



**Ain Shams University**  
**Faculty of Engineering**

**THE INTEGRATION BETWEEN EARNED VALUE  
MANAGEMENT AND RISK MANAGEMENT IN  
CONSTRUCTION PROJECTS**

**A thesis submitted for partial fulfilment  
of the requirements for award of Master of Science  
In Civil Engineering “Structural Engineering”**

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## **Declaration**

**I certify that all the material in this thesis that is not my own work has been identified and that no material is included for which a degree has previously been conferred on me.**

**The contents of this thesis reflect my own personal views and are not necessarily endorsed by the University.**

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**(Date)**

## **Abstract**

The success criterion of a project is to achieve the project objectives and scope of work within the dedicated budget, targeted time and quality requirements. Various techniques have been developed to monitor, control and evaluates the project cost and time performance. One of these widespread techniques is the Earned Value Management technique which effectively measures the project performance to date in the terms of cost and time. On the other hand, the Risk Management technique is dedicated to address any future threats or opportunities.

Using each of the EVM and RM techniques without a systematic integration and synchronosization of the data extracted from both techniques may mislead the project parties in the terms of establishing the project measurement baseline, change management and the forecasting and decision making processes. Hence, the need for a systematic integration between EVM and RM was developed especially in the current crucial world wide economical circumstances.

The literature review was divided into Earned Value Management, Risk Management and the integration process between both techniques, the methodology proposed a systematic steps for the integration technique starting by establishing the project total budget, integrated baseline change management, forecasting and decision making.

A case study for an existing project which used only Earned Value Management technique as monitoring and control tool demonstrates the limitation of the Earned Value Management tool, subsequently the systematic integration between Earned Value Management and Risk Management was conducted resulting in improving the project performance.

A questionnaire was developed to understand the worldwide status of the application of the integration between the Earned Value Management and the Risk Management and also addressed the various benefits from the integration technique. The results of the questionnaire confirmed that there are many added values gained from the integration technique in terms of cost and time aspects.

In summary, the result of this research demonstrate that the integration between EVM and RM generally improves the project management throughout the project life cycle.

**Keywords:** Earned Value Management, Risk Management, Integration

## **Dedication**

I dedicate this thesis to my family. A special feeling of gratitude to my lovely and kind parents whose affection, love, encouragement and prayers of day and night made me able to get such success and honour in addition to their moral support, their words of encouragement and push for tenacity were always ringing in my ears.

This thesis is also dedicated to friends and coworkers who have supported me throughout the process. I will always appreciate all they have done through advices and sharing of experiences.

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## **Table of Contents**

<b>Chapter 1. Introduction</b>	<b>01</b>
1.1 Background	01
1.2 Objective	03
1.3 Organization and Scope	03
<b>Chapter 2. Literature Review</b>	<b>04</b>
2.1 Earned Value Management	04
2.1.1 Earned Value Management Definition	06
2.1.2 Earned Value Management Concept	07
2.1.3 Earned Value Management Role	07
2.1.4 Earned Value Management Benefits	08
2.1.5 Earned Value Management Contribution to this Research	09
2.2 Risk Management	10
2.2.1 Risk Definition	11
2.2.2 Risk Management Definition	11
2.2.3 Risk Management Process	11
2.2.4 Risk Management Contribution to this Research	17
2.3 The Integration between Earned Value Management and Risk Management	17
2.4 Summary and Research Gap	26
<b>Chapter Three: Methodology</b>	<b>27</b>
3.1 Establish the Project Measurement Baseline	27
3.2 Develop an Integrated Baseline Change Management	30
3.3 Perform Analysis and Decision Making	32
3.4 The Practical Implementation of the EVM and RM	35
<b>Chapter Four: Research Questionnaire and Hypothesis</b>	<b>40</b>
5.1 Sample	40

<b>5.2 Data Collection</b>	<b>40</b>
<b>5.3 Data Analysis</b>	<b>40</b>
<b>5.4 Validity and Reliability</b>	<b>40</b>
<b>5.5 Ethical Considerations</b>	<b>41</b>
<b>5.6 Results</b>	<b>41</b>
<b>5.7 Hypothesis Testing</b>	<b>62</b>
<b>5.9 Conclusion</b>	<b>66</b>
<b>Chapter Five: Case Study</b>	<b>69</b>
<b>4.1 Project Nature and Overview</b>	<b>69</b>
<b>4.2 Project Objectives and Success Criteria</b>	<b>69</b>
<b>4.3 Project Start and End Dates</b>	<b>69</b>
<b>4.4 Project Performance Measurement Baseline and Total Budget</b>	<b>69</b>
<b>4.5 Project Narrative and Issues</b>	<b>71</b>
<b>4.6 Project Cost Estimate at Completion</b>	<b>72</b>
<b>4.6.1 Overrun Quantities</b>	<b>74</b>
<b>4.6.2 Materials Prices Fluctuation</b>	<b>75</b>
<b>4.6.3 Currency Devaluation</b>	<b>75</b>
<b>4.6.4 Contract Prices Escalation</b>	<b>75</b>
<b>4.6.5 Additional Indirect Cost due to Project Schedule Prolongation</b>	<b>76</b>
<b>4.6.6 Summary of Cost Impacts</b>	<b>76</b>
<b>4.7 Project Monitoring and Controlling</b>	<b>77</b>
<b>4.8 Conclusion of the Project Cost Performance</b>	<b>79</b>
<b>4.9 Applying the Integration between EVM and RM to the Project</b>	<b>80</b>
<b>4.9.1 Establish the Project Measurement Baseline</b>	<b>80</b>
<b>4.9.2 Develop an Integrated Baseline Change Management</b>	<b>88</b>
<b>4.9.3 Perform Analysis and Decision Making</b>	<b>91</b>
<b>4.10 Summary and Conclusion</b>	<b>91</b>

<b>Chapter Six: Summary, Conclusion and Recommendations</b>	<b>94</b>
<b>6.1 Summary</b>	<b>94</b>
<b>6.2 Conclusion</b>	<b>94</b>
<b>6.3 Research Contribution</b>	<b>96</b>
<b>6.4 Recommendations for future research</b>	<b>96</b>
<b>References</b>	<b>98</b>
<b>APPENDIX A. SURVEY QUESTIONNAIRE</b>	<b>102</b>



## List of Figures

Fig 2.1 Project performance control linkage by Earned Value.

Fig 2.2 Benefits of Earned Value Management method as seen in a British survey.

Fig 2.3 Risk Management and Earned Value Management the Synergy.

Fig 2.4 Establishing of the PMB process using the integration between Earned Value Management and Risk Management.

Fig 2.5 Establishing of the Project Baseline Spend Plan in Full Consideration of Defined Risks with the Ellipse Showing all Possible Outcomes.

Fig 2.6 Output of Establishing the PMB Considering a Systematic Integration between Earned Value Management and Risk Management.

Fig 2.7 Integrated Baseline Change Management Process.

Fig 2.8 Transfer of work and associated budget between SRP and the PMB resulting from actions being transferred to and from the PMB.

Fig 2.9 Risk Management action types indicated by Earned Value Management indices.

Fig 3.1 Possible flow of budget between NSRP and SRP

Fig 3.2 Transfer of work and associated budget between SRP and the PMB resulting from actions being transferred to and from the baseline

Fig 3.3 Project estimate at completion elements

Fig 3.4 Integrated work breakdown structure and organization breakdown structure and responsibility assignment.

Fig 3.5 Cost and time performance measurement parameters such as; planned value, actual cost, earned value, estimate to complete, estimate at completion, budget at completion and variance at completion.

Fig 3.6 Cost variance, schedule variance, cost performance index, schedule performance index and to complete performance index.

Fig 3.7 Monitoring and controlling of changes to the Management Reserve and Performance Measurement Baseline at the integrated baseline change management.

Fig 5.1: Organization breakdown Structure

Fig 5.2: PMB, SRP and NSRP.

## List of Tables

Table 4.1 Respondents Locations

Table 4.2 Respondents Years of Experience in EVM

Table 4.3 Respondents Years of Experience in RM

Table 4.4 Respondents Years of Experience in the Integration between EVM and RM

Table 4.5 Respondents Rate of Using EVM

Table 4.6 Respondents Rate of Using RM

Table 4.7 Respondents Rate of Using the Integration between EVM and RM

Table 4.8 Respondents opinion in the importance of Earned Value Management in evaluating past project performance

Table 4.9 Respondents opinion in the importance of Earned Value Management in future project performance.

Table 4.10 Respondents opinion in the importance of Earned Value Management in estimating the total project cost at completion

Table 4.11 Respondents opinion in the importance of Earned Value Management in estimating the project end date

Table 4.12 Respondents opinion in the importance of Earned Value Management in generally enhancing the project management, monitoring and control

Table 4.13 Respondents opinion in the importance of the integration between EVM and RM in taking early corrective actions

Table 4.14 Respondents opinion in the importance of the integration between EVM and RM in improving project cost control

Table 4.15 Respondents opinion in the importance of the integration between EVM and RM in improving project schedule control

Table 4.16 Respondents opinion in the importance of the integration between EVM and RM in improving the coordination and communication between project stakeholders

Table 4.17 Respondents opinion in the importance of the integration between EVM and RM in reducing the project actual cost

Table 4.18 Respondents opinion in the importance of the integration between EVM and RM in completing the project within the allocated budget

Table 4.19 Respondents opinion in the importance of the integration between EVM and RM in increasing the dependability and accuracy of the project cost and schedule performance reports

Table 4.20 Respondents opinion in the importance of the integration between EVM and RM in controlling the project management reserve

Table 4.21 Mean, Standard Deviation, Degree of Freedom, t Value and p Value for the RQs

Table 5.1: Total project built up areas for different building types.

Table 5.2: Project measurement baseline and management reserve project data.

Table 5.3: Project cost estimate at completion and variance at completion for different work packages, buildings and disciplines.

Table 5.4: The cost impact of the additional quantities those were not allocated in the original project measurement baseline.

Table 5.5: Cost impact due to prices escalation of different construction materials.

Table 5.6: Summary of cost impacts.

Table 5.7: Project cost performance and status till December, 2014.

Table 5.8: Project work breakdown structure.

Table 5.9: Top down budget using three points estimate.

Table 5.10 Established project risk register.

Table 5.11 Qualitative risk analysis applied to the identified risks.

Table 5.12 Revise the Top-down budget using three-point estimates.

Table 5.13 Integrate the WBS/OBS – Responsibility assignment matrix form.

Table 5.14 Allocation of the initial project measurement baseline.

Table 5.15 Updated project risk register and the qualitative risk analysis.

Table 5.16 Quantitative Risk Analysis According to the Latest Update of the Risk Register.

Table 5.17 Estimated Non Specific Risk Provision.

Table 5.18 Allocated Project measurement baseline, Specific Risk Provision and Non Specific Risk Provision.

Table 5.19 Project Cost Monitoring and Control, transfer between PMB, SRP and NSRP.

## List of Charts

Chart 4.1 Locations distribution of the respondents per continent

Chart 4.2 Respondents Years of Experience in EVM

Chart 4.3 Respondents Years of Experience in RM

Chart 4.4 Respondents Years of Experience in the Integration between EVM and RM

Chart 4.5 Respondents Rate of Using EVM

Chart 4.6 Respondents Rate of Using RM

Chart 4.7 Respondents Rate of Using the Integration between EVM and RM

Chart 4.8 Respondents opinion in the importance of Earned Value Management in evaluating past project performance

Chart 4.9 Respondents opinion in the importance of Earned Value Management in future project performance.

Chart 4.10 Respondents opinion in the importance of Earned Value Management in estimating the total project cost at completion

Chart 4.11 Respondents opinion in the importance of Earned Value Management in estimating the project end date

Chart 4.12 Respondents opinion in the importance of Earned Value Management in generally enhancing the project management, monitoring and control

Chart 4.13 Respondents opinion in the importance of the integration between EVM and RM in taking early corrective actions

Chart 4.14 Respondents opinion in the importance of the integration between EVM and RM in improving project cost control

Chart 4.15 Respondents opinion in the importance of the integration between EVM and RM in improving project schedule control

Chart 4.16 Respondents opinion in the importance of the integration between EVM and RM in improving the coordination and communication between project stakeholders

Chart 4.17 Respondents opinion in the importance of the integration between EVM and RM in reducing the project actual cost

Chart 4.18 Respondents opinion in the importance of the integration between EVM and RM in completing the project within the allocated budget

Chart 4.19 Respondents opinion in the importance of the integration between EVM and RM in increasing the dependability and accuracy of the project cost and schedule performance reports

Chart 4.20 Respondents opinion in the importance of the integration between EVM and RM in controlling the project management reserve

Chart 4.21 Mean, Standard Deviation and t Value for the RQs

Chart 5.1: Summary of additional quantities cost impact.

Chart 5.2: Values summary of cost impacts.

Chart 5.3: Weights summary of cost impacts.

Chart 5.4: Project cost performance and trends till December, 2014.

# **Chapter One: Introduction**

## **1.1 Background**

Cost monitoring and controlling of a project is very important and crucial factor for project success, as one of the main objectives of project management is to finish the project at a point that is not far away from the allocated budget, after establishing the project budget and the commencement date of the project starts, normally deviations start to appear between the allocated budget and the actual incurred costs, these deviations may be above the allocated budget (overrun), and may be under the allocated budget (under-run), the probability of the overrun is usually higher than the probability of the under-run, prices of the construction materials raise due to economical inflation and many other risks occur that affect the project cost performance, project stakeholders start to investigate the reasons of the cost overrun, highlight and monitor those reasons, to figure out whether these new impacts will continue affecting the cost performance till end of the project or not.

Forecasting of the project cost at completion is a challenging issue, as the project may go into overrun, under-run and according to the allocated budget, but the issue is whether the current cost performance trend will remain the same, enhanced or worsen for the remaining life cycle of the project. There are two major parts at any time of the project progress, the first is the works executed to date (work done), and the future remaining works which will be carried on to achieve the project, the cost performance till a certain time of a project life cycle can be easily determined and monitored because it is a fact, the challenging part is to know what is coming on - the uncertainty.

Various techniques are used to figure out the cost performance to date, one of these techniques is the Earned Value Management that can be effectively used to monitor and control the project actual costs to date by simply comparing the budgeted cost of work performed against the actual cost of work performed, reasons of the cost performance can be then figured out. On the other hand there is nothing else but the Risk Management can be used to predict the future issues whether threats or opportunities, Earned Value Management system is only fed by the data extrapolated from the past performance and hardly any way to use the Earned Value Management to predict the future, the Risk Management on the other hand is the specialized tool in this regard.

Many organisations use both techniques actually, but the issue is that The Earned Value Management and Risk Management can and should be implemented in an integrated way, not only during the project execution phase, but also from the project initiation phase till project completion.

The integration will be started by establishing the project budget (measurement baseline) which shall be monitored and controlled by the Earned Value Management and establishing the project management reserve which shall be monitored and controlled by the Risk Management.

The integration process will be then pass by the project execution phase, which is the major part of the integration technique, at this stage the project will encounter changes in the cost performance trends, deviation will start to appear, and the management reserve can be used to recover these deviations when materialised. The management reserve will cover the cost deviation which has happened due to risk factors (whether threats and opportunities), and shall not be used to cover for any scope changes or any other related cost impacts.

A synchronisation system will to be conducted between the project measurement baseline and the management reserve, management reserve estimated could be then measured and evaluated when embedded in the project measurement baseline using the Earned Value Management tool.

The Earned Value Management and Risk Management approaches share a mutual interest of providing the project stakeholders with the adequate available information while setting targets and considering management strategies. However, they take differing approaches, Earned Value Management measures the project performance to date and uses these information to gain an understanding of future performance and the required resources to effectively reach these objectives. Risk Management looks forward to the obscure future to recognize and analyze risks and suggest actions to be applied to minimize or avoid the influence and the likelihood of a threat incidence or increase the utilization of the opportunities (APM, 2008).

The Earned Value Management concept has been deeply studied by (Besner and Hobbs, 2006; Bower and Finnegan, 2009; Butler and Richardson, 2011; Fleming and Koppelman, 2008; Garrett and Roberts, 2008; Hillson, 2004 and 2011; Leu and Lin, 2008; Liu and Tu, 2010; Shepherd, 2010; Song, 2010). they highlighted the benefits of the Earned Value Management in forecasting the project cost and time at completion based on a variety of measurable and estimable costs and time of a project based on past performance. In spite of their extensive studies, project management practitioners faced several problems and challenges related to the Earned Value Management technique, for example, Earned Value Management uses the past performance of current projects to expect future trends and performance, that can usually limit its dependability because Earned Value Management solely cannot forecast strategies to foresee future events that are not dependent on past performance (PMI, 2011a).