Municipality was $354.7 million (General Tenders Department (GTD) Annual Book, 2006). The survey of local projects showed the adverse results of executing projects without the use of an EVMS since some projects (30%) overrun their budget by more than 120% and 42% of them exceeded their

* Royal Jordanian Air Force (First Author), and Industrial Engineering Department, Faculty of Engineering and Technology, University of Jordan (Second and Third Authors). Received on 28/1/2008 and Accepted for Publication on 22/4/2008.

schedule by the same percentage.

The inefficiency in projects execution in Jordan is attributed to many independent factors like the degree to which project teams practice proper project management methodologies, use of an EVMS as a monitor and control tool, government regulations as an obligatory requirement to qualify contractors to participate in government tenders and projects and lack of training of Jordanian staff on project management standards.

3. OBJECTIVES AND HYPOTHESES

This research aims to point out important factors which if considered and adopted properly the effectiveness of Jordanian contractors will be increased considerably and government spending will be controlled properly to benefit government, taxpayers and contractors. Other specific objectives are: study the effect of various independent model variables such as government regulations, utilization of proper project management practices, the use of a defined EVMS and training of Jordanian project practitioners on proper methodologies on the project cost and schedule as the model dependent variables by using statistical hypothesis testing on the research assumptions.

The survey part of this research helped in quantifying the Key Performance Indices (KPIs) that are usually used in monitoring and controlling projects like the Cost Performance Index (CPI) and the Schedule Performance Index (SPI) and emphasized the need to improve them. The case study highlighted the benefits of the EVMS deployment in project monitor and control. A final objective is to present recommendations to update current government regulations concerning the methodologies to properly monitor and control public projects.

To achieve the different objectives of this research and build the research model the following null and alternative hypothesis were suggested to test their effect on project schedule and project cost.

H_{01} Practice of proper and up-to-date project management methodologies does not affect project duration and project budget.

H_{a1} Practice of proper and up-to-date project management methodologies has significant effect on project duration and project budget.

H_{02} Contractors training of their project teams on modern project management techniques has no effect on project completion within schedule and allocated budget.

H_{a2} Contractors training of their project teams on modern project management techniques has significant effect on project completion within schedule and allocated budget.

H_{03} Government regulations have no effect on contractors' performance and their choice of projects monitor and control method.

H_{a3} Government regulations have significant effect on contractors' performance and their choice of projects monitor and control method.

H_{04} Use of EVMS has no effect on accomplishing projects within schedule and allocated budget..

H_{a4} Use of EVMS has significant effect on accomplishing projects within schedule and allocated budget.

4. METHODOLOGY

To reach the desired results of this research the following methodology was undertaken in a chronological way:

1- A simple model was developed to study the effect on project performance of the independent variables on the dependent variables as interconnected in the EVM model shown in Figure (1).

2- A questionnaire was developed and distributed to contractors who have executed government project in the past three years in different industries in Jordan to asses their awareness to modern project management practices and whether the use of an EVMS is integrated into their organization. The questionnaire was structured around the study model to enable the researchers to test the validity of their assumptions.

3- A number of local projects completed in the year 2004 through 2006 were surveyed. Required data concerning cost and schedule status at the end of projects was collect.

4- Statistical analysis was performed on the collected data of both the survey and questionnaire and results were presented accordingly.

5- A case study was considered to embark on the benefits of using EVMS to monitor and control project execution. The case study was a project of an aircraft overhaul project completed by a Government aircraft overhaul facility in the period between 18/06/2006 and 11/04/2007. The budget for this project was $471,956.00 and the planned duration was 120 working day.

There are several independent factors that affect the project cost and schedule overruns such as project size, project budget, contractors' performance and many others but efforts were concentrated on studying the effect of only four of such independent variables, outlined in the problem definition section of this research, on the dependent variables (Cost and Schedule). The two variables are interconnected in the simple model shown in Figure (1).

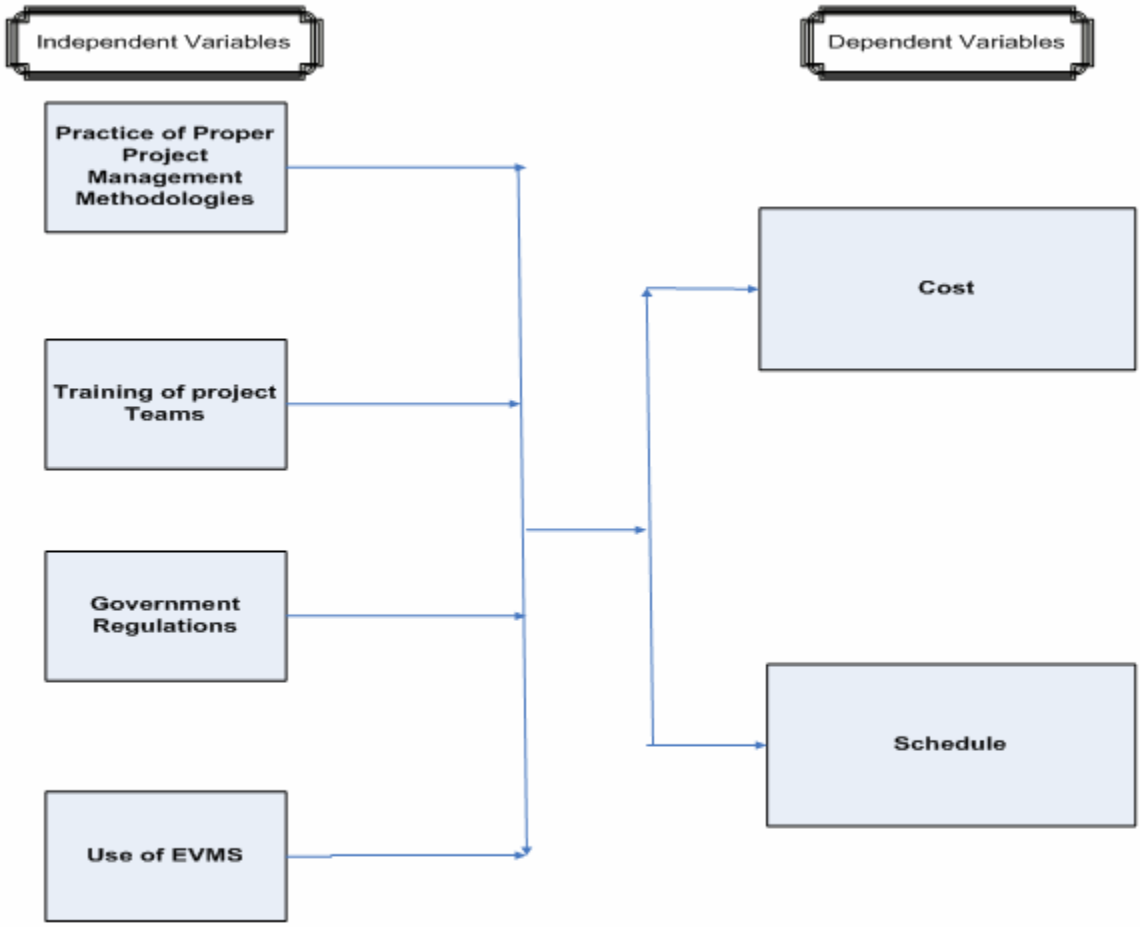

Figure 1. EVM model

5. LITERATURE REVIEW

According to Koppelman and Quentin (1999) EV analysis was originally conceived by industrial engineers over a century ago. EV as a concept means that any use of resources should return something of *Value* to those who provided the resources. Gray and Larson (2003) define EV as simply the percent of the original budget that has been *earned* by actual work completed. In project management *Monitoring* is collecting, recording and reporting information concerning any and all aspect of project performance. *Controlling*, on the other hand, uses the data generated by the monitoring process to keep actual project performance as close as possible to the planned one (Meredith and Mantel, 2003).

Earned value analysis was officially used since 1967 as an integral part of what is known then as the Cost/Schedule Control System Criteria (C/SCSC) in the United States. To encourage the use of the new EVMS by the private sector the United States government in 1998 discarded this criterion and made the ANSI/EIA Standard #748 the criteria to comply with (Christensen, 2002).

The features, benefits and advantages of using an EVMS as a Government tool for projects monitor and control are numerous; a systematic approach to the integration and measurement of cost, schedule and technical performance for projects to provide an early-

warning system for potential threats and opportunities. It is also a method-proven and accurate-to measure the current status and exactify final required costs and durations on major capital projects that span multiple fiscal years. EVM is a repeatable and scalable project management technique that can be applied on projects of various types and sizes to ensure adequate baseline planning, change control, and ongoing insight into project status. EVM is considered a Management-By-Exception (MBE) technique which focuses on troubled areas to bring work back on the right track before it is too late (Johnson, 2006).

The ambiguities of EV terminology and notation have always stood as a roadblock to its adoption by management and project teams. Presently the notation introduced by the Project Management Institute (PMI) in their Project Management Body of Knowledge (PMBOK) Guide (2004) is the one favored by most project management practitioners.

In its traditional form EVM analysis fails to predict the final completion date of a project since the SPI is a monetary index and it is always equal to one at the end of project which is always misleading. Stratton (2007) has introduced the concept of SPI as a function of time and introduced formulae to be used in order to forecast completion dates and other related indices.

The EV analysis is based on what is known as the S-Curve (Figure 2) which is defined as the cumulative project costs plotted against time. It is used to depict planned value, earned value and actual costs of the project. The linearity assumption when working with the S-curve is a major issue and is usually forgotten by project management practitioners. This issue was addressed by Abbasi (1995) as he pointed out that Miller divided the S-curve into three parts and only the middle third is the linear part. Recently, Cioffi (2005) presented an equation that transforms the verbal description of the typical S-curve into precise mathematical formulae. The presented formulae are still to be validated with real project data from the different industries.

6. EV TERMINOLOGY AND APPLICATION

At this point it is appropriate to illustrate the way EVM works and presents the terminologies and charts that are normally used to extract the various KPI[s] that will help project managers and decision-makers to take timely corrective actions to eliminate performance deviations. The terminology and calculations were applied on the aircraft overhaul project as the research case study.

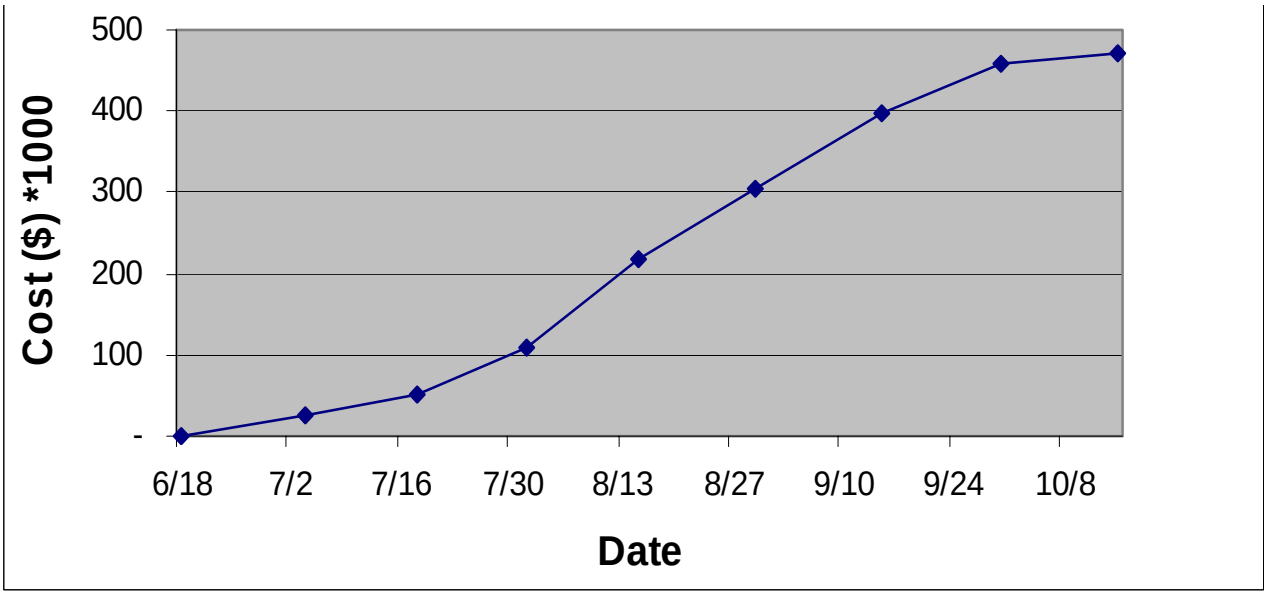

Figure 2. S-Curve for the Aircraft Overhaul Project.

It is assumed here that the project scope is clearly defined in the project charter. The planning phase of the project is concluded and the Work Breakdown Structure (WBS) is ready to the Work Package (WP) level. Each WP is assigned with its budgeted cost and duration. These costs and durations are used in a bottom-up estimate method to form the total budget or what is known as the Budget At Completion (BAC) and the total

project duration. The project network is also assumed to be ready with resources accordingly assigned.

The WP budgeted costs indicate a time-phased budget since they represent the point in time that money or time will be consumed. The time-phased budgets are added to form the project cost baseline (Gray and Larson, 2003) or the Performance Measurement Baseline (PMB) (Christensen, 1998). This baseline usually takes the shape of an S-Curve since the expenditures rate starts low at the initial stage of the project, rise rapidly during intermediate phases and rate of spending drops sharply towards the final phase of the project life cycle. Figure (2) illustrates this behavior for the research case study project.

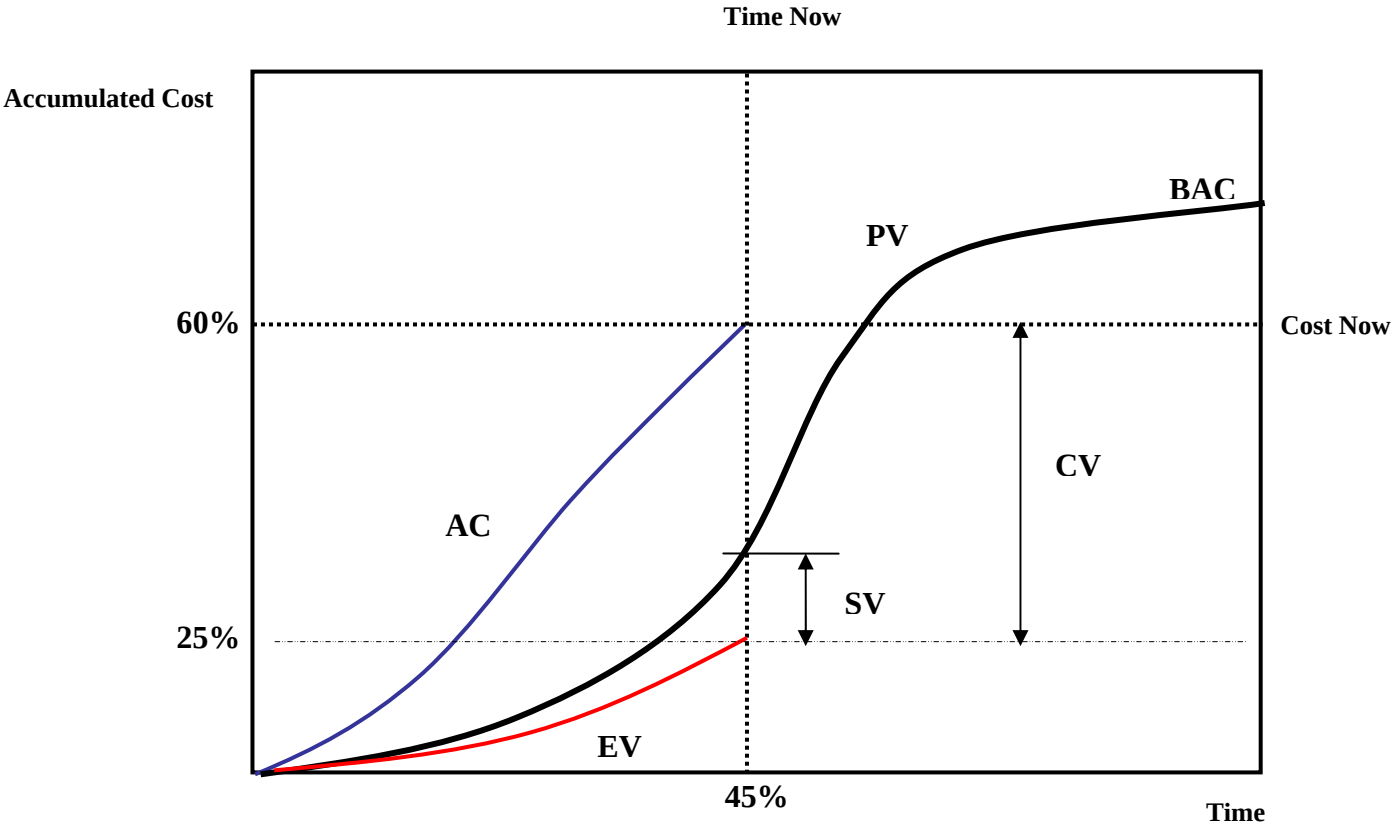

Figure 3. Planned Value, Actual Cost and Earned Value.

The developed S-curve represents the Planned Value (PV) on the approved project time-phased budget baseline (Anbari, 2003). As accomplishment of the individual WP progresses Actual Costs (AC) incurred are reported together with the physical amount of accomplished work which represents the cumulative EV at the reporting point in time. The three values are reported on the same S-curve developed earlier to facilitate analysis and variance calculations.

Figure (3) shows a typical project behavior at a given point in time, say, at the 45% of the schedule, with the three basic quantities needed to conduct an earned value analysis. In this case the numbers say that at 45% of the project schedule the actual cost so far is 60% of the original budget but the earned value of actual work accomplished is only 25% worth of the budget.

Using the three basic elements for earned value analysis (PV, AC and EV) the Performance Report (PR) for the project at the given point in time can be developed. The project team efficiency in utilizing the different available resources can then be judged and corrected if necessary.

Different variances can be estimated using cumulative data collected at a given date. Such data is known as the Project-to-Date data (Anbari, 2003).

a) **Cost Variance (CV):** it represents the degree of conformance between actual spending and the planned amount to be spent. It shows if the work accomplished

costs were higher or lower than what was planned. Its quantity is given by:

$$CV = EV - AC \quad (1)$$

b) **Schedule Variance (SV)**: this is an assessment of schedule progress as compared to baseline schedule and it is given by:

$$SV = EV - PV \quad (2)$$

Both variances are shown on Figure 3. If CV and SV are negative then they indicate over budget spending and behind schedule progress. Positive values mean that spending is under budget and progress is faster than planned. A zero value will simply mean that both spending is on budget and progress is on target.

c) **Variance At Completion (VAC)**: this variance indicates how much over/under budget we expect to be at the end of the project. It uses the Estimate At Completion (EAC) value, see below, with the original BAC:

$$VAC = BAC - EAC \quad (3)$$

The value of VAC will change as the project progress since the EAC will be updated at the different review periods. A well planned and executed project will have a VAC= 0 but rarely is the case.

To empower managers and decision-makers with a different view of the project progress EV analysis provides three KPI[s] that are commonly used as health indicators on the overall project progress. :

1. **Cost Performance Index (CPI)**: In practice this index is the most commonly used cost efficiency indicator (PMBOK, 2004). It is accurate, stable and reliable as a measure of project team efficiency in spending project budget (Christensen, 1993). The CPI is the ratio between EV and AC:

$$CPI = EV / AC \quad (4)$$

2. **Schedule Performance Index (SPI)**: This index is used to investigate conformity to project schedule or scheduling efficiency to date of the project different resources (Gray and Larson, 2003). It is not so reliable toward the closing phase of the project. Many EVM enthusiasts like Coeffie (2005) and Lipke (2000) studied this index with more details.

Basically, the SPI compares what is earned in terms of project time i.e. EV, to what was planned to be accomplished at a given point in time i.e.

$$SPI = EV / PV \quad (5)$$

Any value above one for CPI and SPI is favorable and indicative of under budget spending and ahead of schedule performance and any value below one is an indication of over budget spending and delays and behind schedule progress. Such conditions require corrective actions planning and implementation.

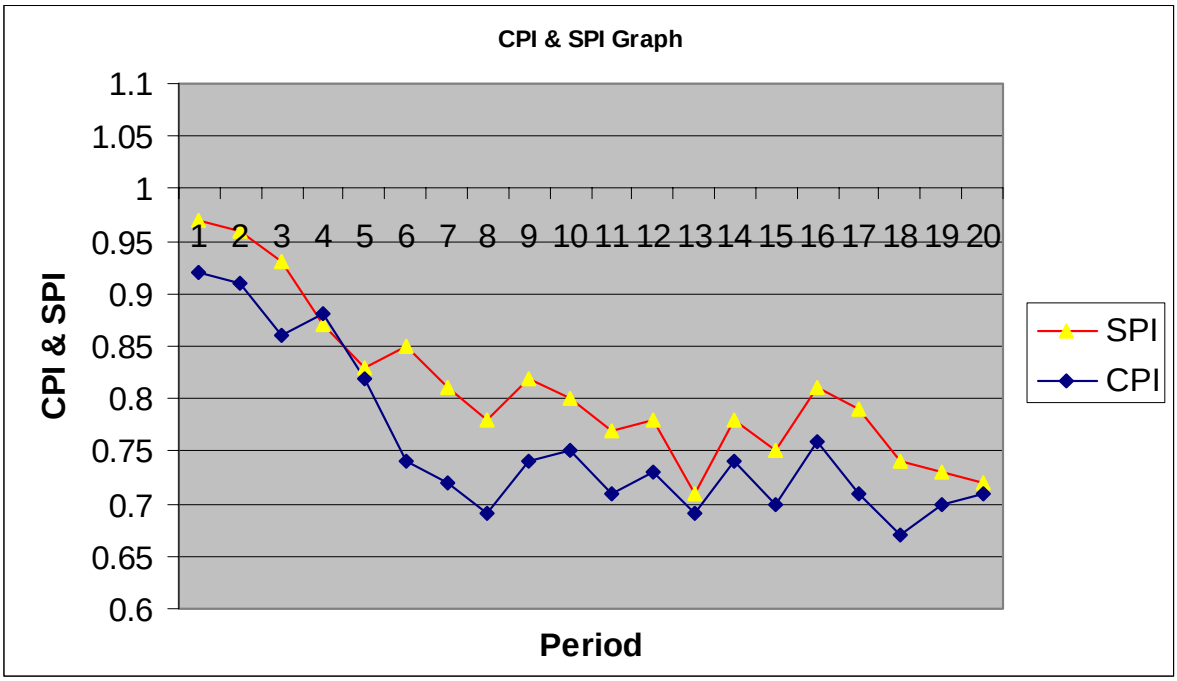

Figure 4. CPI and SPI Variations for the Aircraft Overhaul Project.

Graphical presentation and variation over time of the CPI and SPI is very helpful for project managers, senior management and project sponsors since it provides valuable information of both cost and schedule status and trends will be obvious which will dictate the future management actions. Figure (4) shows the SPI and CPI variations for the case study of the aircraft overhaul project.

3. **Cost-Schedule Index (CSI)**: this index is also known for many as the Critical Ratio (CR) which combines both the SPI and CPI (Meredith and Mantel, 2003). In practice it is very possible to see a project progressing with budget overruns but schedule is on target or any other combination of performance like being behind schedule and overrunning the budget. The CR provides information about the combined effect of such conditions. It is a measure of the "total health" of the project, CR is given by:

$$CR = CPI \times SPI \quad (6)$$

Any value of CR that is below one is an indication of a problem, either in schedule or budget or both. Again, using a control chart can keep a monitor on overall performance of the project and highlights any performance trends. Figure (5) shows the variation of the CR for the case study over its duration.

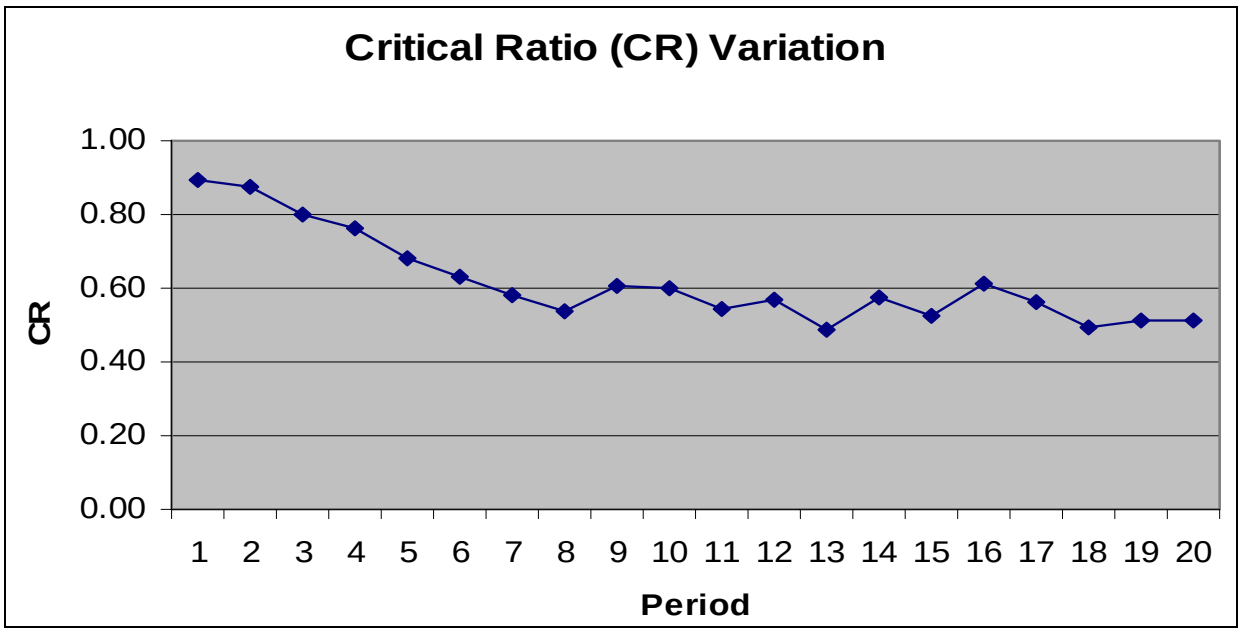

Figure 5. CR Variations for the Aircraft Overhaul Project.

Proactive project management requires project manager to look into the future and anticipate any schedule or budget overruns and take appropriate timely decisions to influence the future performance of the project relying on available present information and EV analysis results. The two most commonly forecasted quantities and the forecasting methods are explained as follows.

1- **Estimate To Complete (ETC):** This is the expected cost needed to complete all the remaining work for a scheduled activity, a WBS component or the project. There are two methods to forecast the ETC, the choice of which method to use depends on the conditions that are prevailing in the project (Gray and Larson, 2003).

When current performance analysis indicates that present cost and schedule variances are typical and corrective actions, when implemented, will prevent such variances from reoccurrence then:

$$ETC_1 = BAC - EV \quad (7)$$

On the other hand, when management considers present variances are typical of future variances, then the CPI comes into the equation and the new ETC will be denoted by ETC_2 where:

$$ETC_2 = (BAC - EV) / CPI \quad (8)$$

ETC_2 above emphasizes the importance of the efficiency of the project team in spending the project budget represented by the CPI which has a great effect on the final cost estimate of the project.

2- Estimate at Complete (EAC): It is the expected total cost of an activity, work package, or project (Christensen, 2002). Similar to the analysis of the ETC, if the project manager and his/her team think that, based on

present analysis of earned value metrics, the present project performance is not a good indicator of future performance and today variances will not occur in the future since whatever conditions that induced such variances have been dealt with positively then the EAC will be computed as:

$$EAC_1 = BAC - CV \quad (9)$$

If management, on the other hand, considers that past performance is a good indicator of future performance and current variances are typical of future ones then the EAC_1 will be modified by the CPI as a performance factor. The new estimate will be denoted by EAC_2 and given by:

$$EAC_2 = BAC / CPI \quad (10)$$

EAC_2 above, again, emphasizes the powerful effect of the CPI on the final cost of the project. The more efficient the team is in controlling spending of project budget the closer the final cost of the project to the original planned budget.

7. STATISTICAL APPLICATIONS

Different statistical tools can be deployed in different ways to follow and analyze EVM results. Behavior of performance indices, SPI and CPI and CR, can be traced using simple run charts, but application of Statistical Process Control (SPC) control charts on such indices is more useful in spotting trends, quantifying performance problems and evaluation of risks in terms of probability of project failure. Control charts also provide warning signals to managers to pay attention to problem areas and guide their development of recovery strategies before problems exaggerate and get out of control.

In this research EVM has been interconnected with SPC to evaluate control charts benefits if used in project management as a general practice and to see if they provide enhancement to the control ability of project managers on project cost and schedule. Hypothesis testing is another statistical tool that was applied to validate the assumptions of this research and to spot factors with statistical significance on project progress performance regarding schedule and cost.

For the aircraft overhaul project a control chart for both SPI^{-1} and CPI^{-1} has been developed. The choice of inverse values is made since they are more meaningful and they indicate the extra time or budget spent to gain the value of a certain amount of accomplishment. Since our data is taken once every two weeks, individual control chart and moving range is chosen (XmR) with n=2 as subgroups size. To evaluate the Upper Control Limit (UCL), Lower Control Limit (LCL) and Center Line (CL) control charts tables (Montgomery, 2003) are used. The values of the used constants are; $d_2 = 1.128$, $D_3 = 0$, $D_4 = 3.267$. The control charts for this project are shown in Figure (6).

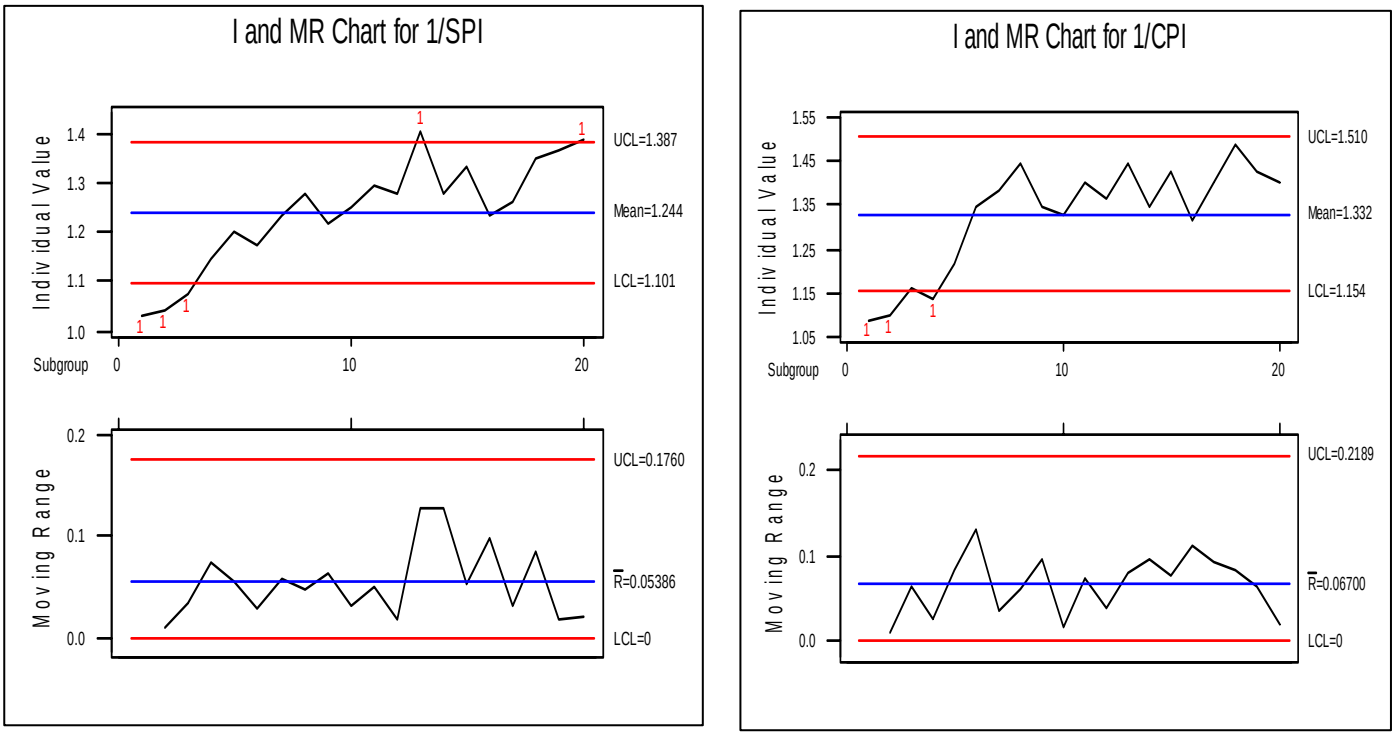

Figure 6. XmR Charts for the Aircraft Overhaul Project.

To interpret Figure (6), define the Upper Specification Limit (USL) for the schedule as the ratio between the negotiated period to complete the project to the planned duration which is one in this particular case, no management reserve is available to mitigate project schedule risks. Similarly, the USL for the cost is unity since it is the ratio between negotiated cost and planned cost for the project. For this particular project it has been in trouble since early beginning, both SPI^{-1} and CPI^{-1} have always been above the USL and they continued to deviate further. Such situation indicates poor planning and lack of structured methodology to control project schedule and budget. The result of this project was a budget overrun by more than 70% and schedule overrun by 175%.

8. DATA ANALYSIS

1. Questionnaire Results: For the questionnaire sides of the research the 224 contractors who participated in government tenders and projects in the years 2004 through 2006 were contacted by email. To guarantee an adequate return rate the questionnaire was delivered to 100 of their head offices. The researchers received back 93 replies. The returned number of questionnaires forms 41.5% of the total population which is considered a representative sample enough for the analysis. Six returned questionnaires (6.5%) were not suitable for the analysis due to errors in the provided answers for some questions. Table (1) shows the distribution of projects completed by the populations according to their specialty as licensed by the General Tenders Department and the number of contractors participated in these projects.

Table 1. Completed Projects in Years 2004 though 2006.

Year	Buildings	Roads	Water and Sewage	Electromechanical	Infrastructure	Total	No. of contractors
2004	58	17	2	2	5	84	71
2005	41	21	6	2	9	79	63
2006	74	24	10	2	9	119	90
Total						282	224

Table 2. Statistical Analysis Summary (ANOVA and Regression).

Dependent Variables	Independent Variables	Unstandardized Coefficients B	Std. Error	Standardized Beta	t- value	Sig.*	Adj. R^2
Project Schedule	**PM Training**	0.791	0.030	0.945	26.65	0.00	0.892
	Practice PM	0.525	0.018	0.951	28.36	0.00	0.903
	EVMS Use	0.711	0.024	0.956	30.099	0.00	0.913
	Gov. Reg.	**0.707**	**0.021**	**0.964**	**33.35**	**0.00**	**0.928**
Project Cost	**PM Training**	0.796	0.030	0.946	26.77	0.00	0.893
	Practice PM	0.531	0.018	0.956	30.03	0.00	0.913
	EVMS Use	0.718	0.023	0.960	31.45	0.00	0.920
	Gov. Reg.	**0.713**	**0.020**	**0.967**	**35.01**	**0.00**	**0.934**

* of statistical significance at $\alpha = 0.05$.

The questionnaire as the study instrument was offered to experts in the field of project management to test its validity and it was adjusted according to their different recommendations. To test instrument reliability and internal consistency Cronbach-Alpha test was conducted and alpha value was determined as 0.95 which is very acceptable for such research. Questionnaire statistical analysis, ANOVA and regression, is summarized in Table (2).

From Table (2) it is seen that government regulations have the most effect on both schedule and cost performance of projects since they have the highest t-value. It is also clear that all independent variable have a significant effect on project schedule and cost, therefore the researchers reject the null hypothesis represented by the research assumptions and accepts the alternative ones which states that all independent model variable have significant effect on both dependent variable. This conclusion is supported by the high Beta values for all

independent variables. The regression models developed from the analysis are found to be adequate as indicated by the high value of adjusted R^2.

2. Survey Analysis: For the field survey part of this research 44 locally completed projects in years 2004-2006 from different governmental departments and ministries were taken as the study sample. The total planned budget for these projects was $66,884,469.57 The total tenders values of projects in the study period was $710 millions The projects completed for Greater Amman Municipality alone in the years 2004 through 2006 was $316 million which is 44.5% of the total tenders value (GTD Annual Book, 2006).

The analysis showed that the means were 0.73 for SPI and 0.77 for CPI. This indicates that in average the government is getting only 73% of the value of each working day and 77 cents for each dollar spent. In percentages, 46% of the surveyed projects were completed with an SPI <1 (behind schedule) and 69% of them were completed with budget overruns (CPI<1). The total budget overrun was $17,095,580.00 (25.5%) and the delays in days totaled to 3,076 working days (65%). Even when a 0.85 value is considered acceptable for SPI and CPI then the percentage of delayed projects did not change but the percentage of completed projects with budget overruns was found to be 42% which is still very high and a country with a limited resources, like Jordan, can not afford such delays and associated costs and budget overruns.

3. **Government Regulations Review:** There are different regulations and instruction issued by the General Tenders Department/ Ministry of Public Works and Housing to control classification and qualification of local contractors and consultant. The latest was issued in accordance with article 4 of government works By-Law number 71 for the year 1986 and its subsequent amendments which was published on 1st April 1996 in official Gazette No. 4108.

All contractors must comply with the instructions of this By-Law before they are assigned a designated class, ranging from first to fifth, which will limit the size of the project that they can participate in.

Reviewing the different By-Law regulations, it is discovered that there are no requirements concerning the level of competency of the project managers or project teams or the methodologies to be used by contractors' while executing government projects. Where, on the other hand, one can see that there are requirements, for example, concerning level of competency of accountants, he/she should be a Certified Public Accountant (CPA), and there are regulations defining other issues like office area, type of equipment owned by contractor, administrative staff level of education, number of engineers of different engineering disciplines, number of years of relevant experience for the various engineers and value of projects completed in the past successfully. Most important that the By-Law does not provide any requirements relevant to the way that projects are monitored and controlled. The only available regulation that will control the execution of projects by both contractor and government as a project owner is The Federation of International Consulting Organizations rules known as FIDEC. To be more effective government is to modify the present regulations to include other requirement like the enforcement of the use of EVMS to monitor and control projects as is the case in modern countries like the US, Australia, and UK who have already established the presence of an EVMS in the contractor organization as an essential requirement for contractors to bid on public projects since 1998. This requirement is known since then as the American National Standard Institute/Electronic Industrial Alliance (ANSI/EIA) standard #748.

9. RESULTS AND RECOMMENDATIONS

It was concluded that, locally, there is a great influence of the independent variables represented by the training of project teams on modern project management, practice of up-to-date project management methodologies, use of EVMS and government regulations on the overall performance of the executed projects. The greatest effect was found to originate from government regulations**.** As it stands today the SPI and CPI for local projects are very low and can be made better by focusing on the independent variables of the suggested model.

It is recommended that local contractors to start paying more attention to training requirement of their project teams and integrate EVMS into their project management information systems. Government is to update current regulations and by-law to enforce the use of EVMS as a project monitor and control tool and to ensure that competent and qualified project managers are leading projects to guarantee minimum deviations from plans.

REFERENCES

Abbasi, G.Y. 1995. Basics of Integrated Project Management. National Press, Amman, Jordan.

Anbari, F. 2003. Earned value Project Management, Method and Extension. School of Business and Public Management. The George Washington University. *Project Management Journal*, Dec.2003 edition.

Christensen, D. S. and Scott, H. 1993. Cost Performance Index Stability. *National Contract Management Journal*, 25, 7-15. Spring 1993 Edition.

Christensen, D.S. 1998. The Costs and Benefits of the Earned Value Management Process, *Acquisition Review, Quarterly*-Fall 1998 edition.

Christensen, D.S. and Templin. 2002. EAC Evaluation Methods, Do They Still Work? David College of Business, Southern Utah University.

Cioffi, D.F. 2005. A Tool for Managing Projects: An Analytic Parameterization of the S-Curve. *International Journal for Project Management*, 23 (3): 215-222.

General Tenders Directorate Annual Book for the Year 2006. Ministry of Public Works and Housing. Amman-Jordan.

Gray, C.F. and Larson, E.W. 2003. Project Management, The Managerial Process. Second Edition. McGraw-Hill.

Jawad, S. and Abu-Alethem, K. 2007. Evaluating Organizational and Environmental Factors Influencing the Performance of the Contractors of Construction Projects In Jordan Amman Arabic University, Jordan.

Johnson, C. 2006. Implementing an ANSI/EIA-748-Compliant Earned Value Management System. Contract Management.

Koppelman, J.M. and Quentin, W.F. 1999. The Earned Value Body of Knowledge. Primavera Systems, Inc. Proceedings of the 30th Annual Project Management Institute 1999 Seminars and Symposium, Philadelphia, Pennsylvania, USA.

Lipke, W. and Vaughn, J. 2000. Statistical Process Controls Meets Earned Value. Cross Talk, *Journal of Defense Software Engineering*.

Meredith, J.R. and S.J. Mantel Jr. 2003. Project Management - A Managerial Approach. Fifth Edition, John Wiley and Sons, New York, USA.

Project Management Institute. 2004. A Guide to the Project Management Body of Knowledge (PMBOK Guide), 3rd Edition, Project Management Institute, PA. USA.

Stratton, R.W. 2007. Applying Earned Schedule Analysis To EVM Data for Estimating Completion Date. *AACE International Transaction*, EVM.04.

العوامل المؤثرة في السيطرة على المشاريع الحكومية في الأردن

سليم محمد الرواشدة، وغالب يوسف عباسي، وناصر رحال*

ملخـص

تمت دراسة أهمية تطبيق مفهوم نظام إدارة القيمة المكتسبة كأداة لمراقبة المشاريع الحكومية والتحكم بها؛ فقد تم تطوير نموذج الدراسة للوقوف على أثر المتغيرات المستقلة مثل: استخدام الطرق الحديثة في إدارة المشاريع والقوانين والأنظمة والتشريعات الحكومية، وأهمية تدريب كوادر لإدارة وتنفيذ المشاريع، واستخدام نظام إدارة القيمة المكتسبة في المتغيرات التابعة وهي كلفة المشروع ومدته. لاختبار صدق فرضيات الدراسة فقد تم تصميم استبانة الدراسة وعرضها على خبراء في مجال إدارة المشاريع وتوزيعها على عينة البحث من المقاولين والشركات التي قامت بتنفيذ مشاريع حكومية في الأعوام 2004، 2005 و2006.

تم إجراء مسح ميداني لجمع المعلومات عن 44 مشروعاً حكومياً جرى تنفيذها خلال الفترة نفسها لتقييم أدائها وإيجاد معاملي أداء الكلفة و أداء الوقت كمؤشرات فعالة للدلالة على أداء هذه المشاريع. من تحليل بيانات المسح الميداني إحصائياً تبين أن الزيادة في كلفة المشاريع للأعوام الثلاثة المعنية بالدراسة كانت أكثر من 17 مليون دولار (25% إضافة على الموازنة الأصلية)، ووصل مستوى التأخير في المعدل إلى 65% زيادة عن الوقت الأصلي.

وبين تحليل المعلومات الناتجة من الاستبانة أن للقوانين والتشريعات الحكومية أكبر الأثر في أداء المشاريع بالمقارنة مع بقية العوامل المستقلة التي بدورها كان لها أثر كبير أيضاً. وهذا يستدعي تعديل القوانين والتشريعات الحكومية لترتقي لمستويات دولية لضمان تحكم أفضل بأداء المشاريع الحكومية.

الكلمات الدالة: إدارة المشاريع، نظام إدارة القيمة المكتسبة، معامل أداء الكلفة، معامل أداء الوقت.

* سلاح الجو الملكي (الباحث الأول)، وقسم الهندسة الصناعية، كلية الهندسة والتكنولوجيا، الجامعة الأردنية (الباحثان الثاني والثالث). تاريخ استلام البحث 2008/1/28 وتاريخ قبوله 2008/4/22.