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Review Article

Big Data in EMR Project Cost, Budget, Variances, and Quality

Cheryl Ann Alexander[1,2]* and Lidong Wang[3]

[1]*Institute for IT innovation and Smart Health, Mississippi, USA*

[2]*Department of Engineering Management, Northcentral University, San Diego, USA*

[3]*Institute for Systems Engineering Research, Mississippi state university, Vicksburg, USA*

***Corresponding Author:** Cheryl Ann Alexander, Institute for IT Innovation and Smart Health, Mississippi, USA.

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Abstract

Project management is a common activity in healthcare. Not only do projects involve a change process, projects are also a necessary part of treating patients as technology, medications, and procedures are updated. However, project management is a specific set of tasks and key activities used to implement change. The project manager is in charge and generally works with the management team. For any change to succeed, however, strict adherence to goals, budget, and schedules is necessary to prevent loss. In this article, we will present a small project of implementing an Electronic Medical Record system in a small hospital. We will present the costs, schedule, variances, and some highlights about quality.

Keywords: EMR; Big Data Analytics; Healthcare; Variances; Costs; Budget

Introduction

After the scope is defined and the WBS done, the next step in project management includes budgeting, estimation, variances, risk, and quality. It is important to have a defined scope statement and an established WBS before attempting to estimate a budget or costs associated with the development of the project [1]. Every hospital will eventually go through changes which will require the organization to develop and complete a project. This complicated process, project management, focuses on one project and its completion through set steps. Creating a timeline and budget for the project is an important step in this process and is generally controlled by the project manager (PM) and sponsors. A project means leaving the comfort of the routine and branching out into new territory. However, a project is temporary and must adhere to budgets, costs, and a timeline. When projects fail or last too long or fall out of timelines or budgets, it is usually due to a failure in cost estimation and budgeting. Therefore, the project manager should be extremely careful when apply a budget. Beginner PMs often have inaccurate estimations. It is imperative to also know that when budgets fail, the morale drops and projects lose momentum [2].

Project cost management includes planning, estimating, controlling costs, and financing so that the project can be completed within budget and on time [1]. A good project will estimate costs accurately and strive to maintain within those limits to keep within budget. The PM is, therefore, critical in keeping those involved with the project on task and within budget. The control team usually consists of an office manager, a marketing professional, the doctors, and someone from administration. The cost estimation should be presented to this control team and approved prior to implementing the project [2]. Table 1 illustrates the schedule that should be adhered to.

A work breakdown structure (WBS), is necessary to do cost estimating. The WBS is a hierarchal list of all the work deemed necessary to complete the project. This is the precursor to a detailed work schedule. Each activity on the WBS needs a price attached to it and each price should come from the organization or company providing the service. Some costs will be ongoing costs, but most will be fixed. Another method of assigning costs is to use historical data. However, a common method for estimating costs is to list the items for the project and total the costs. Hospitals are getting more and more complex. As time goes on, there will likely be the need for more complicated projects. As hospitals try to adapt to new legislation and the computer age, many projects will be established [2].

Big data analytics cybersecurity project

Before the WBS is established, the scope management statement is developed. For this project, the first step is to establish

Deliverables	Key Success Factors	Assumptions	Exclusions
3 V's	Achievable	Define	7 V's
Define cybercrime	Achievable	Define	Healthcare
How can big data be affected by cybercrime	Healthcare data personal identity data and personal drug/ insurance information	Cybercrime	Any data other than health
Define HITECH	Enforce	Define	
Define HIPAA	Enforce	Define	
IT Protection program	IBM	Program will defend against all cybercrime	Healthcare Data only
Design provider sites to ensure privacy	Ensure HIPAA, HITECH, cloud, IoT, etc.	These programs will defend the organization against cybercrime	Healthcare
Design of Big Data Repository	Ensure HIPAA, HITECH	Privacy is key for monitoring personal data	Only monitor when and what is necessary
Mobile computing into Big Data Repository	Double encryption	Data will be secure	Healthcare only
Instruct personnel on working with Big Data Repository		Use Big Data to identify patients according to criteria	Patients identified only
Computer screen covers	Keep Data secure	Will keep data secure	Computer
Biometric protection devices	Identify key personnel	Keep data and personnel secure	Data and personnel secure
Check for programs associated with IT protection of Big Data Repository			
Hire data scientists	Protect and manipulate data and Big Data		Will need highly trained
Costs for data scientists			

Table 1: Key inputs for project.

data governance to have a sound Big Data analytics landscape. Next, the data architecture needs to be designed to protect Big Data from cyberattacks. An assessment of recent cyberattacks and potential strengths and weaknesses is necessary. The following is justification for the scope statement:

1. Big Data analytics is powerful in processing large volumes of data.
2. It can help analyze data variety (different formats and types such as structured, unstructured, semi-structured data).
3. It enables analyzation of high velocity data such as streaming data and perform real-time analysis.
4. It can detect missing data or error data, improve data quality, and veracity.

The scope statement is therefore developed as:

- Specifically, in cyber-attacks, it can identify new types of attacks, help give real-time response in identifying response, and give 365-degree view of attack identification because it can be used to identify many types of attacks.
- To have a master data management system in place for establishing a data governance program to protect EHR data landscape.

For this project, a WBS has already been developed and is included as table 2 and figure 1 in this paper. Cost estimations will be mock numbers as the PM has no access to live quotes for activities.

Cost estimations

Some cost estimations can have huge influences on the project. For example, some cost estimates can influence the cost of projects after the planning process is completed while other cost

#	Task	Duration	From	To	Resources	Status
1	**Select Project Team**	4 days				
1.1	Team Definition-Organizing Team	1 day	8/2/2019	8/03/2019		
1.2	Kickoff Meeting	1 day	08/04/2019	08/05/2019		
1.3	Organize Team Meetings	1 day	0803/2019	08/04/2019		
1.4	Project Charter Design	1 Day	08/03/2019	08/04/2019	Project Sponsor, PM	
2	**Needs Assessment and Requirements Determination**					
2.1	Program Flowchart and Sequence Analysis	1 day	08/05/2019	08/06/2019	Project Sponsor, PM	
2.2	Resource Allocation Assessment	5 days	08/05/2019	08/09/2019	Project Sponsor, PM	
2.3	Assessment of Available Software	5 days	08/12/2019	08/16/2019	Project Sponsor, PM	
2.4	Assessment of Cyber ware	5 days	08/12/2019	08/16/2019	Project Sponsor, PM	
3	**Cybersecurity Needs Assessment of Big Data in EMR**					
3.1	Assess Big Data in EMR in Various Areas	10 days	08/19/2019	08/30/2019	Project Sponsor, PM	
3.2	Evaluate EMR Cyber ware in Various Areas	10 days	08/19/2019	08/30/2019	Project Sponsor, PM	
10	Project Closure Phase Report	1 day	09/01/2019	09/01/2019	Project Sponsor, PM	

Table 2: Work schedule detailed.

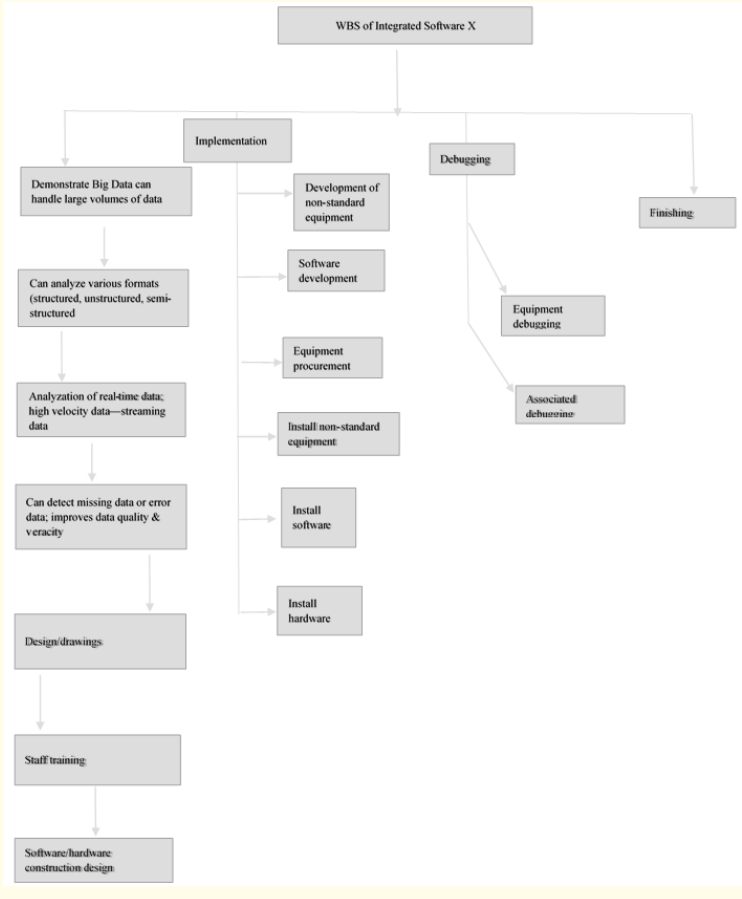

Figure 1: Work schedule (flowchart).

estimates are only effective during the planning process [1]. Cost overrun happens with nearly every project. It is critical that careful planning is done to prevent cost overrun. A few of the problems affecting cost are cost fluctuation, inflation, unavailability of materials, project complexity, etc. Many of these reasons are related to project management, therefore it is critical for PMs to have a deep understanding of cost estimation [3]. Another aspect of cost management is to remember that different stakeholders will have various methods for estimating costs. It is important for the PM to understand this and apply this knowledge to the process of cost estimation [1].

Cost estimation can be defined by earned value (EV), actual cost (AC), and planned value (PV). Planning cost is an important step in the project management process. When doing variances, if the AC is over the EV, the project could be over budget [4]. As project needs change over time, it is necessary to allow costs to evolve to keep up. EV however, is widely used as a standard to monitor the project's projected costs. PMs track variances in the costs and adjust the costs as needed. The Schedule Performance Index (SPI), the ratio of PV and EV, indicates whether the project is on time or not, and whether the costs are aligning [5]:

- A cost estimation chart for the Big Data project is included in this paper
- Variances are included in this paper.

Information technology as a project

Information technology (IT), is developing rapidly and many organizations are struggling to keep up with the demands of IT requirements. Hospitals are mandated to stick to the electronic medical record (EMR) currently, and there are already many more outlets for EMR data such as social media, sensors, wearables, smart devices, etc. IT projects have become the pillar of society as organizations try to keep up with rapidly changing technology. PMs need to have a solid understanding of cost, quality, and risk as they undertake these projects as IT projects can be simple or complex. With the extensive development of software engineering, integrated projects, and rework rate, the process risk and difficulty in software and hardware construction are important constraints in the IT project [6].

The following are the cost variances that are used in table 3:

- Cost Variance: CV=BCWP-ACWP
- Cost Performance Index: CPI=BCWP/ACWP
- Schedule Variance: SV=BCWP-BCWS
- Schedule Performance Index: SPI=BCWP/BCWS.

Conclusion: At one of the checking nodes of the project, if CV > 0, then cost saved instead of cost overrun; if SV > 0, the progress is advanced, whereas the progress is delayed [6].

Process Name	Planned Value/ per thousand	Earned Value/ per thousand	Actual Cost/per thousand
2.1	4	7	4
2.2	2	4	3
2.3	12	15	12
2.4	24	30	25.11
3.1	0.5	1	0.5
3.2	0.5	1	0.5

Table 3: Cost Estimation.

Note: These are mock cost estimations for the Big Data in Healthcare project. Process 2.4 has the highest actual cost at 25.11. Once the costs have been identified, it is easy to move into variances.

The potential for rework on an IT project can cause necessary cost and time readjustments and account for costs over budget. Demands may not be evident in the beginning of the project and rework may have to be done to software or hardware to keep compliance, keep up with standards, etc [6]. For example, sensors must be wired in early during the project, otherwise the system will not be wired and completed [7]. To calculate EV, it is necessary to record the data where materials and supplies are purchased. If the project is off or out of budget range, the PM can always apply critical maneuvers to bring cost back into line. The PM needs to assess about every third of the way or at least when there has been a change in the project costs [8].uu

Table 4 describes variances that are used in this solution. Variances demonstrate whether the project is on budget and time or not [6]. Here, process 2.4 has completed 95% of the project and according to the formula for budgeting, the project is slightly behind schedule and over cost as evidenced by the SPI < 0. The overall project is 93% completed and still over budget as well. The SPI of .76 indicates that some headway needs to be made to get the project back on schedule and budget. Despite growth of IT projects, stakeholders report some failure to specialize in core competencies, improve service quality, and lower IT costs. It has been widely reported that providers fail to support IT quality service. Scholars have tried to determine what factors contribute to the failure of these prominent IT projects; however, studies fail to show what factors are exactly

contributory, and outsourcing IT projects are showing a high level of failure [9]. Although, researchers have identified an "iron triangle" and cost is the most important factor in this group. However, it is well known that cost overrun, and scope creep are well known phenomena within IT projects [10].

Variance of 2.4	2.4 completed 95%
BCWS = 5 × 0.28 + 3 × 0.67 + 13 × 1.15 + 26 × 0.14 = 22, BCW-P = 21.27 SV = BCWS-BCWP = -0.76 < 0, 1.3/3=43.3%<93%	

Table 4: Variances.

Conclusion

Project management occurs in virtually every field. In engineering and technology, project management occurs frequently as stakeholders seek to upgrade technology, install new technology, or rework old technology. In information technology, projects frequently fail as projects experience cost overrun, lack of quality, or risk factors. It is in the PM hands to control costs and other related tasks to keep the project on schedule and within budget. This project is to evaluate whether Big Data can withstand current cyberattacks. Without a strong cybersecurity program, patient data and personal data is vulnerable to cyberattacks such as Ransomware, malware, and other programs.

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Conflict of Interest

Any financial interest or any conflict of interest does not exist.

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