

EARNED VALUE MANAGEMENT AND TELECOM PROJECTS SUCCESS

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DECLARATION

STUDENT'S DECLARATION

I declare that this research project is my original work and has not been presented to any other university for the award of a degree.

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SUPERVISOR'S DECLARATION

This research project has been submitted with my permission as the University Supervisor.

SIGNATURE:.....

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DEDICATION

I dedicate this dissertation to my family, especially....

To Dad and Mom as I can never compensate what they have done for me;

To My wife as she has always been the best support towards any changes;

To My son & daughter, Arshia & Arshida who are my proud & pride;

ACKNOWLEDGEMENT

It is not easy to thank everyone who had an input into this research project, for the list is almost inexhaustible. However, there are those individuals and institutions, without whom, the research consultation and mandated authority would have been near impossible to take place.

I wish to register my sincere gratitude to some of the contributors including my Lecturers and supervisors for the light they shed on me and the encouragement since we met and all along, for the success of this research.

ABSTRACT

This study has been carried out to determine the relationship between EVM and Project success, which was targeted on two major items which are Investigating the relationship between the application of EVM principles and project success plus the investigation on the moderating effect EVM Structure may have on the relationship. The study employed a descriptive design since the study concentrated on Nokia projects in Africa. Survey study was conducted to get detailed information on the relationship between EVM and project success. Secondary data was used. The data was obtained from monthly reports, annual plans and achievements of the Nokia network deployment projects in Africa. This ensured that the information obtained was not biased and depicts the real situation of the projects. The study found that there was positive relationship between proper Earned value Management and project success considering the fact that the planning phase and assumptions set at the beginning of the project can have a major impact on the way EVM can be handled through the project. Inaccurate assumptions will lead in undesired results of EVM throughout the project life cycle that can impact the stakeholders decision at any stage of deployment. On the other hand with a good quality EVM structure we will benefit a lot in terms of project handling and success of the same. The study recommends that the initial plan of the EVM should be handled with the direct supervision of the PMO team who have had enough experience in terms of project cost, time and quality

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Project management is challenging. Whether in construction, information technology, or software development, odds are high that project success will be jeopardized. Consider that cost overruns of 25–33 percent are not unusual in the construction industry (Reid & Priest, 2004). The same industry also has seen substantial growth in projects ending in either dispute or litigation (Levin, 1998). In the information technology industry, “at-risk” projects have been commonplace in the public sector (GAO, 2006). Moreover, 18 percent of projects in the software industry are prematurely canceled (Standish Group, 2004). Further still, 53 percent of software projects will exceed their cost, schedule, or scope constraints. There is no shortage of data about under-performing projects, and even more frequent stories in the workplace about troubled and worse still failed projects. Therefore, project managers need effective tools and techniques to meet the challenges of their profession. One such method believed to be effective is earned value management (EVM).

EVM is a comprehensive methodology used to manage projectized efforts. The methodology addresses many project management areas, including project organization, planning, scheduling and budgeting, accounting, analysis, reporting, and change control (Fleming and Koppelman, 1996). EVM also incorporates specific mechanics to include the use of the work breakdown structure (WBS), performance curves (S-curves), as well as a defined set of performance metrics. EVM is among the first project management methodologies to be codified by national standards setting organizations (ANSI/EIA, 1998; ASI, 2003).

Project management approaches enable organizations to accomplish projects efficiently, addressing both internal constraints and dynamic external situations in the interim. Project management enables organizations to prevent or remove internal project constraints and also adapt to unforeseen changes in project scope or goals. An organization can, depending on its requirements, either adopt a standard project management approach or combine multiple approaches. Additionally, an organization has the advantage of project management software applications which facilitates intelligent planning, constraint removal and monitoring of projects.

Here is a list of standard project management approaches; Traditional approach, Critical chain approach, Extreme project approach, Event chain project approach.

The traditional approach assumes that the project scope and goals will remain constant till project completion. Obviously, a project manager plans and identifies project resources based on this assumption. The traditional approach lays down the following project phases, Project initiation, Project planning and design, Project monitoring and control, Project execution, Project completion (Mukho and Lisanti, 1982).

The Critical Chain Approach assumes that at least one constraint (behavioral or process-related) is likely to hinder projects which utilize complex processes and a large number of cross-functional teams. The approach recommends the use of behavioral and mathematical sciences to first predict, and then analyze and remove constraints. The project team can use data to remove the constraints (Adamczyk, 1989). For example, if productivity is a foreseen concern, then a project manager could track the actual time spent by team members on the job. This approach is useful in sending quality deliverables on time by proactively removing constraints.

Extreme project approach is suitable for projects which handle dynamic situations, such as, changing customer requirements. Often, it may not be possible to obtain a full clarity of requirements and a project may purely be guided by market changes. The mobile phone industry, which experiences rapid changes, is a case in point. The project team, hence, plans purely on the basis of the currently available data and depending on requirement changes, modifies plans (Kauffman, 2002). Event chain project approach, where a single constraint can create a chain of constraints and severely impede a project. For example, in a project, if several departments depend on one another, then constraints in any one department can negatively impact the productivity of downstream departments. A project team can use past data to foresee a negative event and identify preventive measures. Reliable data, collected over time, can even help track event chains. The Gantt chart is a popular event chain tracking tool. The event chain approach, hence, could be an excellent problem solving approach for critical projects.

The concept of earned value management became a fundamental approach to program management in 1966 when the United States Air Force mandated earned value in conjunction with the other planning and controlling requirements on Air Force programs. The requirement

was entitled the Cost/Schedule Planning Control Specification (C/SPCS). Over the decades, the concept and its requirements have remained basically unchanged. It has had periodic updates to its title: Cost/Schedule Control System Criteria (C/SCSC), Earned Value Management Systems Criteria (EVMSC), and the current 32 guidelines in the ANSI-748 Standard for Earned Value Management Systems (EVMS).

The EVM concept presented in these requirements is a sound management approach, that once incorporated on any type of program, whether research and development, construction, production, Telecom, etc. provides all levels of management with early visibility into cost and schedule problems (Mukho, 1983). Earned value management is now used on programs world-wide. Primary users include the United States, Europe, England, Canada, Australia, China, and Japan. It is a requirement of many U.S. Government agencies, including the Department of Defense (DoD), the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), the Intelligence Community, the Department of Homeland Security (DHS), the Federal Aviation Administration (FAA) and Department of Transportation (DOT), Health and Human Services (HHS), and others.

1.1.1 Earned Value Management

What is earned value management (EVM)? The basic concept of EVM is more than a unique project management process or technique. It is an umbrella term for guidelines that define a set of requirements that a management system must meet. The objectives of an EVMS are to: Relate time phased budgets to specific contract tasks and/or statements of work, Provide the basis to capture work progress assessments against the baseline plan, Relate technical, schedule, and cost performance, provide valid, timely, and auditable data/information for proactive management action, supply managers with a practical level of summarization for effective decision making (Lisanti, 1982).

Once the EVM System is designed and implemented on a project, there are significant benefits to the contractor and to the customer. Contractor benefits include increased visibility and control to quickly and proactively respond to issues which makes it easier to meet project schedule, cost, and technical objectives. Customer benefits include confidence in the contractor's ability to manage the project, identify problems early, and provide objective, rather than subjective, contract cost and schedule status.

Earned value management does introduce a few new terms. Contractors' internal systems must be able to provide: Budgeted cost for work scheduled (BCWS), sometimes called the planned value. Budgeted cost for work performed (BCWP) or earned value. Actual cost of work performed (ACWP). Budget at completion (BAC). Estimate at completion (EAC) which is comprised of the cumulative to date actual cost of work performed plus the estimate to complete the remaining work. Cost variance (CV) which is calculated as BCWP minus ACWP. A result greater than 0 is favorable (an underrun), a result less than 0 is unfavorable (an overrun). Schedule variance (SV) which is calculated as BCWP minus BCWS. A result greater than 0 is favorable (ahead of schedule), a result less than 0 is unfavorable (behind schedule). Variance at completion (VAC) which is calculated as BAC minus EAC. A result greater than 0 is favorable, a result less than 0 is unfavorable.

1.1.2 Project Success Metrics

Every PMO and project manager has a vested interest in optimizing performance. Tracking project performance over time is a crucial part of building a project that weathers changing objectives without stretching time, budget, and scope. Success evaluation provides a solid foundation for predicting outcomes of schedules in the early stages, simplifies spotting cost and schedule problems for projects further along, and helps managers establish benchmarks and long-term goals. In short, as long as measuring project success does not take too much time away from core project work, the information gained will contribute to success. Each organization must take the time to establish what is most important to evaluate as key success indicator Metric.

Metric' is defined as "Standard of measurement by which efficiency, progress, performance, productivity, quality of a deliverable, process, project or product can be assessed". Metrics help in building predictability, improving organization's decision making ability, and lay out what is working and what is not working within the organization and help guide the management focus in the right directions (Adamczyk, 1989). Project management success metrics enable Project managers to, assess status of ongoing project in terms of schedule, cost and profitability, foresee any potential risks, nail down the problems much before they become severe, keep a check on project profitability, assess productivity of team, assess quality of work products to be delivered. These Metrics which are described more in detail in Literature review can be mentioned as,

Schedule and effort/cost variance; Productivity, Resource Utilization; Change requests to Scope of work; Change requests to Scope of work; Quality and Customer Satisfaction; Gross Margin

1.1.3 Success Measurement challenges

Now let's have a look at the related cite studies on success indicators and project success elements and see what they were focusing on and what has failed there.

There can be different project management metrics defined based on complexity and nature of project. However, following five performance metric groups cover all the important aspects of a project to measure during execution:

The Iron Triangle was originally conceived as a framework to enable project managers to evaluate and balance the competing demands of Cost, Time and Quality within their projects (Atkinson, 1999). Subsequently it has become the de-facto method to define and measure project success, with the general perception amongst project managers that a successful project is based upon these three criteria alone (Shenhar and Dvir, 2007; Duggal, 2011). Any attempt to deviate from, or supplement the three criteria that make up the Iron Triangle is often considered a problem that must be either corrected or prevented in the first place (Shenhar and Dvir, 2007; Turner and Bredillet, 2009). Centre to the concept of the Iron Triangle is the mutual dependency between the three constraints: increasing quality will increase the amount of time needed, which also will lead to an increase in cost. A tight time schedule could lead to a decrease in quality and subsequent increase in cost (Morris and Sember, 2008). However, the validity of the iron triangle and the traditional triple constraints of time, cost and quality, have been debated throughout the academic and industry literature on project management.

1.1.4 Telecom Projects in Africa - Mobile Networks

A cellular network or mobile network is a wireless network distributed over land areas called cells, each served by at least one fixed-location transceiver, known as a cell site or base station. In a cellular network, each cell uses a different set of frequencies from neighboring cells, to avoid interference and provide guaranteed bandwidth within each cell. When joined together these cells provide radio coverage over a wide geographic area. This enables a large number of portable transceivers (e.g., mobile phones, pagers, etc.) to communicate with each other and with fixed

transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

Major telecommunications providers have deployed voice and data cellular networks over most of the inhabited land area of Africa. This allows mobile phones and mobile computing devices to be connected to the public switched telephone network and public Internet.

Africa region had a total mobile network penetration rate of 80 % with the majority of the population being connected. The fixed-line communications sector is still underdeveloped, with a very low penetration rate, and is only available in the main business districts within the countries in the region. Civil wars, poverty, government monopolies, and outdated telecommunications infrastructure are some of the inhibiting factors for parts of the region.

The mobile sector is the most active means of communication as a result of market liberalization and investment from major regional operators.

Africa is home to the some of the biggest international mobile operators, such as Orange, Millicom, Bharti Airtel, Cell C, Etisalat, MTN, Ooredoo, and Vodafone. Burkina Faso, Niger, Guinea, and Sierra Leone also present opportunities for growth for mobile communications. Meanwhile, Nigeria, Ghana, Senegal, and the Ivory Coast have to look for new revenue streams as a result of decreasing average revenues per user (ARPU's).

The main suppliers of service and equipment to the operators round the globe can be referred to as Nokia, Ericsson, Huawei, Alcatel Lucent and ZTE who provide divers range of services and equipment on the growing market of Mobile Networks together with all the new features and competitive evolvments.

1.2 Statement of the Problem

Project managers are always looking forward to see projects perform well with success. This involves finishing the project on time, within budget, meeting end product specifications, meeting customer needs and requirements and meeting management objectives (Cooke-Davies, 2002).

Despite the quest for project success, many Telecom projects in Africa have continuously experienced time overrun, budget overrun, unmet end product specifications, unmet customer needs and requirements and unmet management objectives (Auditor general's report, 2008). The high failure rate in these projects could be due to failure of deploying a proper Project Management strategy. Despite wide range of knowledge on project planning and management, project failure is still reported (Standish, 2011; Miller, 2007; NACSC, 2008; ICAD, 2010). Different stakeholders expect to be involved in the decision making process within the project cycle. However this is not the case as complains of exclusion are still reported.

Furthermore, Garrett (2008) suggests that the three traditional time, cost and scope factors are strictly efficiency based, whereas the focus should be shifted to more business oriented results and customer satisfaction (Garrett, 2008). This opens for the question whether EVM can be seen as a new concept to consider in connection with the project management success.

Research suggests that current standards for project management fail to seriously address these issues, or equip project managers with the tools necessary for them to integrate all principles into the project planning, and operation (Eid, Silvius and Schipper, 2011). Other studies include that of Kagiri (2005) which focused on the time and cost overruns in the power projects in Kenya and attributed project failure to factors ranging from delayed payments to contractors, clients cash flow problems, bureaucracy in government agencies and inadequate planning by the technical people. Lastly, Isensi (2006) recommends for further study of other projects other than building projects.

Besides, the EVM is an excellent tool for a project manager to discover the priorities and motivation for the various stakeholders and how well the project is understood. This gives the foundation for good dialogues but also view on whether stakeholders are aligned or not (Morris and Sember, 2008). Deploying successful projects within the organization considering the 3 major factors of time, cost and scope is one of the main purpose formation of a project management organization team. To achieve such an objective the organization needs to deploy various factors, tools, processes and procedures to ensure it. EVM (Earned Value Management) is one of these methods that can be used.

How can a broader approach of EVM improve the Performance of the projects in different types of organizations and lead in project success? Are principles of EVM significant positive predictors of project success? Is there any difference between fixed-price and cost-plus contracts when relating principles of EVM to project?

1.3 Research Objectives

This study aimed at determining the relationship between EVM and Project success. It;

- i. Investigated the relationship between the application of EVM principles and project success
- ii. Investigated the moderating effect EVM Structure may have on the relationship

1.4 Value of the Study

It is hoped that the information obtained from this study might provide project managers and program managers especially on the Telecom Implementation projects to set a wiser plan at the beginning of the projects to benefit from the EVM analysis while executing projects. This study will be invaluable for network implementation contractors as its findings would appraise utilization of EVM for project controlling purpose which will at the end help a more successful project deployment.

The study will benefit both academicians and future researchers in Kenya and beyond. Academicians and researchers are always searching for new information and references. They can benefit from this study as it will add to the wealth of already existing knowledge on EVM and project success. The study will, thus, broaden the knowledge of EVM utilization for future research on the same.

This study will aim at contributing to the existing body of knowledge on the relationship between EVM and project success. Another beneficiary of the study will be the Kenyan big network operation vendors whose objective is to grow in the East African growing countries as they are now deploying lots of large scale projects to enhance mobile networks within the region as Kenya is a hub for such network quality.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

A review of literature uncovered three categories of knowledge regarding the contribution of earned value management to project success. Ample literature offers rational support for EVM's positive contribution (Presutti, 1993; Fleming and Koppelman, 1996, 2002; Christenson, 1998; Abba, 2001; Antvik et al, 2001; Anbari, 2003). Works of this type suggest the benefit of EVM across major project management processes including planning, executing, monitoring, and controlling (PMBOK, 2004). While logical and meaningful, these works are sources of propositional knowledge, limited to providing theoretical beliefs and assertions. They do not provide evidence of EVM's contribution to project success.

Another source of knowledge is from the experiential accounts of project practitioners (Mukho and Lisanti, 1982; Adamczyk, 1989; Chen, 1991; Yu, 1996; Antvik, 2001; Kauffman, Keating, and Considine, 2002). These works are important in that, unlike theory, they offer empirical evidence based personal experience and observations. They generally illustrate EVM's contribution in one or more project management processes. To the extent the author's projects were successful, a contribution to project success can be concluded from these experiential accounts.

A third source of knowledge about EVM's contribution to project success blends both theory and experience (Marrella, 1973; Kim, 2000; Vargas, 2003). These works offer the highest level of precision in both their methodology and findings and can be said to offer scientific knowledge. Works in this category are research-oriented, and to date rely on qualitative methods to make relevant points. All emphasize EVM's contribution to project control (Marrella, 1973; Kim, 2000; Vargas, 2003). Additionally, two of the three have emphasized EVM's contribution to project planning along with project control, yet differed on the relative strength of each (Marrella, 1973; Vargas, 2003). In Marrella's work, the author found that EVM's predecessor, have affected a significant improvement in planning and a positive but less significant improvement in control." In Vargas's, the author concluded EVM to be effective in the control of projects, yet dependent on a project's first having established effective plans.

2.2 Earned Value Management

EVM is a comprehensive methodology used to manage projectized efforts. The methodology addresses many project management areas, including project organization, planning, scheduling and budgeting, accounting, analysis, reporting, and change control (Fleming and Koppelman, 1996). EVM also incorporates specific mechanics to include the use of the work breakdown structure (WBS), performance curves (S-curves), as well as a defined set of performance metrics. EVM is among the first project management methodologies to be codified by national standards setting organizations (ANSI/EIA, 1998; ASI, 2003).

A distinguishing characteristic of EVM is its unique metrics. EVM integrates a project's scope, schedule, and cost into a unified set of prescribed metrics for the purpose of monitoring and forecasting project performance. The building blocks of all EVM metrics are the following three elements: Budgeted cost of work performed (BCWP or EV1)=Earned Value; Actual cost of work performed (ACWP or AC)=Actual Cost; Budgeted cost of work scheduled (BCWS or PV)=Planned Value. *Figure 1.* (on page 32) depicts a simplified project in demonstrating the sequence of EVM implementation. The methodology begins with planning the entire project scope in the form of a WBS. Each of the work packages contained in the WBS is cost-estimated, scheduled, and rolled up to the next higher-level WBS element. An S-curve, bounded by zero and total cumulative cost as end-points, is created next using BCWS (PV) data to form a visual baseline. Values for BCWP (EV) and ACWP (AC) are calculated as work progresses, forming their own unique S-curves to compare against the baseline. Higher-level EVM metrics are derived from the three primary values, and are used to monitor and control the project, as well as to provide performance information to stakeholders. Putting EVM aside and relying on the traditional accounting viewpoint of this sample project, one might erroneously conclude that the project is performing well.

2.3 Project Success

What is project success? How do we define project success and design performance measures that allow us to recognize the degree of success attained? There has been a great deal written over the years about project success, project management success and performance management to

deliver success. A number of papers relating to critical success factors emerged during the late 1980's for example see (Pinto and Slevin, 1987) and de Wit (1988) who viewed success as being judged by the degree to which project objectives have been met. These views centered on success of project management delivery processes and also acknowledged that project success is also a matter of the project stakeholder's perception of the value (in their terms) of what was delivered.

A study of the "Criteria of Project Success: an exploratory re-examination" (Lim and Mohamed, 1999) where they look at projects where some stakeholders perceive success and others do not on the same project. Whilst they also define criteria and factors leading to success as similar to Crawford (2000), they do look further into the perspectives of project success and break it down into macro and micro views of project success.

They cite examples of projects which were successful for some but not for others. We have, in Australia, significant examples of these projects. The Sydney Opera house is generally acknowledged to have been a project management failure but a roaring project success. It was delivered grossly over time and over cost budgets and yet it placed Sydney on the map and had many other longer term benefits.

More recently, however, the Redevelopment of the international event venue, the Melbourne Cricket Ground (MCG) for the staging of the Commonwealth Games, International Cricket and Australian Football is viewed as a project management success and, interestingly, a project success, both at the same time. The MCG Project is quite significant and rare at the same time in that it is perceived as a success by all the key stakeholders and more but also satisfies project success at a micro and macro view as explored in the exploration by Lim and Mohamed (1999).

An earlier paper on determining critical success/failure factors in projects (Belassi and Tukel, 1996) sensibly works to group critical success factors according to; those related to the project, those related to the project manager and the team members, those related to the organization and those related to the external environment. They further cite that factors which relate to the project include the "urgency" of a project. They identify that "projects which start after natural disasters are typical examples and that in these situations, not enough time is allocated for planning and scheduling projects". They further identify that in relation to actors related to external environment, a number of environmental factors such as political, economic, and social, as well

as factors related to the advances in technology or even factors related to nature affect project performance. They do not, however, critically review these aspects into her study. These aspects as well as the previously cited ones do have a major impact on aid projects. We will be critically reviewing these in the environment of aid projects but necessarily first need to conclude on critical success criteria and factors in any project environment. This is the focus of our research overall.

2.3.1 Schedule and Effort/Cost Variance

The goal of this metric is to measure the performance as well as progress of the project against signed baselines. This metric is very important and is the base for profitability of project. The EVM (Earned Value Management) concept, as defined by PMI standard PMBOK, is the commonly used method to track this metric. It integrates project scope, cost and schedule measures to help the PM to assess and measure project performance and progress. The principles of EVM can be applied to all projects, in any industry. Under this method, at any given point in time, project performance to date is used to extrapolate the expected costs and duration at project completion. This technique uses past performance (i.e. actuals) to more accurately forecast future performance. EVM develops and monitors three key dimensions of each work package.

2.3.2 Productivity: Resource Utilization

The objective of this metric is to measure productivity of resources involved in project and let PM assess over or under-utilization cases.

Utilization% = Total Effort spent by resource/Total Budgeted Effort for the resource. Budgeted effort is the planned billable work of resource. Any over-utilization and under-utilization indicated by this metric has an impact on the project's profitability. It is important for the PM to track this metric very closely and find out the reason for deviations and the action items to bring back resource utilization to optimal level. Delayed projects, increased ramp up activities, less work provided by customer, unplanned vacations, less competent resources can impact this metric. To get better control over this metric, robust time reporting systems should be available in the organization.

2.3.3 Change requests to Scope of work

Signed Scope baseline with customer forms the baseline for the entire project planning and development. Any change to signed scope should happen in controlled manner. So here comes another important metric for PM to track i.e. the number of change requests coming from customer for the already signed scope of work. Each and every change request, once approved by internal change control board (CCB), requires update to Scope baseline which in turn has a cascade impact on cost baselines and schedule baselines and resource plans. Uncontrolled change requests often result in project scope creep and further impact negatively on the project cost/schedule, which is the worst thing to happen for any project. PM should never allow such scope creep.

2.3.4 Quality and Customer Satisfaction

Throughout the execution of project, Quality Assurance should always be on the radar of project manager. Quality here is defined as the number of severe, medium or low defects delivered through the lifetime of the project. It indicates the health of the deliverable to the end user and drives the Customer Satisfaction (Keating, 2001). PM needs to define, based on project type, what severe, low and medium means. Quality should be reported throughout the life of the project; the later defects are caught, the more impact they will have on the project. Under quality metrics, following are the key ones to track.

2.3.5 Gross Margin

Gross Margin is the mother of all metrics and the quickest way to determine if your business is on track or not and acts as an early warning system to put in place margin improvement initiatives. Ultimate goal of project execution is to bring revenue to organization with the approved gross margin. Gross margin (GM) is basically the difference of total revenue and the total cost spent on project i.e. profit. When a project is started, certain GM levels for the project are approved by project sponsor. This approved GM value is generally based on project scope definition, duration, a forecast of resources: onsite, offshore and organization's investment analysis (Considine, 2002). Project PNL (Profit and Loss) statement gives a way to PM for tracking his/her projects GM metric at any point of time. For this, PNL statements and forecasts should be current documents i.e. changes in project parameters need to be reflected quickly in this statement to keep the PM informed about any potential risks to project profitability. All the

above four project management performance metrics impact this metric, if not handled in controlled manner. A good organizational level PNL tool rather than manual excel sheets reduces the overhead on PM here.

2.4 Empirical Review

Earned value management (EVM) is a management methodology for integrating scope, schedule, and resources, and for measuring project performance and progress (Anbari, 2003; Project Management Institute, 2008). Historically started as cost/schedule control system criteria (C/SCSC) by the U.S. Department of Defense in the 1960s, it is now mandated for many U.S. government programs and projects (Abba, 1997, 2001; Christensen, 1994; Kim, 2000; Kim, Wells, & Duffey, 2003).

The interest in and demand for applying and implementing EVM has increased in recent years in government agencies where organizations and auditors are required to report on the adequacy of the organization's internal control over financial reporting (Fleming & Koppelman, 2003, 2010).

The emphasis on performance measurement in government continues to increase steadily, supported by mandates imposed by government laws and public pressure. Specifically, management of government projects, programs, and portfolios and the related expenditures of public funds are major, visible areas of concern (Lipke & Henderson, 2006).

Despite a growing understanding of the determinants of success, increasing maturity, and a stream of successful programs and projects, project failures continue at an alarming rate (Anbari, 2003; Kwak & Anbari, 2006). There are visible examples of failure in major public programs and projects. Analytical Perspectives, Budget of the United States Government, Fiscal Year 2008 (Office of Management and Budget, Executive Office of the President, 2008) points out that, of the 840 major information technology (IT) investments (about \$65 billion) in the U.S. federal IT portfolio in fiscal year (FY) 2008, there were 346 major IT investments (about \$27 billion) that were not well planned and managed, reflecting investments on the "Management Watch List" as well as those rated "Unacceptable." It states: "346 of 840 projects valued at \$9.9 billion are on the 'Management Watch List.' These projects still need to address performance measures, implementation of earned value management, security or other issues before obligating funding

in FY 2008.” Project and program failures deprive the sponsoring organization and the public from the anticipated benefits of the projects selected for deploying organizational strategy, and divert resources and funds from what might have been more promising endeavors. This ultimately weakens the society’s competitive position, well-being, and security (Kwak & Anbari, 2006).

2.5 Summary of Literature Review

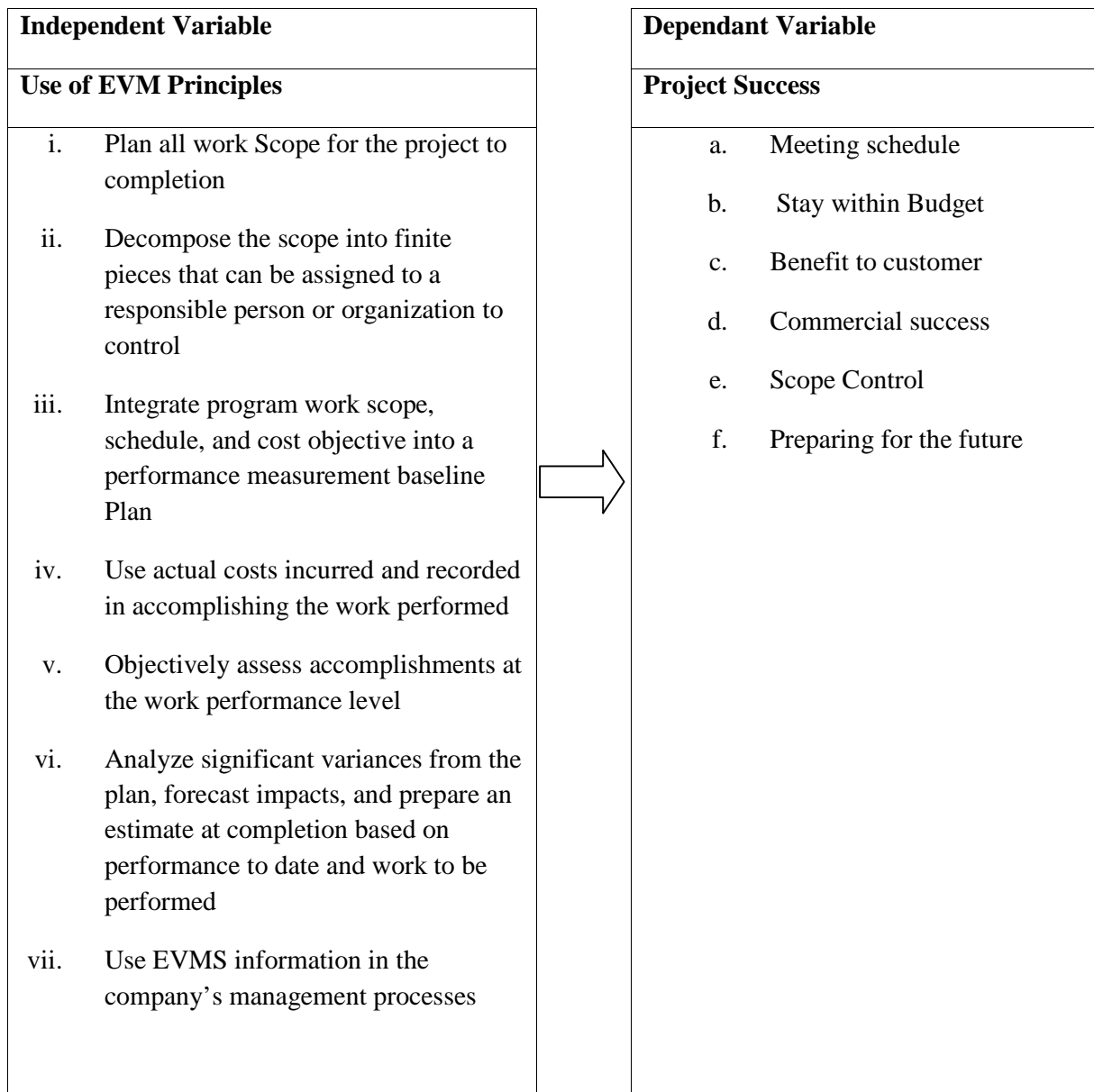
This study explores current EVM practices at Nokia in Africa to identify emerging performance measurement History, Practices, and Future of Earned Value Management in Telecom business.

Looking back into the projects which were deployed prior to a clear EVM process implementation, the rate of success and clarity on the projects were lower than what we can see as a result of recent practices through EVM now. In most of the projects there is always a gap in the initiation phase, basically the main structure and formation of EVM model for any individual project can play an important role towards project successful deployment and control. It is tried to address this point of concern and analyze it more to find out how this can be improved for future projects.

2.6 Conceptual frame work

The theoretical framework for this research is the belief that EVM directly contributes to project success; and contract type may moderate EVM's overall contribution as well as the contribution of EVM's mechanics to contract formation and administration items.

Figure 1. EVM and Project Success Framework



CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research findings to determine the relationship between the application of EVM principles and project success. The study was conducted on all Nokia projects in Africa to establish the relationship.

3.2 Research Design

The research methodology used was purposive sampling using structured Survey.

As long as the resources carrying out the EVM activities on the projects were limited to the certain people who were managing all the projects therefore a comprehensive questionnaire could gather all the required information across multiple countries and projects for data mining.

3.3 Population

All 170 Telecom projects deployed by Nokia in Africa during the past 2 years have been considered for this study. All these projects have been monitored by a group of 35 CPMs (Cost & Progress Managers) who will share their findings of EVM deployment towards the project success on their projects. All classes of projects are examined through this observation.

3.4 Data Collection

Questions were created by presenting affirmative declarations and asking respondents to select an answer that best reflects their level of agreement with the statement as it applies to their specific project. Each of these declarations was followed by an identical seven-point Likert scale anchored on the far left end with “strongly disagree,” and on the far right with “strongly agree.” A neutral point was included in the center of the scale. The questionnaire will be collected via Email communication as long as the 35 CPMs are sitting in different countries and this will make

it easier for data collection. A complete set of 35 questionnaire will be completed to represent all Africa projects. The questionnaire consists of 4 main sections, which will be the general information related to the information provider; study of indirect variables; study of direct variables and the fourth one contains two categorical variables. The general part, indicating the name of the CPM and countries where the projects are/were running; Independent variable section; dependant variables survey part, and finally the categorical variables.

3.5 Data Analysis

The techniques of correlation-regression are used to measure the relationship between dependent and independent variables, more details of the analysis will be shared having collected the questionnaire. In order to perform the bivariate correlation-regression, two single continuous variables are required. Single continuous variables are created by totaling all responses of a single respondent to all questions comprising the variable and dividing by the number of questions. The resulting composites are arithmetic mean scores for each variable. Composites not only facilitate the statistical technique, they have the added value of offering higher measurement reliability (Nunnally, 1967; Biemer et al, 1991) than single elements for a given construct.

CHAPTER FOUR: DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter presents research findings, analysis and interpretation of the data collected from the respondents. It presents findings on the the relationship between the application of EVM principles and project success and investigates the moderating effect EVM Structure may have on the relationship.

4.2 General Information

The study targeted the 35 Africa project. All the 35 Africa project managers responded giving a response rate of 100%. This excellent response rate was achieved after the research made frequent calls and emails to identified respondents to fill and return the questionnaires. The questionnaires were administered through email.

The study sought to establish the number of projects that the respondents observed at the period of the study.

From the findings, 22.9% of the respondents observed between 1-3 projects, 37.1% observed between 4-6 projects 28.6% observed 7-9 projects while 11.4% observed between 10-12 projects. These findings show that the respondents observed varied number of projects in their locality. Thus the results are more representative of all the African market.

The study further sought to establish the distribution of projects where the projects were running in terms of the African region.

From the findings, it was established that 17.1% of the projects were running in South Africa, 22.9% were running in Northern Africa, 11.4% were running in West Africa, 14.3% were running in East Africa while majority of 34.3% were running in Central Africa. These findings show that the projects were distributed across Africa with a majority found were found in Central Africa.

4.3 Principles of EVM

The study carried out a descriptive statistics analysis on the independent variables. Respondents were asked to indicate the extent of use of various EVM principles on a scal of 1-7 (where 1 is “Strongly Disagree”, 2 is “Disagree”, 3 is “Disagree somewhat”, 4 is “Undecided”, 5 is “Agree Somewhat”, 6 is “Agree”, 7 is “Strongly Agree”. Results from analysis of their responses are summarized in table 4.1 below.

Table 4.1: Principles of EVM

Independent Variable	Mean	Std. Deviation
All work scope was planned for the project to Completion	5.514	1.010
EVMS information was used in the company’s management processes	5.314	0.993
Actual costs incurred and recorded in accomplishing the work performed was used	5.228	0.972
All the scope decomposes into finite pieces that can be assigned to a responsible person or organization to control.	5.200	0.900
All the program work scope, schedule, and cost objective were integrate into a performance measurement baseline	5.057	1.055
Objectively assessed accomplishments at the work performance level	5.057	1.136
Significant variances from the plan, forecast impacts were analyzed, an estimate at completion based on performance to date and work to be performed was prepared	5.057	1.055

On whether all work scope was planned for the project to Completion scored a mean of 5.514 an indication that the respondents highly agreed to have it as the most important item related to the EVM Prrinciples which means that covering all the scope of work in the project plan till completion of the whole activities in the plan is the most important aspect of the EVM method. On whether EVMS information was used in the company’s management processes, the respondents agreed somewhat with a mean of 5.314 which means that this is the second important EVM principles to be applied impacting project success factors. On whether the actual costs incurred and recorded in accomplishing the work performed was used, scored a mean of 5.228 an indication that the respondents agreed somewhat and therefore this is ranked as the 3rd important items in applying EVM principles impacting the project success. The statements on whether all the scope decomposes into finite pieces that can be assigned to a responsible person or organization to control scored a mean of 5.200 an indication that the

respondents agreed somewhat. On whether all the program work scope, schedule, and cost objective were integrate into a performance measurement baseline, the respondents agreed somewhat with a mean of 5.057. The statement on objectively assessed accomplishments at the work performance level scored a mean of 5.057 an indication that the respondents agreed somewhat. On whether significant variances from the plan, forecast impacts were analyzed, an estimate at completion based on performance to date and work to be performed was prepared scored a mean of 5.057 an indication that the respondents agreed somewhat. The results shows that all in all EVM Principles are playing a very important role in projects success strongly, which supports the whole concept as also indicated in the literature review on the analysis carried out by Kauffman, Keating and Considine (2001).

4.4 Indicators of Project Success

The table below shows the descriptive statistics of the dependent variables which were basically the indicators of project success.

Table 4.2: Dependent Variable Descriptive Statistics

Dependent Variable	Mean	Std. Deviation
Preparing for the future	5.657	0.905
Commercial success	5.342	0.998
Stay within Budget	5.285	0.957
Meeting schedule	5.228	1.113
Benefit to customer	5.171	1.042

Preparing for the future scored 5.657 indicating it as the most important indicator of the project success. This reveals that studying the projects carefully and narrating the project lessons learned can play a very significant role on project success. The commercial success scored 5.342 which also shows the second level of importance as project success indicators based on the responds received. The respondents also agreed somewhat on staying within the budget with a mean of 5.285 to be the 3rd important indicator of the project success. Meeting schedule and benefit to a customer scored 4th and 5th important items in as the project success indicators. It all reveals that these 5 items are the most important factors related to project success which are all scored on the highest side of the trend.

4.5 Correlation Between EVM Principles and Project Success

The study carried out a Pearsons correlation analysis between the dependent and independent variable. The responses are in table

Table 4.3: Correlation analysis

Bivariate Analysis		4.IV2	5.IV3	6.IV4	7.IV5	8.IV6	9.IV7	10.DV1	11.DV2	12.DV3	13.DV4
3.IV1	Pearson Cor-r	0.465	0.331	0.565	0.537	0.331	0.625	0.833	0.36	0.639	0.694
	Sig. (2-tailed)	0.005	0.053	0	0.001	0.053	0	0	0.033	0	0
	N	35	35	35	35	35	35	35	35	35	35
4.IV2	Pearson Cor-r	1	0.359	0.315	0.305	0.235	0.388	0.422	0.307	0.369	0.314
	Sig. (2-tailed)		0.034	0.065	0.075	0.174	0.021	0.012	0.073	0.029	0.066
	N		35	35	35	35	35	35	35	35	35
5.IV3	Pearson Cor-r		1	0.417	0.316	0.894	0.403	0.364	0.566	0.605	0.316
	Sig. (2-tailed)			0.013	0.064	0	0.016	0.032	0	0	0.065
	N			35	35	35	35	35	35	35	35
6.IV4	Pearson Cor-r			1	0.334	0.417	0.471	0.412	0.56	0.888	0.704
	Sig. (2-tailed)				0.05	0.013	0.004	0.014	0	0	0
	N				35	35	35	35	35	35	35
7.IV5	Pearson Cor-r				1	0.316	0.192	.570**	.417*	.488**	.579**
	Sig. (2-tailed)					0.064	0.269	0	0.013	0.003	0
	N					35	35	35	35	35	35
8.IV6	Pearson Cor-r					1	.515**	.364*	.566**	.605**	.372*
	Sig. (2-tailed)						0.002	0.032	0	0	0.028
	N						35	35	35	35	35
9.IV7	Pearson Cor-r						1	.571**	.336*	.571**	.481**
	Sig. (2-tailed)							0	0.049	0	0.003
	N							35	35	35	35
10.DV1	Pearson Cor-r							1	0.296	.548**	.642**
	Sig. (2-tailed)								0.085	0.001	0
	N								35	35	35
11.DV2	Pearson Cor-r								1	.775**	.356*
	Sig. (2-tailed)									0	0.036
	N									35	35
12.DV3	Pearson Cor-r									1	.705**
	Sig. (2-tailed)										0
	N										35

** . Correlation is significant at the 0.01 level (2-tailed). * . Correlation is significant at the 0.05 level (2-tailed).

From the findings there is there is a positive and significant relationship between all the dependent and independent variables of different magnitudes. The most important and one of highest relationship which could be found was related to the first principle which is the planning all work scope to project completion versus the success factor of the Meeting schedule which is having a value of 0.833. It clearly shows that the more we clearly identify the activities related to completion of the work with all details and not missing any part, then definitely it can help us improve the time plan as far as all the items considered to accomplish the tasks on time. In other words if we look at this logically and consider the previous studies on the same issue such as the one of Wit (1988) who viewed success as being judged by the degree to which project objectives have been met, which is also mentioned in this paper as part of the literature review, we can confirm that meeting the schedule of the project could be more reliably achieved if all the related activities towards the completion of the project were well defined and considered in the plan.

The magnitude of the correlation between the DV4 which is commercial success and the IV4 which is the related to recording the actual cost in accomplishing the work performed is 0.704. This shows a very high relationship between these 2 variables which indeed nothing else is expected, the more we are transparent and clear on properly recording the actual costs related to the work performed the better it will result on the commercial aspects of the project since we can have a more clear understanding of the GM changes throughout the project. Having such a visibility towards the GM the project stakeholders can have a more confidence on the results and this will help them for an improved decision making on many aspects. This has also been highlighted in the literature review where we have referred to the findings of Vargas (2003) which is emphasizing on EVM's contribution to project planning that could result in a successful control and deployment of the project.

There is another highlight here to be referred to which is related to the extent of relationship between all the EVM principles and their impact on the benefit to customer which clearly indicates that the more structured we have our data and information the better we can communicate and satisfy the customer requirements as there is always mutual benefits while completing the project on time, on budget and within the predefined level of quality. To elaborate this a little bit more we can refer to some items in the principle as the IV1 which is

basically defining all scope to the project completion. Having done such an activity and considering all the required works to be accomplished is basically a kind of insurance towards having the project delivered as agreed with customer. If we decompose all the scope into finite pieces that can be assigned to a responsible person or organization then following the items to be accomplished based on the shares of responsibilities identified will make it much easy to track and ensure on time delivery of the items which will lead in customer satisfaction. Going forward to the IV3 which is integrating all the work scope, schedule and cost objectives and checking the impact on customer satisfaction we can understand that this integrity of data and harmonization will help the project team to stay within the agreed frame with the customer on delivering all the contracted activities. This is truly impacting the customer benefit as they can continue their relevant activities and chain of contracts and deliveries towards other vendors and basically they will also be able to meet their targets and agreements with their clients. Now looking into another factor of EVM principles which is all in all showing a very high corelationship towards all the project success elements which was also concluded through some experiential accounts by Mukho and Lisanti (1982). There is no doubt that a more successful project deployment will add a lot of value and benefits to the customer itself.

The correlation magnitude between IV6 and DV2 which is 0.566 reveals another important point that analyzing variances between the planned values against the real performance of the projects can significantly improve the budget alignment which is another success factor of the projects. Considering the fact that proper comparison o actual against what has been planned in some cases would be very tricky and may go wrong in some particular cases if we have not done a proper base with a detailed structure of the budget allocated for each tasks. Here we have already discussed the importance of the integrity of planning elements (as explained for the IV3 analysis) which will help us determine and link each and every individual cost elements of the project, the fact had been highlighted by Anbari (2003) where we had referred to in the empirical review.

4.6 Challenges on deploying the EVM in projects

The study sought to establish what were the challenges being faced on deploying EVM in projects. The responses are shown in the table below.

Table 4.4: Challenges on deploying the EVM in projects

	Frequency	Percent
Data overload	12	34.3
Special IT tool set needed	10	28.6
Executive ambivalence	3	8.6
Inexperienced contractors	3	8.6
Too bureaucratic	3	8.6
Poor data	2	5.7
Poorly chosen software	2	5.7
Total	35	100.0

With such analysis we can understand the importance of Data load and the way we have defined the required tools to manage them. The first 4 categories of the challenges covers almost 80% of the problem area. The first 2 points are very relevant to each other and they can be considered as back to back, since the more load of data we have, the more tools and special IT supports are required so that we can analyze the data and information within the correct time line as the decision making deadlines are not big enough to provide us sufficient time for data mining.

4.7 Benefits of using EVM for your project control purpose

The study sought to establish what the benefits of using EVM in project control purpose were. The responses are in the table below.

Table 4.5: Benefits of using EVM for your project control purpose

	Frequency	Percent
Increased project visibility	10	28.6
Improved estimating and planning	9	25.7
Early warning of Problems	5	14.3
Deflates PMs natural Optimism	4	11.4
Gives and objective basis for EAC	4	11.4
Highlights Overspens & overrun	3	8.6
Total	35	100.0

As it was expected the most important benefit highlighted by the respondents is increasing project visibility. For sure with the EVM method, having defined all the elements of project cost management into the finite pieces, we can then understand and get a correct visibility of what is happening on the project during different stage of the project execution. This project visibility can provide a proper base for the management to set their decisions based on the reliable findings which can lead them to success.

The second point of deriving improved estimating and planning can also be easily linked as a consequence of increased visibility on the project. this means that not only we have benefited the visibility item for the decision making, we have also been able to improve the estimating and planning factors relevantly. The other items highlighted here as early warnings of problems, deflating PMs natural optimism and providing an objective basis for EAC are coming here as the other categories of EVM deployment benefits which are not basically carrying the same weight of the first 2 items.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter provides the summary of the findings from chapter four, and also it gives the conclusions and recommendations of the study based on the objective of the study.

5.2 Summary

The study established that the work scope was planned for the project to Completion. The respondents somewhat agreed that all the scope decomposes into finite pieces that can be assigned to a responsible person or organization to control. The findings also established that somewhat all the program work scope, schedule, and cost objective were integrated into a performance measurement baseline. The findings also showed that the actual costs incurred and recorded in accomplishing the work performed was used to some extent. The respondents also somewhat agreed that objectively assessed accomplishments at the work performance level. The findings revealed that on whether significant variances from the plan, forecast impacts were analyzed, an estimate at completion based on performance to date and work to be performed was prepared to some extent. The findings also showed that somewhat EVMS information was used in the company's management processes. The findings showed that the meeting schedule had a moderating effect to some extent. The respondents also agreed somewhat on staying within the budget, on the benefit to a customer, the commercial success and preparing for the future all to somewhat extent using EVM Principles.

The study established that executive ambience was a challenge, Poor data was a challenge and Data overload was also a challenge. The findings revealed other challenges as poorly chosen software, inexperienced contractors and bureaucratic. Another challenge that the study established was the need for a special IT tool set. The findings also revealed the benefits of using EVM for your project control purpose as Increased project visibility were

Deflation of the PMs natural Optimism, Early warning of Problems, objective basis for EAC, Highlights overspends & overrun and improved estimating and planning.

5.3 Conclusions

The study made the following conclusions

The study concludes that all the work scope is planned for the project to completion and there is constant assessment of accomplishments at the work performance level. The study also concludes that all the program work scope, schedule, and cost objective were integrated into a performance measurement baseline. The study also concludes that Meeting schedule, staying within Budget; Benefits to customer, Commercial success and Preparing for the future all could be driven well using the EVM principles..

The study concludes that executive ambivalence, poor data and data overload are challenges faced on deploying the EVM in projects. The study also concludes that other challenges faced are poorly chosen software, inexperienced contractors, bureaucracy and the need for Special IT tool set. The study also concludes that increased project visibility, deflation of PMs Natural Optimism, early warning of Problems, giving an objective basis for EAC, Highlighting overspends & overrun and improved estimating and planning are the benefits of using EVM for your project control purpose

5.4 Recommendations

The study recommends that project managers ensure that they plan for the work scope of the project up to completion. The study also recommends that the project management team assess the progress of the implementation of the project. This will be important in comparing the expected progress with the actual progress. The study also recommends that the project managers should ensure they plan for meeting schedules constantly to discuss the success of the implementation as well as make the necessary changes within the time frame and the budget allocation.

The study also recommends that project managers ensure they get the necessary special IT tool set that will ensure the easier planning, implementation and monitoring of the projects. The study also recommends that project managers evaluate contractors so that they do not have to deal with inexperienced contractors that will not ensure effective implementation of the project. The study also recommends that project managers deploy EVM in projects so as to monitor the progress of the project as well as identify problems in advance.

5.5 Limitation of the study

A primary limitation of the research is in the use of statistical analysis itself. While statistical analysis techniques may serve to either explain or predict the relationship among one or more variables, an exact causal connection can never be absolutely determined. Statistical analysis provides only explanatory or predictive utility. Moreover, the unexplained portion of the relationships between variables is inherently outside the scope of this research. Future studies should attempt to achieve greater levels of project diversity within an even larger sample population.

5.6 Suggestions for future study

The findings of this study point out several possible directions for future research on EVM. As a logical extension of the heretofore unasserted belief that the principles of EVM contribute relatively more to the success of well detailed project plan, an in-depth research case study is warranted in order to uncover the significant characteristics of a well detailed project plan. A long duration study on the use of EVM in would serve to discover new variables and new theories.

REFERENCES

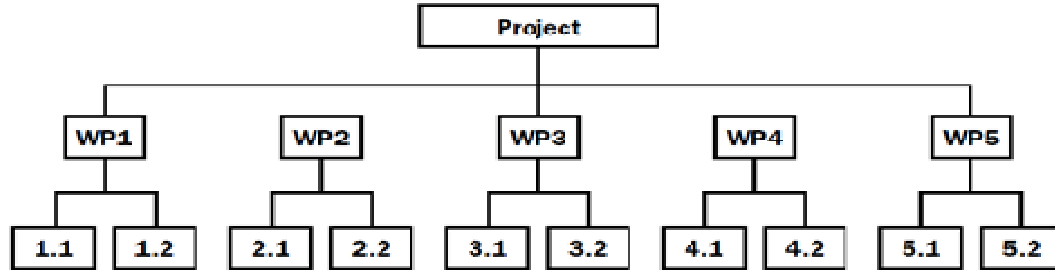
- Ascott, E. (2006) Benefit Cost Analysis of Wonder world Drive Overpass in San Marcos, Texas. Applied Research Project. Texas State University.
- Bhandari, D.B and Roy, N.K. (2000) Project Management in Indian Scenario, New Delhi, Tikoo Printer.
- Byoungho, J. and Jai-Ok- K. (2003) A typology of Korean Discount Shoppers: Shopping motives, store attributes and outcomes available at 48
- Chandra, P. (2002) Projects-Planning, Analysis, Financing, Implementation, and Review, (5th edn), New Delhi Tata- McGraw Hill.
- Christensen D.S. (Fall 1998), The costs and benefits of the earned value management process, Acquisition Review Quarterly Fall 1998, 373-386
- Clifford, G and Larson, E. (2005), Project Management. A Complete Guide for Every Manager, New Delhi, Tata, McGraw Hill.
- Cooper D. R. & Schindler P.S (2006). Business Research Methods, Tata McGraw-hill, New Delhi
- Dvir, D. Raz, T. and Shenhar, A.J. (2003) An Empirical Analysis of the Relationship between Project planning and Project Success; international journal of project management, 21 p. 89-95
- Earned Value Management System (EVMS) reference guide, Project Management Office, Lawrence Berkeley National Laboratory, March 2009
- Humphreys & Associates, Inc (1978). The Leader in Earned Value Management Consulting and Training. PMI Earned Value Management Community of Practice
- Goss, J. (1993) The Magic of the mall, An analysis of Form, Function and meaning in the contemporary built environment, Annals of the Association of American Geographers.
- Ireland L. R. (2006). Project Management. McGraw-Hill Professional, ISBN 0-07-147160-X.p.110.
- Heerkens, G. (2001) Project Management (The Briefcase Book Series). McGraw- Hill. ISBN 0-07-137952-5.
- Isensi O. H. A Survey of Factors that lead to failure of building construction projects in Kenya. Unpublished MBA Thesis, University of Nairobi, 2006
- Kerzener, H. (2001) Project Management: A system approach to planning, scheduling and controlling (7th edn), London, John Wiley and Sons, Inc.

- Malik Khalid et al (2002), Handbook for Monitoring and Evaluating for Results, UNDP, Evaluating Office, 2002
- Mari Clark and Rolf Sartorius et al(2004), “Monitoring & Evaluation: Some Tools, Methods & Approaches”,World Bank Operations Evaluation Department-Evaluation Capacity Department (OED-ECD), Copyright 2004
- Mukoko, (2000), “Project Monitoring and Evaluation”, Project Planning, Implementation and Evaluation: A Training Manual: UNCRD Textbook Series No. 8
- Phillips J. (2003). PMP Project Management Professional Study Guide. McGraw-Hill Professional, 2003. ISBN 0-07-223062-2 p.354.
- PMI (2010). A Guide to the Project Management Body of Knowledge p.27-35 Pressman, Roger S. (November 3, 2011), Software Engineering, a practitioner's approach.(7th ed.), McGraw-Hill, pp. 895, ISBN 9780071267823
- Project Management Institute (PMI) (2000), A Guide to the Project Management Body of Knowledge (PMBOK Guide) 4th ED 2008 edition

FIGURES

Development of EVM Metrics

Work Breakdown Structure (graphical)



Work Package Number	BCWS/PV	BCWS or PV	ACWP or AC
1	100	80	90
2	200	175	185
3	300	150	275
4	100	TBD	TBD
5	50	TBD	TBD
Period Total	600	405	550
Project Total	750	TBD	TBD

Performance Metrics

Metrics Definition	Value this Period
BCWS=PV=Planned Value	600
BCWP=EV=Earned Value	405
ACWP=AC=Actual Cost	550
BCWP - ACWP=CV=Cost Variance -	145
BCWP (EV) - BCWS (PV)=SV=Schedule Variance -	195
BCWP (EV) / ACWP (AC)=CPI=Cost Performance Index .	74
BCWP (EV) / BCWP (PV)=SPI=Scheduled Performance Index	67
BAC=BCWS (PV)	750
EAC=BAC/CPI	1013
VAC=BAC - EAC	-263
TCPI=BAC - BCWP (EV) / BAC	1.72

S-Curves

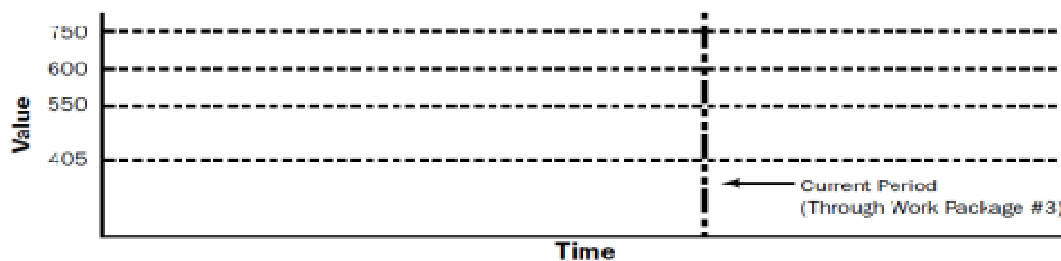


Figure 2. EVM Basic Structure

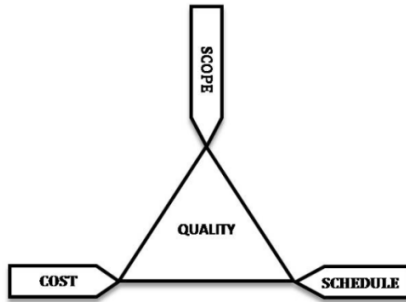


Figure 3. Iron Triangle

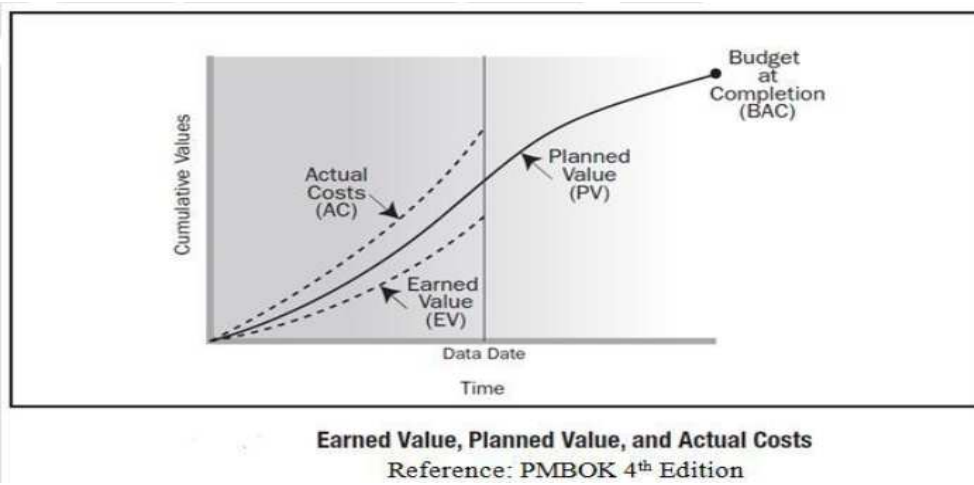


Figure 4. EVM S Curve

APPENDICES

Appendix 1: Survey questions

Section 1: General Question								
GQ1	Number of projects Observed	1-3	4-6	7-9	10-12			
GQ1	Countries where project were running	SA	NA	WA	EA	CA		
ID	Question	Strongly Disagree	Disagree	Disagree somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
Section 2: EVM Principles								
IV1	All work scope was planned for the project to Completion							
IV2	All the scope decomposes into finite pieces that can be assigned to a responsible person or organization to control.							
IV3	All the program work scope, schedule, and cost objective were integrate into a performance measurement baseline Plan							
IV4	Actual costs incurred and recorded in accomplishing the work performed was used							
IV5	Objectively assessed accomplishments at the work performance level							
IV6	Significant variances from the plan, forecast impacts were analyzed, an estimate at completion based on performance to date and work to be performed was prepared							
IV7	EVMS information was used in the company's management processes							

ID	Question	Strongly Disagree	Disagree	Disagree somewhat	Undecided	Agree somewhat	Agree	Strongly Agree
		Section 3: Project Success Indicators						
DV1	Meeting schedule							
DV2	Stay within Budget							
DV3	Benefit to customer							
DV4	Commercial success							
DV5	Preparing for the future							
Section 4: Descriptive Questions								
DQ1	What were the main Challenges on deploying the EVM in your projects?	Executive ambivalence	Poor data	Data overload	Poorly chosen software	Inexperienced contractors	Too bureaucratic	Special IT tool set needed
DQ2	What were the benefits of using EVM for your project control purpose?	Increased project visibility	Deflates PMs natural Optimism	Early warning of Problems	Gives and objective basis for EAC	Highlights Overspens & overrun	Highlights causes of variance	Improved estimating and planning

Appendix 2: Survey Results

ID	1:4	1:5	1:7	1:7	1:7	1:7	1:7	1:7	1:7	1:7	1:7	1:7	1:7	1:7	1:7	1:7
	1.GQ1	2.GQ2	3.IV1	4.IV2	5.IV3	6.IV4	7.IV5	8.IV6	9.IV7	10.DV1	11.DV2	12.DV3	13.DV4	14.DV5	15.DQ1	16.DQ2
1	1	1	7	7	7	6	7	5	5	7	7	7	6	6	7	1
2	2	1	6	5	6	6	5	6	6	6	6	6	5	6	3	2
3	3	1	6	5	4	5	5	4	5	5	5	5	6	6	1	3
4	1	1	7	6	5	6	6	5	6	6	6	6	7	7	3	1
5	2	1	7	5	5	6	7	7	7	7	7	7	7	7	7	7
6	3	1	5	5	2	6	4	2	4	4	3	4	6	4	1	5
7	1	2	5	4	5	5	5	5	5	5	4	5	6	5	7	1
8	3	2	6	5	4	6	6	4	6	6	6	6	5	6	4	7
9	4	2	4	5	5	4	4	5	5	4	5	4	4	4	2	4
10	2	2	4	4	4	3	3	4	4	3	4	3	3	5	7	7
11	2	2	4	3	5	4	4	5	4	4	5	4	4	6	7	7
12	3	2	6	5	6	5	7	6	5	5	6	5	6	6	7	5
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16	3	3	5	4	5	6	6	5	6	5	6	6	6	7	2	3
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19	2	4	5	6	6	5	5	6	5	5	5	5	5	6	6	1
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21	2	4	6	5	5	6	5	5	5	5	5	5	5	6	6	3
22	3	4	6	6	6	6	5	6	6	6	6	6	6	4	7	7
23	2	4	5	4	6	5	5	6	4	5	5	5	6	5	5	1
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25	1	5	6	5	4	6	6	4	4	6	6	6	6	6	6	7
26	2	5	7	6	5	5	7	5	6	7	5	5	7	7	7	1
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31	3	5	5	5	5	6	4	5	5	5	5	5	5	6	1	1
32	1	5	6	6	5	6	3	5	6	4	6	6	5	5	3	2
33	2	5	7	6	5	5	5	5	7	7	5	5	6	7	7	3
34	2	5	5	7	5	4	4	5	6	6	4	4	5	5	3	7
35	3	5	4	5	5	5	5	5	5	4	5	5	5	4	3	1