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Cost Management of the Electronic Archive Platform Project at University of Derna

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الملخص— يتطلب التطور التكنولوجي من المؤسسات اعتماد الحلول الرقمية؛ ومن هنا ظهرت الحاجة إلى وجود نظام متكامل يعرف بالأرشفة الإلكترونية، فهو يوفر استراتيجية لإدارة عدد كبير من الوثائق التي تمتلكها المؤسسة، وتشمل وظائف هذا النظام الأرشفة والفهرسة والتلخيص والبحث والاسترجاع مما يوفر الوقت والجهد ويضمن سلامة البيانات، ولهذا تهدف هذه الورقة إلى إجراء تقييم دقيق لتكلفة مشروع بناء أرشيف إلكتروني لجامعة درنة في ليبيا، وتناقش ايضا مواصفات المشروع المقترح ويفحص إدارة تكلفة تنفيذ هذا الأرشيف من خلال تحليل القيمة المكتسبة، كما تم استعراض أهم المخاطر والتحديات التي يمكن مواجهتها وتأثيرها والحلول التي يجب تقديمها، و أظهرت نتائج تحليل إدارة التكلفة باستخدام تحليل القيمة المكتسبة أن المشروع في حدود الميزانية، وهو ما وضحها ايضا مؤشر أداء التكلفة (CPI)،الا أن مؤشر الأداء التخطيطي (SPI) كشف أن المشروع كان متأخرًا عن الجدول الزمني، إضافة إلى ذلك، فقد حددت مصفوفة التأثير المخاطر الرئيسية التي يمكن أن يوجهها المشروع مثل الهجمات الإلكترونية، وفقدان البيانات، وتأخير تسليم المشاريع، والأخطاء في مسح المستندات، ومشكلات تفاعل المستخدم، وفي نهاية الورقة تم تقديم التوصيات للتخفيف من هذه المخاطر وضمان التنفيذ الناجح لمشروع الأرشيف الإلكتروني بجامعة درنة .

الكلمات المفتاحية— الأرشفة الالكترونية؛ إدارة التكاليف؛ تحليل القيمة المكتسبة؛ مصفوفة تأثير المخاطر.

Abstract— Technological advancements require organizations to adopt digital solutions. Hence, there is a need for an integrated system known as electronic archiving. It provides a strategy for managing the large number of documents that organizations possess. The functions of this system include archiving, indexing, summarizing, searching and retrieval, which saves time and effort and ensures data integrity. This paper aims to accurately evaluate the cost of a project to build an electronic archive for University of Derna, Libya. It discusses the project specifications and examines the cost management of implementing this archive through an earned value analysis. The most important risks and challenges that can be faced, their impact, and the solutions that must be provided were also reviewed. The results of the cost management analysis using earned value analysis showed that the project was running on budget, as indicated by the Cost Performance Index (CPI). However, the Planned Performance Indicator (SPI) revealed that the project was behind schedule. Additionally, the impact matrix identified key risks such as cyberattacks, data loss, project delivery delays, errors in document scanning, and user interaction issues. Recommendations were provided to mitigate these risks and ensure the successful implementation of the electronic archive platform at University of Derna.

Keywords— Electronic archive; Cost management; Earned value analysis; Risk impact matrix.

1. Introduction

The purpose of archive digitization is to record documents onto digital media, allowing them to be retrieved in a form identical to the original content. It also ensures safe and quick access to information while reducing the likelihood of data loss. An electronic archive is a digital repository hosted on secure servers that stores digital data and provides a user-friendly interface [1, 2]. It employs several stringent procedures to maintain the integrity, availability, confidentiality, and legal value of the materials, as well as traceability to preserve the inferential value of the documents [3]. The need to create an electronic platform for the university's archives is driven by the need to maintain important information in a lasting and reliable manner, protect against damage and loss, and provide easy and convenient access for authorized users. It also aims to organize the movement of digital documents between departments effectively and systematically. Therefore, the archives department has been tasked with studying the type and size of documents, the indexing methods used, and the process of transferring documents between departments to determine the project requirements. Currently, the archives department uses a traditional system containing a large number of correspondences, documents, and administrative, financial, and legal files. These documents are classified and indexed based on the index number and department name. Each department stores its files on a personal computer that is not connected to the internet to preserve the documents. However, this traditional archive requires significant space due to the large volume of documents, which increases storage costs and prolongs information retrieval time.

Traditionally, Gantt charts have been used to monitor physical progress and incurred costs, as well as to maintain physical and financial accounts of project activities. This approach has faced criticism from several authors [4]. Instead, the technique of Earned Value Management (EVM) or Earned Value Analysis (EVA), developed by the US Department of Defense, has emerged. This technique is widely used as a control tool and is endorsed by the Project Management Institute (PMI) as the standard method for measuring project performance. PMI provides a historical overview of this technique, starting with initial efforts using PERT/Cost (1962, 1965) and Cost/Schedule Control Systems Criteria, C/SCSC (1967, 1996). Major developments have included the integration of planning, control, and project scoping into a single tool [5,6]. Effective value management focuses on forecasting final costs and project duration, which is critical for alerting managers and enabling responses to address delays and cost overruns. This study represents the first of its kind at the University of Derna, highlighting pioneering efforts in implementing an electronic archive platform to enhance document management practices within the institution. The research contributes to the field of electronic archiving by providing a detailed analysis of the cost management involved in implementing an electronic archive platform at the University of Derna.

2. Project Specifications

The project aims to create and launch an electronic archiving platform for University of Derna to archive administrative documents. It involves the purchase of computer hardware and software, as well as training and maintenance. The initial estimated cost of the project was set at 120 thousand dollars, with implementation taking 10 months, including supply, installation, programming, operation and training [7]. The project adopted the Agile methodology, which is considered as one of the best methods in software development. This method is characterized by flexibility and re-evaluation during the project development process [8].

2.1. Terminologies

There are three terms through which earned value analysis can be performed. Planned Value (PV), Actual Costs (AC), and Earned Value (EV) [9,10].

- Planned Value (PV), which represents the initial estimate of planned work. It is provided by evaluating planned costs.
- Earned Value (EV), which represents the amount of work actually completed to date, and can be equated with the price and total value estimated according to the client's opinions.
- Actual Cost (AC) represents the true cost of work completed to date. Timely assessment of actual costs may prove to be a significant burden on EVM implementation.
- Schedule Variance (SV = EV – PV), this indicator represents the extent to which the project is ahead (SV>0), behind (SV=0), or over budget (CV<0) and primarily measures cost variance.
- Schedule Performance Index (SPI = EV/PV), represents the pace of production, i.e. the rate at which planned cost is converted into earned value. An SPI greater than one indicates better than expected time performance.
- Cost Performance Index (CPI = EV/AC) represents the efficiency with which resources are being used. A CPI less than 1 indicates that the project is heading toward over-costing, where what is achieved does not match what was estimated.

3. Project Cost Control

In this research, we examined the cost within four months of the project implementation and identified the risks and proposed solutions. Therefore, the requirements were identified and the price and duration were estimated. The requirements are summarized in Table 1 [11], and the total cost of the project was scheduled and calculated as presented in Table 2.

Table 1. The requirements of project Cost

ID	Task	Duration	Task interior	Planned cost (USD)
A	Buying and installation of computers	30 days	_	20000
B	Buying and installation of software	15 days	A	15000
C	Buying and operating the network	45days	A, B	20000
D	Purchasing and programming the server	15 days	C	10000
E	Website programming	120 days	C	10000
F	Operator training	30 days	E	10000
G	Maintenance	360 days	E	10000
H	Information security subscription	360 days	D	20000

Table 2. The total cost of the project

Work breakdown structure (WBS)	Task ID	TBC	1	2	3	4	5	6	7	8	9	10
	A	20000	20000									
	B	15000		15000								
	C	20000			20000							
	D	10000				10000						
	E	10000					5000	5000				
	F	15000							10000	5000		
	G	10000									10000	
	H	20000										20000
Total budget cost (TBC)		120000	20000	15000	20000	10000	5000	5000	10000	5000	10000	20000
Cumulative planned value (PV)			20000	35000	55000	65000	70000	75000	85000	90000	100000	120000

4. Results

4.1 Earned Value Analysis

In this study the earned value analysis was used to assess the project performance by analyzing timeline and cost differences.

Table 3. The Project Performance

Actual Cost and earned value					
Cumulative Actual Cost AC	20000	35000	40000	50000	60000
Cumulative Earned Value EV	15000	36000	42000	52000	75000
Project performance matrix					
Cost Variance CV=EV-AC	-5000	1000	2000	2000	15000
Schedule variance SV=EV-PV	-5000	1000	-13000	-13000	5000
Cost Performance Index CPI= EV/AC	0,75	1,02	1,05	1,04	1,25
Schedule Performance Index SPI=EV/PV	0,75	1,02	0,76	0,8	1,07
Estimate at Completion EAC=AC+(BAC-EV)	125000	119000	118000	118000	105000

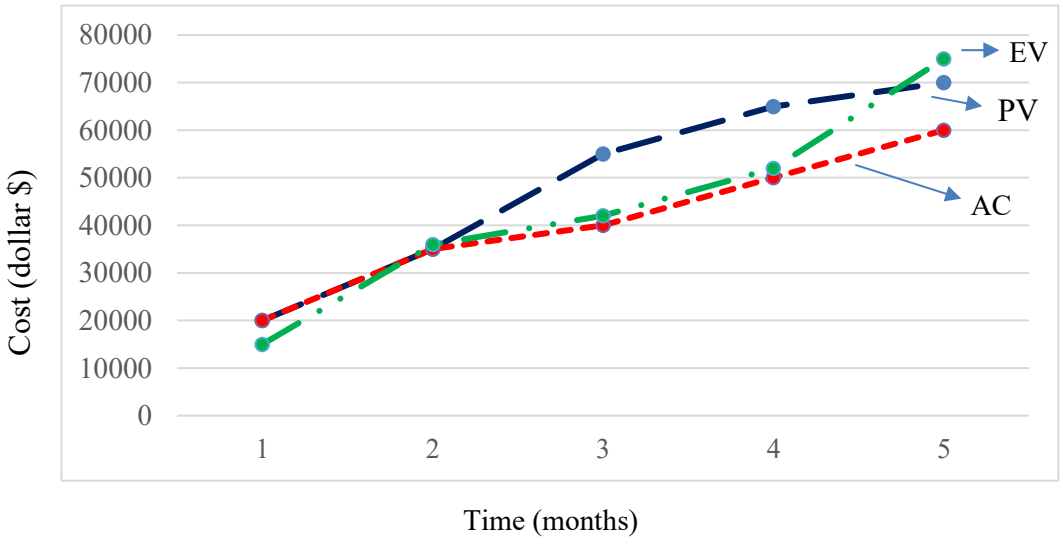

Fig.1. Earned Value Management

4.2 Expected risks:

This study began to identify potential risks, using a strategy of interviewing university archivists to explore risk areas. Interviews were planned through scenario-based and problem-solving questions. Four risks were identified for this project and we analyzed the risks based on likelihood and severity and then calculated the overall impact and prioritized the risks accordingly as shown in the table below.

Table 4. The probability of occurrence and impact of risks

NO	Risk	Probability	Effect on project	Impact	Probability
1	The user does not interact with the system	Low	Low	0.1	0.3
2	Cyberattacks and data loss	Very High	Very High	0.8	0.9
3	Errors in scanning or uploading documents	Low	Medium	0.2	0.5
4	Project delivery delay	Medium	High	0.4	0.7

The impact matrix is a matrix of five rows and five columns, The columns of the matrix display the risk scale arranged in ascending order according to its severity. The probability of risks was arranged in descending order with qualitative values as follows:0.9,0.7,0.5,0.3,0.1, and the impact factor was arranged in ascending order as follows: 0.05, 0.1, 0.2, 0.4, 0.8. The effect of each notifier is then calculated based on the probability and severity of the following relationship:

$$\text{Risk factor (RF)} = \text{Event probability (EP)} * \text{Impact factor (IF)}$$

Where: RF: risk factor, EP: event probability, IF: impact factor, and the hazard impact matrix can be coded in green to red in order to see the overall impact of the risk as in the following table. The study identified some risks and assessed their likelihood and impact as follows [12,13]:

Table 5. The Probability Matrix

Probability	Risk score = P * I				
0.9	0.045	0.09	0.18	0.36	0.72
0.7	0.035	0.07	0.14	0.28	0.56
0.5	0.025	0.05	0.1	0.2	0.4
0.3	0.015	0.03	0.06	0.12	0.24
0.1	0.005	0.01	0.02	0.04	0.08
	0.05	0.1	0.2	0.4	0.8
	Impact				

From the table, we can see that the risk of "cyber-attacks and data loss" has a risk factor of 0.72, which is considered the most important and will be the first in terms of importance. Similarly, the risk of "project delivery delay" is considered the second with a risk factor of 0.28.

5. Discussion and Interpretation

From the earned value analysis (EVA), the cost variance measure CV indicates that the project exceeded the actual value of the project in the first month by 5,000 $. It then followed the budget. The schedule variance measure (SV) also indicates that the project is behind the schedule in the first, third, and fourth months and ahead in the second and fourth months. As for the cost performance index (CPI), it indicates that the project is within the budget limits with an average of 1.02. As for

the planned performance indicator (SPI), an average of less than 1.00 indicates a delay in terms of the project schedule [14]. Figure 1 revealed that the actual cost is less than the earned value starting from the second month, indicating that the project is within the budget. The fact that the value of PV is often higher than the value of EV indicates that progress is slow.

From the probability matrix, the priority risks are:

1. Cyberattacks and data loss. This type of risk is avoided by the risk transfer process, through an agreement with a protection company responsible for safeguarding the system in return for an annual contract, with the assurance that protection software will be continuously updated.
2. Project delivery delay. In terms of impact is the delay in delivery, this risk can be addressed by involving experienced teams to expedite implementation.
3. Errors in scanning or uploading documents. To avoid these problems, you should choose the right equipment, software, settings, and formats for your documents. You should also check the quality and resolution of the digital images and correct any errors or omissions before uploading them to your electronic content management system, and ensure that the digitized documents are secure and compliant with relevant laws and regulations.
4. The user does not interact with the system. If the user does not interact with the system, it can be mitigated by developing a flexible user-friendly interface that is comfortable to use and easy to understand.

6. Conclusion

This research study was successfully addressed a detailed analysis of the cost management involved in implementing an electronic archive platform at the University of Derna. By analyzing the earned value corresponding to the work performed on the project, it was found that the project was running on budget through the Cost Performance Index (CPI). The Planned Performance Indicator (SPI) indicated that the project was behind the schedule. As for risks, the most important risks, as revealed from the impact matrix, are electronic attacks, data loss, and delayed delivery of the platform, data erasure errors, and the user's lack of interaction with the platform. Hence, the study recommends continuous update of the protection program at the university's website to prevent these risks. The emphasis should also be placed on monitoring the risks on a regular basis to identify any changes in their probability of occurrence or impact.

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