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Project Report

Implementation of Risk Management System

Instructor

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Abstract

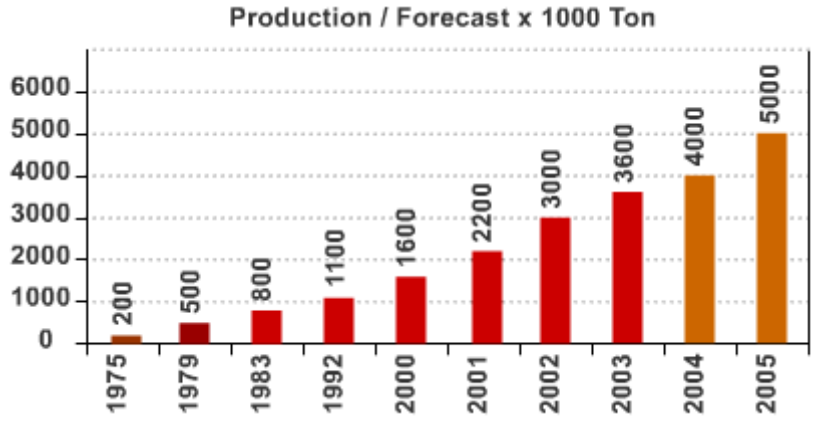
This paper takes on an existing company that does not have a risk management system in place and attempts to implement it. The company is in the field of manufacturing red bricks. It is planning to expand to take the opportunity presented to it through the huge governmental investments occurring nowadays. The company managed to survive so far but it is tough times due to competition now and the company has to evaluate its options very carefully to succeed.

In order to implement a useful Risk Management System, we have to implement different tools needed to support the risk management system such as the Work Breakdown Structure, Responsibility Interface Matrix, Critical Path Method, and Earned Value Analysis. Then we will describe the Risk Management System and provide the templates and tables to assist the project manager within the company to assess risks in an easy and effective manner.

Introduction

This paper will attempt to implement a new Risk Management System (RMS) in an existing company. This company which will be named “Red Sea Manufacturing”, is based on a real company in Saudi Arabia, however, some of the information was modified due to confidentiality issues. Our team will be responsible to plan and implement RMS for this company. The company has an existing project management system in place but have no risk management system at all.

In 1975, it was a great opportunity to invest in building materials and construction industry due to the fact that the region was in a construction and building booming era. Thus, one investor founded a red brick manufacturing factory 35 kilometer from Jeddah in a town called Bahra. In 1976, after intensive work, the first factory was built and the production wheel started rolling and never stopped since then. To meet the increasing demand throughout the past three decays, a series of production line expansions were done which increased its first one production line to nine more with different capacities. At the beginning of the new millennium, the company built a factory in Jizan so it can cover the southern region of Saudi Arabia. However, the demand for red bricks kept increasing dramatically not just in Saudi Arabia, but in the neighbor countries too. Therefore, the company built a third factory in Kulais (120 kilometer from Jeddah) in order to double its total capacity from both factories. Less than year ago, the new factory started its production. Meanwhile, the government latest effort in launching several industrial cities in the kingdom will force the company to expand even more. Figure.1 shows the increase of the company’s production as a result of several upgrades and expansions throughout its history. Such a history is another indicator for the company to expand so it can meet forecasted demand.



Figuer.1 Company’s production over the years

The objective of this report is to develop a risk management system (RMS) for Red Sea Manufacturing. The company’s previous line production expansion,

factory upgrades, and new factories constructions lacked the modern and advanced project management tools and best practices. Moreover, the company is on the verge of its greatest expansions to cope with the current and expected demands, and the greater the projects are the greater the risks. Therefore, a development of such risk management system is a must for this company.

Background

During the company's history, as we discussed above, the company have gone through different projects to expand its production and enhance its operations. The most common types of project are: equipment upgrades, new production line, and new factory build. Even though such projects are considered recurring projects, the company struggled managing them appropriately. Such struggles were like cost overruns, scope creeps, and lag behind schedule. These types of problem did not only cost the company money, but also the loss of key employees and customers. Below we will discuss the different types of projects that are done in the company and the common issues that those projects face.

Such projects include upgrading equipments, a part of the production line, the whole production line, the research and quality control lab, or the loading and transportation machines. Those projects are more complicated than they seem. For example, upgrading a part of the production line must be done in a way that the upgraded section should be compatible with other machines in the production line. Down Time is another crucial aspect of upgrades projects, because they usually affect the production capacity of the factory.

The company has added several new production lines to its factories all through its history. The problem with these projects that it takes place at the same factory and most likely the new line share some machines with the old ones like mills, packing, and loading. To explain such difficulties we will discuss a previous issue happened three times in new line project. After the new line got in place and ready to be integrated, the new machines was not caliber appropriately. That led to the break of the loading machine. Consequently the furnaces have to shut down and sub consequently the whole factory. Giving that the furnaces takes several hours to be used again the company lost 2 days of production and lag behind in orders.

The company has built two factories in addition to the main one and expected to follow them with few more, all of which were and will be built in house. Such projects were nightmares for the company. Both built factory lagged behind schedule many times and overrun cost as well.

Ever since the company beginnings, it handles a continuous flow of projects regarding custom mad bricks for large construction projects. Such projects include molding designs, technical and quality specs, and production line preparations. The risks of not meeting the client's standards and deadline are enormous and costly. Thus, a Risk Management System is required to avoid any potential loss for Red Sea Manufacturing.

Project Management Tools

Our project team will plan and implement a Risk Management System (RMS) for this company. In order to do that, there are a number of project management tools that are required to as the basis of this system. These tools are Work Breakdown Structure (WBS), Responsibility Interface Matrix (RIM), Critical Path Method (CPM), and Earned Value Analysis (EVA). Since none of these tools are being used currently in the company, we will attempt to describe them and provide generic templates that can be used for any project in the company.

Work Breakdown Structure (WBS):

WBS is a plan project or task list that breaks down the tasks of a project under the key deliverables. WBS is a good narrative definition for the project scope. It allows tracking down the entire project tasks and segments. On top of that, it alerts the management about the scope change and fit them in schedule when contingencies take place. **Appendix 1** shows a generic WBS.

It consists of two categories; Level of details and Accounting Codes. Level of details breaks deliverable down to segments so that it is less held up in details and data entry time. PMI`s standard recommends to break down work packets so that they are no longer than your standard reporting period. Accounting Codes are the WBS ID number of the deliverables and tasks of the project. The deliverables have high-level numbers and the tasks are broken down underneath them so that an accounting roll-up can occur. For a small project there should be 3 levels with 15-40 work packages and 40 hours per work package. Larger projects will consist of 4 or more levels with each work package consist of 40 to 100 hours.

Responsibility Interface Matrix (RIM):

A responsibility matrix or linear responsibility chart is a tool that lays out the major activities in the project and precisely details the responsibilities of each stakeholder involved in a project. It is an important project communication tool because all stakeholders can see clearly who to contact for each activity. It is helpful in showing in who is responsible for what. RIM also shows critical interfaces between units that may require special managerial coordination. With it, the project manager (PM) can keep track of who must approve what and who must report to whom. **Appendix 2** shows the different roles in the RIM while **appendix 3** shows a RIM table for an example of a work packet.

The different steps of constructing a responsibility matrix include:

- Listing the major activities in the project (in the matrix rows)
- Listing the stakeholder group (in the matrix columns)
- Specifying the involvement level, authority role, and responsibility of each stakeholder by codifying the responsibility matrix.

- Incorporating the responsibility matrix into the project rules; the original version of the responsibility matrix and all future changes in it must be approved by project stakeholders.

After the matrix is completed, it should be circulated for approval so that everyone understands and agrees to their roles and responsibilities. If this is done early enough, you can include it in your Project Definition (charter). If it's done a little later, it can be created as a stand-alone project management deliverable.

Critical Path Method (CPM):

This tool is very critical to the risk management system. It uses the tasks defined in the WBS and connects them together using their dependences and duration. This identifies the longest chain of connected tasks that have no float, i.e. the critical path of the project. Any delay in any of these tasks will result in a delay in the whole project. This diagram will show how early and late each task can be started. Using this, a forward pass and backward pass techniques are used to identify the critical path and any floats in the other paths.

This tool's importance to the risk management system is that it clarifies which risks will have high impact on the project. Any risk related to a task on the critical path by definition will be a high priority risk since it will be assessed high on its impact as will be described later. Without CPM, it will be difficult for the project team to assess the impact of the risks on the project. **Appendix 4** shows an example of set of activities and their dependences while **appendix 5** shows the network diagram of the activities.

Earned Value Analysis (EVA):

This tool provides an essential need by the project which is the integration of the scope, cost and schedule measurement of the project in one simple tool. EVA provides the project manager with ability to measure the performance of the project and forecast its final cost and completion date.

In order to implement EVA successfully, a clear scope must be define for the project. WBS should be very clear and agreed upon between the customer and the project team. Once the scope is defined, the next step is to define Control Account Points (CAPs). Each CAP consists of a group of tasks with known budget and schedule metrics. There are different methods to measuring CAPs but we will be using the 50/50 formula which assigns 50% of progress when the task starts and 50% when it finishes. This will be helpful as it requires a minimal tracking of actual costs since there is no formal system to track the work done. **Appendix 6, 7, 8** shows the terminology used in EVA, an example CAP, and an example of a graphical plot of the planned, actual and earned values for a project.

EVA will allow the project manager to have an accurate estimate of the project's budget as early as 20% of the project completed. This gives the project manager

the ability to detect and correct any overruns that could happen in the future. However, in order to accurate measure the performance using EVA; the company will be required to keep track of the actual work done on each task.

Risk Management System (RMS)

Risk Management is a process of assessing, mitigating and monitoring risks. In business organizations, the purpose of risk management system is to manage uncertainty and threats by involving people following procedures and using several risk management tools to ensure conformance with risk-management policies.

A risk management system is based on various principles. A RMS of the organization should create value, should be integrated well with the organization's processes and be a consistent part of decision making. It also should explicitly address all uncertainties in a systematic and structured way. RMS will take all the relevant information under consideration which means accounting for human factors. It should be transparent, inclusive, dynamic, iterative and responsive to change and should be capable of continual improvement and enhancement.

The RMS is a process consisting of several steps. These steps are discussed as follows.

The Risk Management Process:

This process start with the identification of risk, planning the remainder of the process, mapping out the social scope of risk management, the identity and objectives of stakeholders and the basis upon which risks will be evaluated and its constraints. The next step in the process is that of definition of a framework for the activity and agenda for identification. Risk analysis and development of a risk response plan follows next and one of the most critical steps of a risk management system.

Risk Identification:

The first step in the risk management is to identify any potential risks. What is a risk? A risk is an event that when triggered can cause problems or seriously impact the cost, schedule and performance of a project. Therefore, risk identification can start with the source of problems or the problem itself. The chosen method of identifying risks may depend on culture, industry practice and compliance. Thus it is important to initiate a study to find the best way to identify risks in this company. The WBS will be used to identify the risks by examining each of the work packets within it. In this step there will be no analysis to the risks. It is crucial to only list the different risks of the project with no criticism. Part of the identification is to identify opportunities which are the other side of the coin from risk. This step will be performed at the beginning of any project. Without this

step, there will not be any risks to assess or plan for in the rest of the RMS process.

Risk Assessment:

The next step in the process is the need to assess risks to identify or determine the severity of impact of that risk on different project activities. Also, the probability of occurrence of that risk should be identified to prioritize the different processes of projects. If the probability of occurrence of a risk is high along with its impact then that risk or event should be given the highest priority or needs immediate attention.

A scale from 1 to 5 will be used to rank the probability that a risk can occur and impact of each of the risks on the project where 1 is the lowest probability/impact and 5 is the highest. **Appendix 9** shows a table describing the different probability and impact ranks to help the user assess the risk correctly. A Probability-Impact (P-I) matrix will be used to identify the priority of each of the risks as seen in **appendix 10**. In order to priorities a risk, the assessment of the probability and the impact will be multiplied together to form the Probability-Impact Number (PIN). Any risk that has a PIN of less than 8 is considered a low priority risk and over 12 is a high priority risk.

Risk Treatments:

After the risks have been identified and assessed, it can be treated by using one of the following modes or strategies.

- Avoidance (eliminate) : includes not performing an activity that could carry risk
- Reduction (mitigate) : involves methods that reduce the severity of the loss or the likelihood of the loss from occurring
- Transfer (outsource or insure) : involves outsourcing or transferring the risk
- Retention (accept and budget) : involves accepting the loss when it occurs

Risk Analysis:

The risk analysis is the next step in the process. This step involves the analysis of the source and the analysis of the problem that can occur from a probable risk event. The risk sources may be internal or external to the system that is the target if risk management. Examples of risk sources are: stakeholders of a project, employees of a company and so on. The problem analysis step involves identification of threats related to a risk. When whether source or problem is known, the events that a source may trigger (trigger point) that can lead to a problem can be investigated.

Risk Response Plan:

A risk response plan has to be developed to assess the risks identified and to determine course of actions to increase opportunities and reduce threats to the overall project goals. Appropriate controls, tools or counter measures should be used to measure each risk. Risk mitigation needs to be approved by the appropriate level of management. It should propose applicable and effective security controls for managing the risks. A risk response plan should have following:

- Risk Number
- Related Work Package
- Identified risks
- Risk probability and impact
- PIN
- Risk Severity
- Preventive action, trigger point, contingent action
- Name of the risk owner

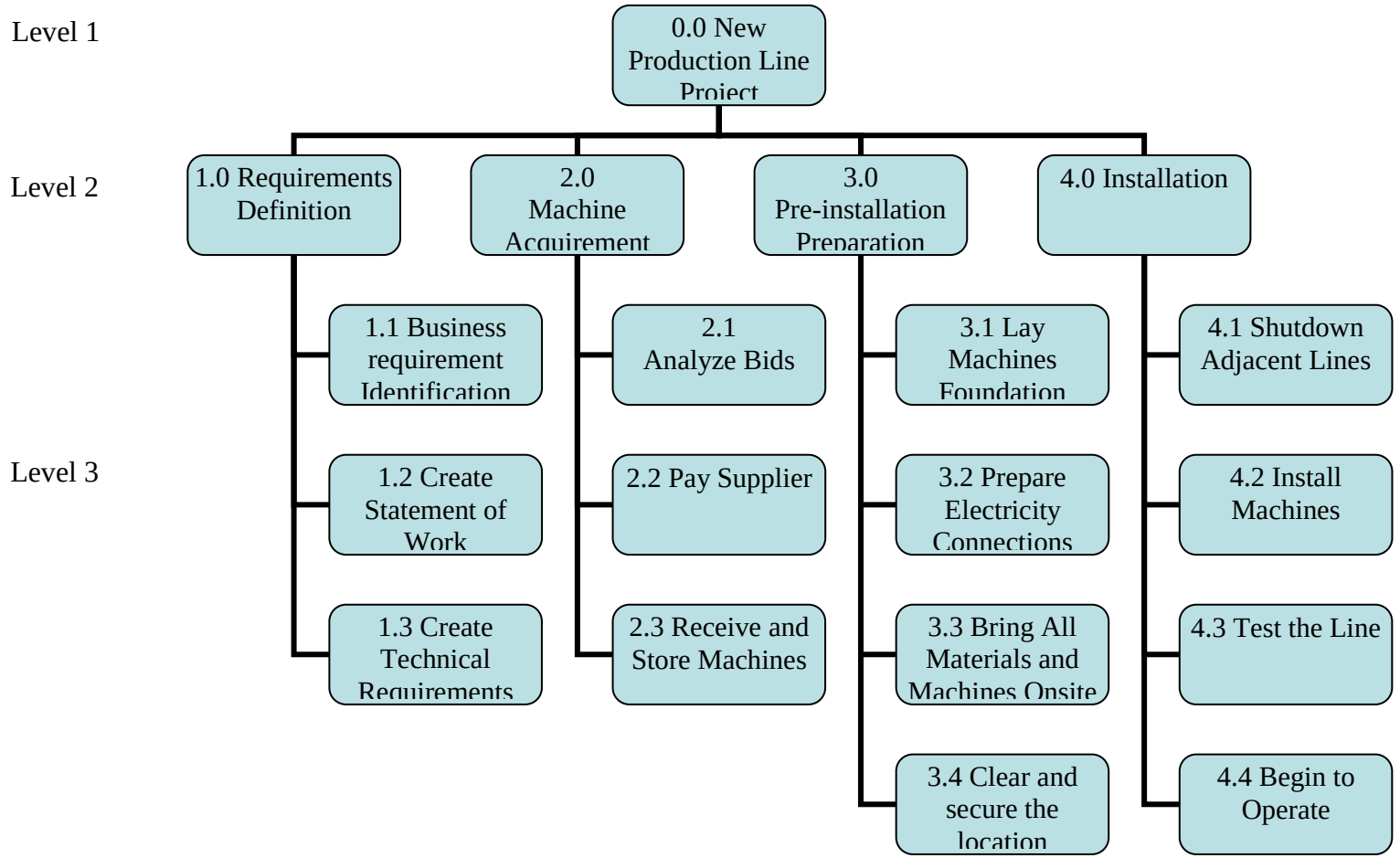
The table in **appendix 11** can be used as a database that has all of the above information. Based on the response planned for each risk, contingency funds will be allocated to the project to absorb the costs of the risks.

Conclusion

Red Sea Manufacturing is upon another major opportunity to expand due to the economic boom in Saudi Arabia the last few years. However, unlike the first expansion, this time the competition is stiff and it's crucial that the company implements a Risk Management System to succeed. This will allow the company to far exceed their competitors by preparing for any risks that might occur while their competitors fall and lose their chance.

Using simple yet effective tools such as the WBS and EVA is an important step to successfully implementing a Risk Management System. The use of these tools requires discipline and commitment from the company to ensure they work as intended and provide the benefits highly needed by the company.

Appendix 1: Simplified WBS for adding a new production line project



Appendix 2: Responsibility Interface Matrix Ranks

Owner (O) is the person(s) responsible for the work packet completion.
Approver (A) is the person(s) who approves the packet as being complete
Participant (P) is the person(s) responsible for working on the work packet
Reviewer (R) is the person(s) who review the work packet progress

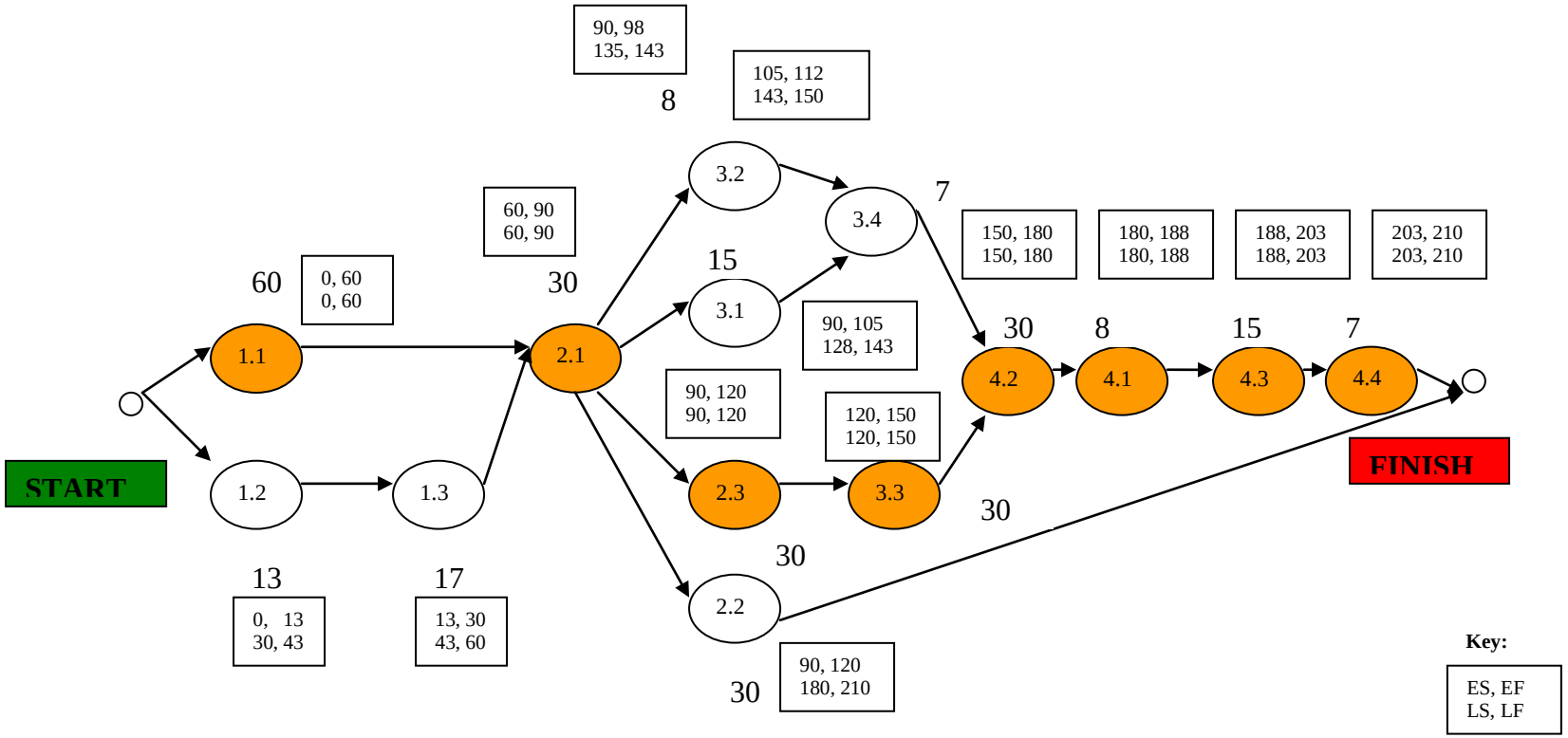
Appendix 3: Responsibility Interface Matrix Example Table

Accounting Code	Description	Project Customer	Production Engineer	Project Sponsors	Project Team	Project Manager	Steering Committee	Senior Technical Engineer
1.1	Business requirements identification	A		O			A	R
1.2	Create statement of work	A	R	O	P	P	A	R

Appendix 4: Example of CPM Dependency Chart

CPM Dependency Chart			
Accounting Code	**Description**	**Predecessor**	**Duration (in days)**
1.1	Define and analyze requirements	-	60 days
1.2	Create Statement of work	-	13 days
1.3	Create technical requirements	1.2	17 days
2.1	Analyze bids	1.1, 1.3	30 days
2.2	Pay supplier	2.1	30 days
2.3	Receive and store machines	2.1	30 days
3.1	Lay machines foundation	2.1	15 days
3.2	Prepare electricity connections	2.1	8 days
3.3	Bring all materials and machines onsite	2.3	30 days
3.4	Clear and secure the location	3.1, 3.2	7 days
4.1	Shutdown adjacent lines	4.2	8 days
4.2	Install machines	3.3, 3.4	30 days
4.3	Test the line	4.1	15 days
4.4	Begin to operate	4.3	7 days

Appendix 5: CPM Network Diagram



The identified critical path (as shown in orange) using forward/backward pass procedure is:

1.1, 2.1, 2.3, 3.3, 4.2, 4.1, 4.3, 4.4

Appendix 6: Earned Value Analysis

Earned Value Terminology:

Planned Value (PV) = How much physical or intellectual work has been scheduled to be completed as of a point in time; expressed in hours, $, units, etc.

Earned Value (EV) = How much of the authorized work they actually accomplished; expressed in hours, $, units, etc.

Actual Cost (AC) = How much money was spent converting the PV into EV during the measurement period; expressed in hours, $, units, etc.

Cost Variance (CV) = EV – AC; expressed in hours, $, units, etc.

Schedule Variance (SV) = EV – PV; expressed in hours, $, units, etc.

Cost performance index (CPI) = EV/AC

Schedule performance index (SPI) = EV/PV

Budget at completion (BAC) = Original total budget to complete the project; expressed in hours, $, units, etc.

Estimate at Completion (EAC) = (AC/EV) * BAC; projected budget at the end of project; expressed in hours, $, units, etc.

Schedule at Completion (SAC) = (PV/EV) * original schedule; projected duration at the end of project; expressed in time units

Budget Variance at Completion (VAC) = Projected budget overrun; expressed in hours, $, units, etc.

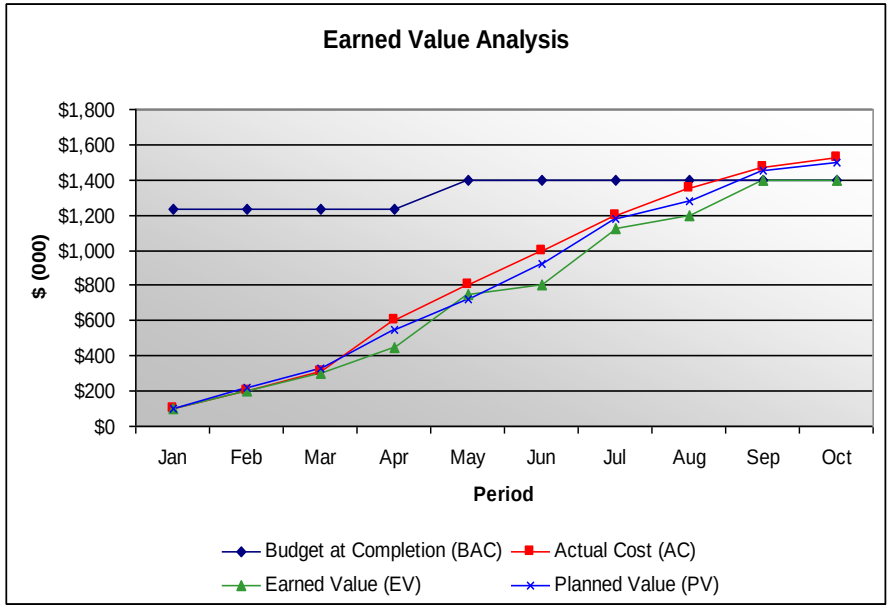
Schedule Variance at Completion (VAC) = Projected schedule delay; expressed in time, units, etc…

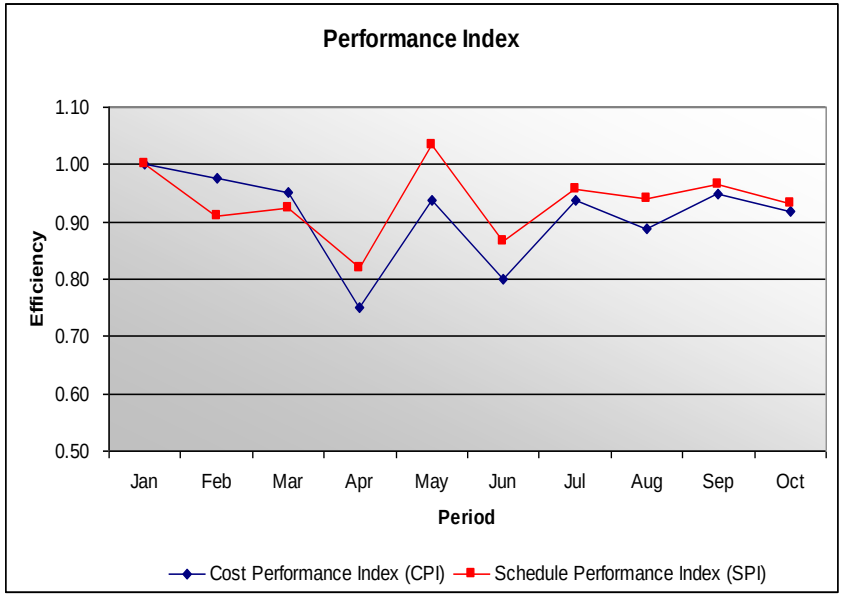
Reporting date = point in time at which EVA is performed

<u>Appendix 7:</u> Earned Value Template

CAP	Work Package	EV Method	Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	BAC
1.0 Requirements Definition	1.1 Identify Business Requirement	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	1.2 Create Statement of Work	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	1.3 Create Technical Requirements	Percent Complete Estimate	Plan													
			Earn													
			Actual													
Total CAP			Plan													
			Earn													
			Actual													
2.0 Machines Acquirement	2.1 Analyze Bids	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	2.2 Pay Suppliers	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	2.3 Receive and Store Machines	Percent Complete Estimate	Plan													
			Earn													
			Actual													
Total CAP			Plan													
			Earn													
			Actual													
3.0 Pre-installation Preparation	3.1 Lay Machines Foundation	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	3.2 Prepare Electricity Connections	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	3.3 Bring Materials&Machines Onsite	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	3.4 Clear and secure the location	Percent Complete Estimate	Plan													
			Earn													
			Actual													
Total CAP			Plan													
			Earn													
			Actual													
4.0 Installation	4.1 Shutdown Adjacent Lines	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	4.2 Install Machines	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	4.3 Test the Line	Percent Complete Estimate	Plan													
			Earn													
			Actual													
	4.4 Begin to Operate	Percent Complete Estimate	Plan													
			Earn													
			Actual													
Total CAP			Plan													
			Earn													
			Actual													
Total CAPs			Plan													
			Earn													
			Actual													
Varianc	Scheduel Variance (SV)															
	Cost Variance (CV)															
Indicies	Scheduel Perfomance Indicator (SPI)															
	Cost Perfomance Indicator (CPI)															
Forecasting	EAC															
	SAC															
	Budget Overrun (VAC)															

Appendix 8: Earned Value Example Graph





Appendix 9: Risk Ranking Table

Scale	1 = Very Low	2 = Low	3 = Medium	4 = High	5 = Very High
Impact	- Slight schedule delay - Minimal Cost	- Overall project delay < 5% - Cost overrun < 5%	- Overall project delay 5-15% - Cost overrun 5-20%	- Overall project delay 16-25% - Cost overrun 21-50%	- Overall project delay > 25% - Cost overrun > 50%
Probability	Less than 5%	6-15%	16-25%	26-35%	36-50%

Appendix 10: Probability-Impact Matrix Table

Probability	Risk Score = P * I				
VH = 5	5	10	15	20	25
H = 4	4	8	12	16	20
M = 3	3	6	9	12	15
L = 2	2	4	6	8	10
VL = 1	1	2	3	4	5
	VL = 1	L = 2	M = 3	H = 4	VH = 5
	IMPACT				

Key:

	High Severity > 12
	Medium Severity 8-12
	Low Severity < 8

Appendix 11: Risk Response Plan Template

Risk Response Plan										
Project Name: _____						Page #: _____			Date: _____	
Risk #	Work Package	Risk Event	Probability (P)	Impact (I)	Risk PIN (P*I)	Severity	Actions			Owner
							Prevention	Contingent	Trigger Point	
1	4.4 Operate Line	Line Fails	2	4	8	Medium	Ensure proper testing	Vendor on standby	Failed testing	John Doe
2	….	….	….	…	…	….	….	….	….	…