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Research Paper

Evaluation of Project Time Performance in the Upstream Oil and Gas Industry: The Case of Ghana

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Abstract
An emerging economy like Ghana, one of the developing nations in Africa, is fortunate to have started exploration not long ago, which means that it is still developing in the field of upstream oil and gas exploration compared to other industrialized nations that have a lot of experience in the field of project management and oil exploration. About 80% of the management style in the upstream oil and gas sector is project-based; therefore, any delays in project deliveries and completion will have a negative effect on completion time and, at the end of the day, affect the performance of the organization as a whole as well as the nation as a whole. Only Crude Oil Storage Tank Maintenance Project in the upstream oil and gas industry in Takoradi, Western Region, was included in the research. Secondary data was taken on nine completed Crude Oil Storage Tank Maintenance Project from managers preoccupied with project management in the Ghanaian upstream oil and gas industry in the Western Region of Ghana. These willing management staff have been employed in the sector for more than 3 years. The study used the budgeted cost of work scheduled (BCWS) and the budgeted cost of work performed (BCWP) as inputs to calculate the estimated schedule (ES) and actual time (AT) to finally calculate the schedule performance index (SPI) and schedule variance (SV). The purpose of the study is to evaluate the performance of project time in the Ghanaian upstream oil and gas industry. The study demonstrates that out of the nine Crude Oil Storage Tank Maintenance Project in the Ghanaian upstream oil and gas industry analyzed using both the schedule performance index and schedule variance, eight projects were completed on time and one project was delayed.

Keywords - *Ghana, project time performance, schedule variance, schedule performance index, and Emerging economy.*

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I. Introduction

Delays impact all individuals and organizations involved in oil and gas projects, making efficient project management crucial. For oil and gas companies, postponing project start dates can hamper anticipated revenue generation and raise financial costs. Strong project performance is essential not only for these companies but also for the global economy and, more specifically, oil-dependent nations like Ghana. In many of these economies, the oil sector is the primary taxpayer, emphasizing the importance of meeting stakeholders' expectations for sustainable growth. Evaluating company performance requires both financial and non-financial perspectives, as best practices demand success on both fronts (Mayston 2005; Pollit 1986). Common performance assessment methods include the balanced scorecard (BSC), customer profitability analysis (CPA), ratio analysis, benchmarking, and data envelopment analysis (DEA), with BSC being widely used for its comprehensive framework (Anthes, 2003). This study specifically utilizes the schedule performance index (SPI) and schedule variance (SV) to assess project timelines.

Upstream oil and gas activities, encompassing exploration, crude oil, and natural gas production, are driven by objectives like wealth creation and profit maximization (Wright & Gallun, 2008). However, companies face multiple challenges, including contractual obligations related to project delivery dates (Marzouk et al., 2008). Delays in project execution often lead to cost overruns due to increased management staff expenses, supply price hikes, rising financing costs, contract penalties, and other factors (Singh, 2009). Additionally, delays may harm the reputation of contractors in the competitive industry, hindering future contract opportunities. Prolonged construction periods can also compromise quality, as teams often allocate less time to quality assurance in a rush to meet deadlines, resulting in mistakes and rework (Woodward, 1997). In developing nations, delays in constructing public infrastructure, like schools, can harm society by stalling urgently needed facilities. Completing such projects on time is critical to meeting societal demands.

Project management involves a range of planning and control procedures to meet expectations for time, cost, and quality (CIOB, 2002). The PMBOK Guide dedicates one of its knowledge areas to project time management, covering processes like activity sequencing, resource estimation, schedule development, and schedule control to prevent delays (PMI, 2013). Effective time management serves as a measure of contractors' efficiency and performance (Solís et al., 2009). This study is particularly relevant, as it examines nine Crude Oil Storage Tank Maintenance Project in Ghana's upstream oil and gas sector—an area with limited prior research. With projects comprising 80% of management activities in this industry, timely completion is essential for economic impact. Projects completed on or ahead of schedule can significantly contribute to wealth creation, national development, and progress toward global sustainable development goals aimed at poverty reduction.

Purpose of the Study

The goal of this article is to evaluate the performance of projects in the Ghanaian upstream oil and gas industry, which is one of the emerging economies in Africa.

Research Question

What is the time-performance of projects in the Ghanaian upstream oil and gas industry?

II. Literature Review

Definition and Nature of Projects

A project is a short-term activity or series of endeavors designed to provide a distinctive good, service, or outcome (PMI, 2014). The transient nature of projects suggests that they have a distinct beginning and finish (time constraint), meaning a deadline must be met for the project. According to Calisir and Gumussoy (2005) and PMI (2013), project duration is the amount of time needed to complete a project. It is measured in days and determined by the time interval between the project's start date and conclusion date. Before obtaining a precise schedule during the planning phase, project time management begins from the very beginning of launching the project by establishing the needed project length and its milestones (Hazar, 2014).

Challenges with Project Delivery and Scheduling

According to Romel and Gilberto (2016), delivery delays are one of the most prevalent issues impacting projects, resulting from subpar project time management. These delays affect all project stakeholders. The art of project scheduling involves organizing and arranging project activities to ensure the project can accomplish its objectives and top priorities while staying within budget and schedule constraints. Project time management must address the scheduling of tasks and activities due to precedence or resource limitations (Herroelen, 2005). Scheduling includes defining project tasks and estimating the time and resources needed for each activity (Muhammed & Muhammet, 2018). Vennila (2018) suggests strategies for efficient time management, highlighting ways for top management to improve performance.

Strategies for Effective Time Management

Firstly, project team members should set up their schedules based on the Work Breakdown Structure (WBS) or Critical Path Analysis (CPA), organizing key dates for project activities on a calendar. This simplifies project visibility. Secondly, establishing an effective risk mitigation plan helps the project team, including stakeholders, overcome any negative emotions that may arise. Thirdly, communication should be integrated into the company's culture to reduce project team conflicts. Lastly, becoming organized helps save time, such as by clearing desks, filing documents, listing tasks, and planning events.

Importance of Planning and Control

Planning and control are fundamental to the success of project activities (Rochman and Wahyuni, 2018). Time constraints can delay or divert projects from their intended course (Mishakova et al., 2016; Andrade, Martens, and Vanhoucke, 2019). Several novel management strategies based on the Earned Value Management (EVM) technique have been used in recent years to reliably anticipate project duration (Batselier and Vanhoucke, 2015; Ballesteros-Pérez et al., 2019). Earned value management (EVM) is an effective method for managing project performance, integrating costs and time. The concept of "earned value" includes three key components: the physical completion of the project (percentage complete), intended cost absorption (budgeted cost), and the actual costs incurred (earned value) (Warburton and Cioffi, 2016; Wood, 2017).

Earned Value Method for Project Performance

The earned value method allows a comprehensive view of project performance, including cost performance and time. Previous studies indicate that earned value promotes performance and practical excellence (Colin et al., 2015; Espinosa-Garza and I. Loera-Hernández, 2017). In some projects, the earned value approach helps monitor non-linear accruals from various project incentives (Kerkhove and Vanhoucke, 2017), explaining how intended values can lead to benefits, reliability, and duration accuracy, as demonstrated in multiple large projects (Warburton and Cioffi, 2016). The system's operational and design features support successful earned value analysis, allowing the development of earned-value-based systems (Bryde, Unterhitzenberger, and Joby, 2018). The Earned Value system's forecast of Plan Value provides early insights for management, enabling proactive measures to ensure favorable performance outcomes (Chen et al., 2016).

Core Elements of Earned Value Analysis

Three essential elements in analyzing project performance based on earned value are BCWS, ACWP, and BCWP. The Budgeted Cost of Work Scheduled (BCWS), or Planned Value (PV), is allocated based on the work plan. At the project's end, BCWS is called the Budget at Completion (BAC) and measures time performance. The Actual Cost of Work Performed (ACWP), or Actual Cost (AC), is the total expenditure incurred for work within a specified period. The Budgeted Cost of Work Performed (BCWP), or Earned Value (EV), represents the value of completed work. Project performance appraisal can be done through variance analysis, performance index analysis, and estimated project completion cost analysis.

Schedule Variance and Performance Index

Schedule variance (SV) is used to determine differences between BCWS and BCWP, with positive numbers indicating better-than-anticipated performance and negative values showing poorer-than-expected performance (Kistiani, 2015). The Schedule Performance Index (SPI) measures task efficiency by comparing completed work (BCWP) with planned spending (BCWS). If SPI is below one, job performance is below expectations, as scheduled objectives are unmet (Bombana, 2015).

Rationale for Research in Ghana's Oil and Gas Industry

While prior research demonstrates the effectiveness of schedule variances and performance indexes, these projects were completed outside Ghana. Therefore, this research focuses on the performance of projects in Ghana's upstream oil and gas industry. The objective of this article is to analyze project performance in this industry, addressing unique challenges specific to the region.

Documentary Theory

In this research, Documentary Theory **(**Buckland, 1997) was applied in several ways to shape the use of secondary data from the nine Crude Oil Storage Tank Maintenance Projects in the Ghanaian upstream oil and gas industry. It involved assessing document reliability to ensure accurate and complete project records. The theory also emphasized contextualizing data within the local industry environment, enabling a more accurate analysis. Additionally, it guided data interpretation and trend analysis**,** helping identify patterns in project performance. Finally, recognizing potential biases in the data ensured objective and balanced analysis of project time performance.

Assessing Document Reliability

The theory guided the evaluation of secondary data from project management records. The reliability of the documents was thoroughly checked to ensure that the data accurately reflected the project's progress, time performance, and outcomes. This involved examining the consistency and completeness of the records used in the analysis of schedule performance.

Contextualizing Data

Documentary Theory emphasized the importance of understanding the context in which the data was collected. In this study, the theory helped ensure that the data from the projects in the Ghanaian upstream oil and gas industry was interpreted within the local environmental, economic, and operational context. This provided a more accurate analysis of project time performance.

Data Interpretation and Trend Analysis

The theory facilitated the extraction of meaningful insights from the secondary data by guiding the interpretation of project documents, such as project schedules, timelines, and budget records. By applying the theory, the research was able to identify recurring patterns in project performance, such as delays or timely completions, and analyze the causes of those trends.

Recognizing Potential Biases
Documentary Theory also helped in identifying any biases in the secondary data, such as discrepancies in reporting or selective documentation. This ensured that the analysis remained objective and balanced, and that conclusions were drawn based on the most accurate and representative data available.

H1: Upstream oil and gas projects in Ghana are successfully finished on schedule.

III. Methodology

As part of the research, nine Crude Oil Storage Tank Maintenance Project in the upstream oil and gas industry that were finished over various time periods were evaluated. Tank cleaning, painting, blasting, non-destructive testing (NDT), gas testing, demucking, water pumping, scaffolding on structures, rigging of pipelines, and inspection for each project were among the numerous tasks that had to be completed in the constrained area. Secondary data on the nine completed projects was obtained from the project managers in charge of them in the upstream oil and gas industry in order to measure two different variables (i.e., schedule variance and schedule performance index) of the project's performance level regarding timely completion. Secondary data also included the weekly information on the budgeted cost of work scheduled and the budgeted cost of work performed for each of the nine Crude Oil Storage Tank Maintenance Project in the upstream oil and gas industry. This weekly information was obtained until the end of all nine Crude Oil Storage Tank Maintenance Project

In order to understand the Crude Oil Storage Tank Maintenance Project very well and the calculations that were done, this will be useful and very important to note that the client (all contractors in charge of the projects were employed by the same agency), the type of project (Crude Oil Storage Tank Maintenance Project), the design (similar tank sizes and materials for all projects), the environmental context (all projects were completed in Takoradi, Ghana's upstream oil and gas industry), the timing of the project, and auxiliary variables were fixed to reduce the impact of significant factors that could affect project performance (all projects were executed by firms mostly dedicated to the same Crude Oil Storage Tank Maintenance Project type). Utilizing the schedule variance and schedule performance index, the project time performance was determined. Both were employed to check whether the same performance outcomes could be attained.

IV. Data Analysis and Results

Data Analysis for Research Question

In Project 1, which had an estimated value of $400,000, at the end of Week 1, the budgeted cost of the scheduled work was $10,400. The budgeted cost of the work performed was $10372. This had an SPI value of 1.01 and an SV value of 78.00. At the end of Week 2, the budgeted cost of the scheduled work was $38,000. And the budgeted cost of the work performed was $37,800. This had an SPI value of 1.01 and an SV value of 200.00. At the end of Week 3, the budgeted cost of work performed was $64,950, and the budgeted cost of the scheduled work was $65,500. This also had an SPI value of 1.01 and an SV value of 550.00 dollars. At Week 4, the budgeted cost of work scheduled was $95010, and the budgeted cost of work performed was $95,000. This had an SPI value of 1.00 and an SV value of 10.0. Of religion. The four weeks give us a mean SPI value, which is estimated to be 1.01, and the mean value for SV is 209.5. All the mean SPI values as well as the mean SV values were determined. for all 9 Crude Oil Storage Tank Maintenance Project in Ghana's upstream oil and gas industry until completion. This allowed us to determine which projects were finished on time, which were finished ahead of schedule, and which were behind time.

Table 1: Information of Projects Observed in this Study.

Projects	Total budget (US dollars)	Scheduled duration (days)
1	373,000.00	98
2	512,000.00	91
3	631,100.00	105
4	421,100.00	112
5	692,000.00	84
6	699,700.00	105
7	710,800.00	112
8	702,300.00	126
9	512,000.00	91

This table shows the sum total of funds allotted for each of the nine Crude Oil Storage Tank Maintenance Project as well as the number of weeks estimated for the project to be completed in the upstream oil and gas industry in Ghana.
Source: Researchers (2021)

Measuring the Schedule Performance.
Every week throughout the execution phase, the schedule performance of the projects seen in this research was evaluated. The Earned Schedule (ES) technique developed by Lipke (2003) was used to conduct this evaluation, which comprises the following:

ES (Earned Schedule) is the point in time at which the cumulative amount of Earned Value (EV) should have been attained in accordance with the schedule Lipke (2003). According to the PMBOK Guide (PMI, 2013), the project EV or ES can be obtained as the Budgeted Cost of Work Scheduled (BCWS) of the project and AT can also be obtained as the Budgeted Cost of Work Performed (BCWP),

The Schedule Performance Index (SPI) represents the time performance of construction activity as a quantitative relationship between the units of time that correspond to the ES and the units of time that correspond to the AT, as indicated in

$$SPI(t) = ES / AT \text{ --------------------------------(1)}$$

The Schedule Variance (SV) assesses time performance in absolute terms by subtracting the units of time corresponding to the AT to the units of time matching the ES, as indicated in

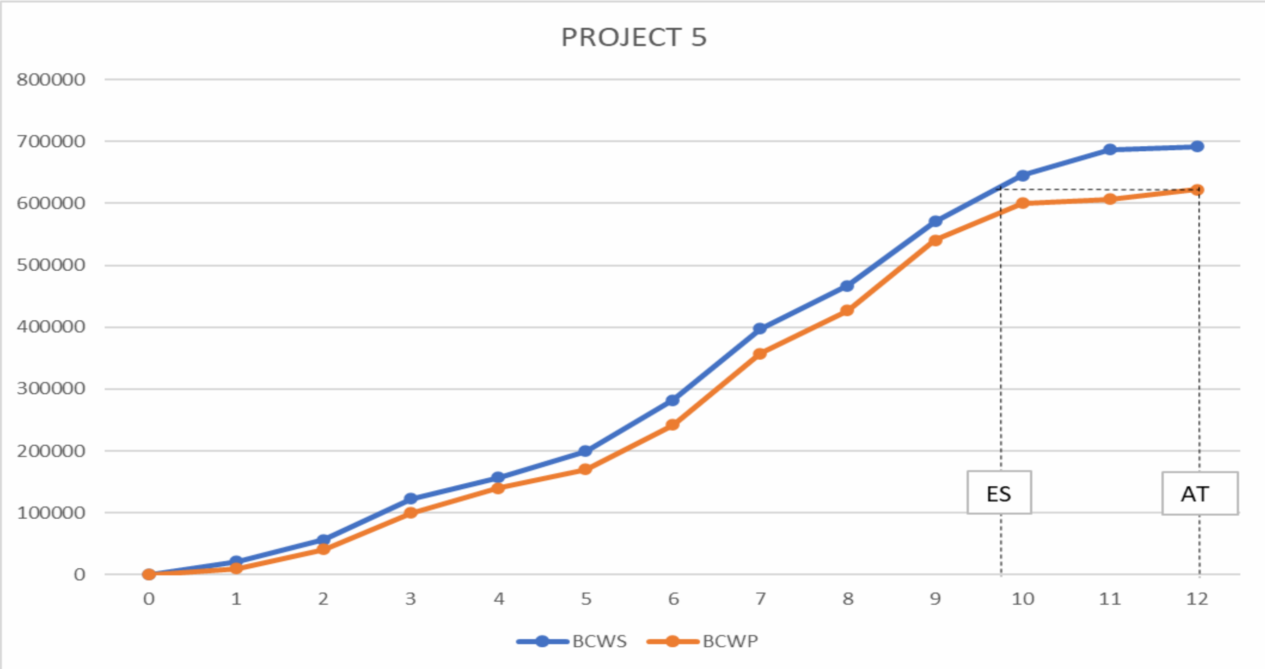
$$SV(t) = ES - AT \text{ ----------------------------------(2)}$$

Both, the SPI and the SV, are indicators that can be used for decision making regarding the need to implement actions to overcome construction delays.

Table 2: Project 5 Weekly Information Observed for Budgeted Cost of Work Scheduled and Performed, as Well as Estimated Schedule and Actual Time

BCWS	BCWP	ES	AT
0	0		
21350	10400	0.5	1
56700	40715	1.65	2
123000	100010	2.78	3
157000	140000	3.45	4
199700	170000	4.25	5
282300	242410	5.5	6
397300	357350	6.81	7
466800	426810	7.45	8
570900	541000	8.81	9
645600	600650	9.28	10
687000	607100	9.48	11
692000	622100	9.78	12

Source: Researchers, 2021



Throughout the duration of Project 5, from Week 1 to Week 12, this figure on Project 5 serves as an illustration of how the AT and ES may be computed.

Source: Researchers, 2021

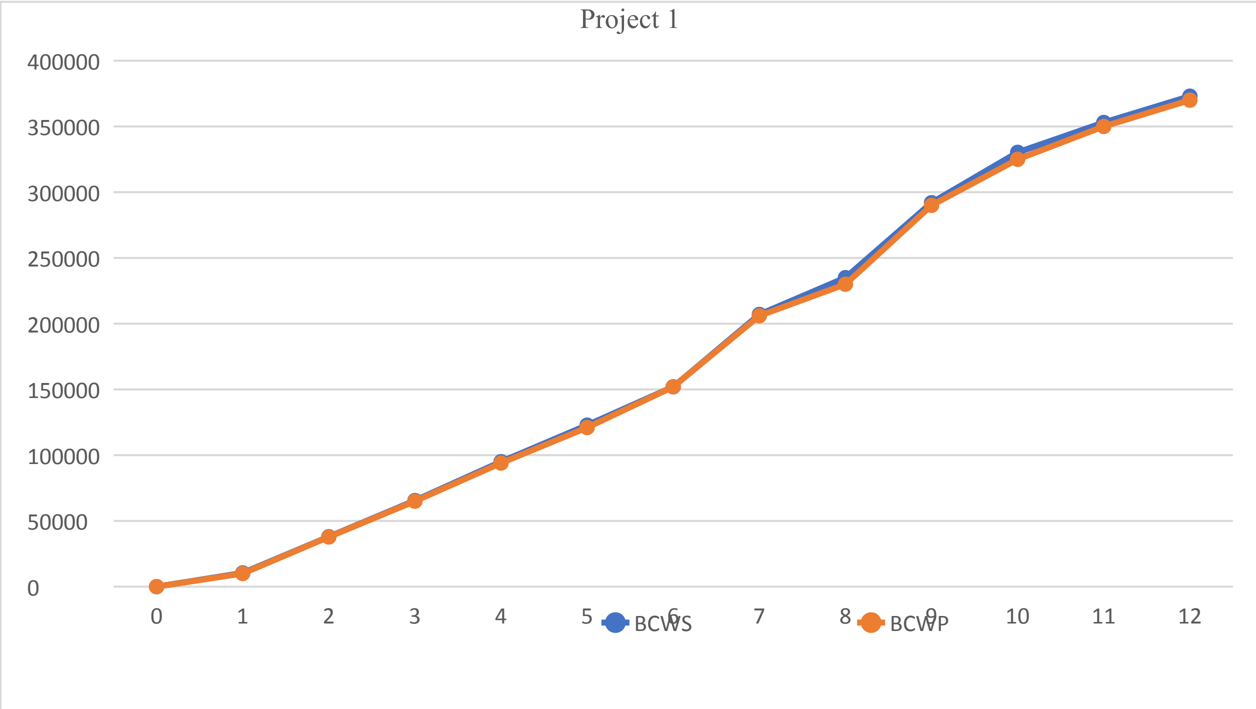
Figure 4: An illustration of how to estimate ES and AT

The estimating carried out for one of the projects evaluated in this study serves as an example of how to estimate ES. According to the BCWP curve, as shown in Figure 1, at the conclusion of week 12, the project's cumulative EV was $622100 (US dollars) (AT). The outcome of the ES was 9.78 weeks after projecting the point designated by such time (week 12) and value ($622100) on the BCWS curve. This indicated that the project work had made actual progress at the end of week 5 and would be finished by week 9.78. SPI (12) produced a result of 0.82 (i.e., the percentage of work actually done) using these values for (1), indicating that the project timetable lagged behind the projected progress by the length of time indicated. This computation was performed weekly and was spread out among the 9 projects. Table 2 below lists the outcomes of all the calculations.

Table 3: Project 1 Weekly Information Observed for Budgeted Cost of Work Scheduled and Performed, as Well as Estimated Schedule and Actual Time

WEEKS	BCWS	BCWP	ES	AT
0	0	0		
1	10450	10000	0.99	1
2	38000	37800	1.99	2
3	65500	65000	2.99	3
4	95010	94000	3.99	4
5	122810	121000	4.99	5
6	152000	152000	6	6
7	207000	206000	6.99	7
8	235000	230000	7.98	8
9	292000	290000	9	9
10	330300	325000	9.95	10
11	353000	350000	10.95	11
12	373000	370000	12	12

Source: Researchers, 2021



The graph above depicts the budgeted cost of work scheduled and performed against the project cost and time interval, from which the estimated schedule (ES) and actual time (AT) were calculated.

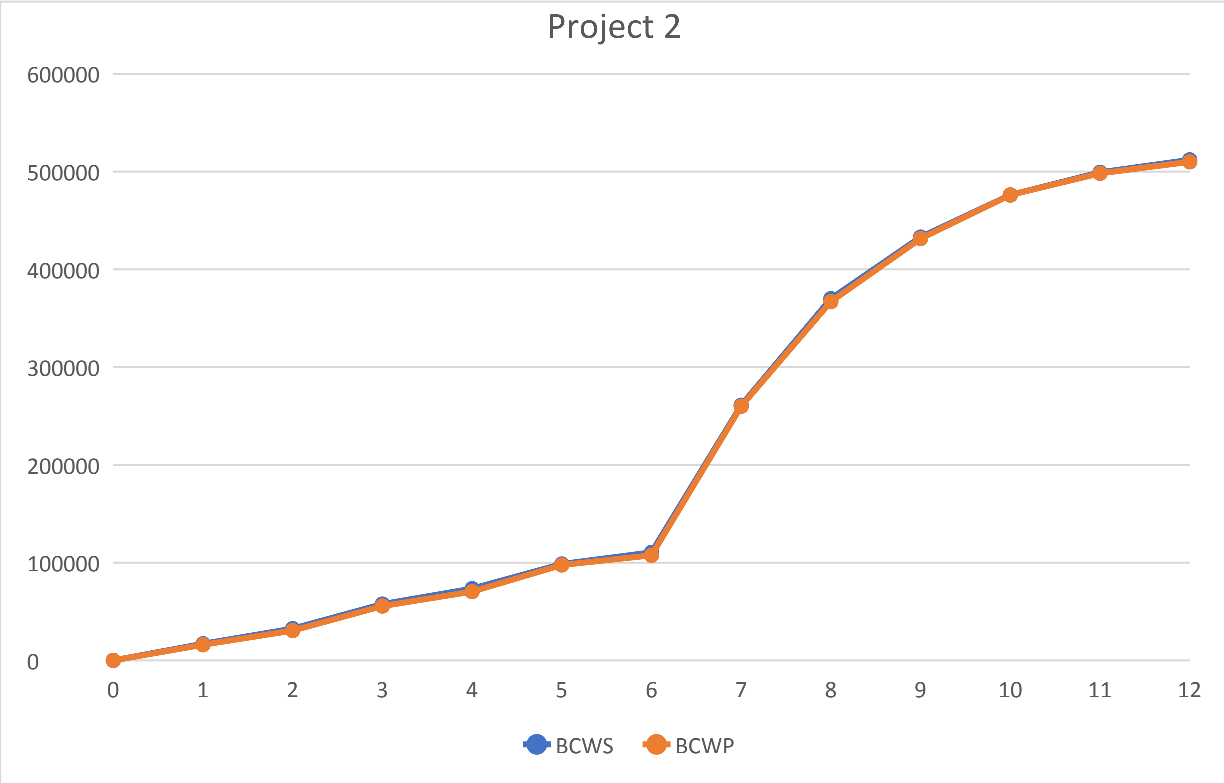
Source: Researchers, 2021

Figure 4: A graph of BCWS, BCWP, and the number of weeks allocated for project 1.

Table 4: Project 2 Weekly Information Observed for Budgeted Cost of Work Scheduled and Performed, as Well as Estimated Schedule and Actual Time

BCWS	BCWP	ES	AT
0	0		
17000	16000	0.97	1
32500	30500	1.97	2
57600	55600	2.99	3
73400	70400	3.88	4
98600	97600	5	5
110500	107500	5.99	6
261000	260000	6.99	7
370000	367000	7.99	8
433000	431500	9	9
476100	476100	10	10
499200	498200	10.99	11
512000	510000	12	12

Source: Researchers, 2021



The budgeted cost of the planned and completed work is shown in the graph above in relation to the project cost and time interval for project 2, from which the estimated schedule (ES) and actual time (AT) were derived.

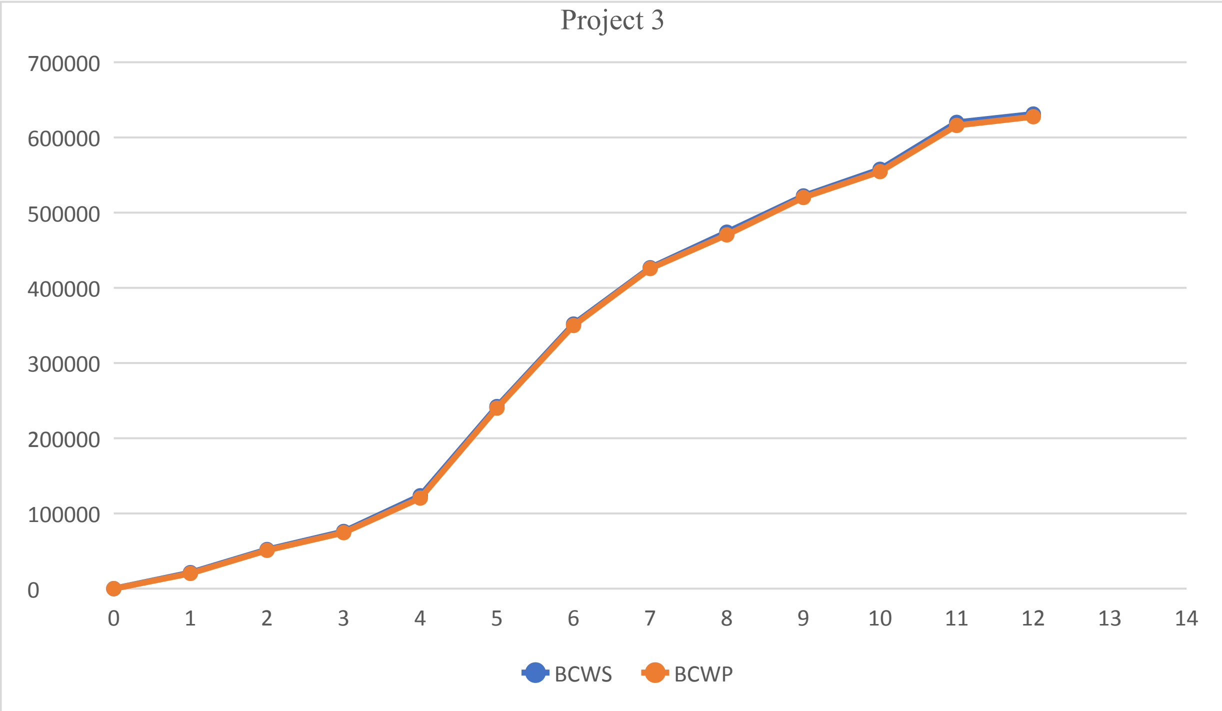
Source: Researchers, 2021

Figure 5: A graph depicting the weeks allotted for Project 2, the BCWS, and the BCWP

Table 5: Weekly Project 3 Information Observed for Estimated Schedule and Actual Time, as Well As Budgeted Cost of Work Scheduled and Performed

BCWS	BCWP	ES	AT
0	0		
21300	20300	0.99	1
52000	51000	1.98	2
76000	74500	2.98	3
123500	120500	3.98	4
242100	240100	4.98	5
351800	350000	5.99	6
426700	425700	6.98	7
474000	470500	7.99	8
522200	520200	8.88	9
557600	554600	9.87	10
620000	616000	10.96	11
631100	627600	11.95	12

Source: Researchers, 2021



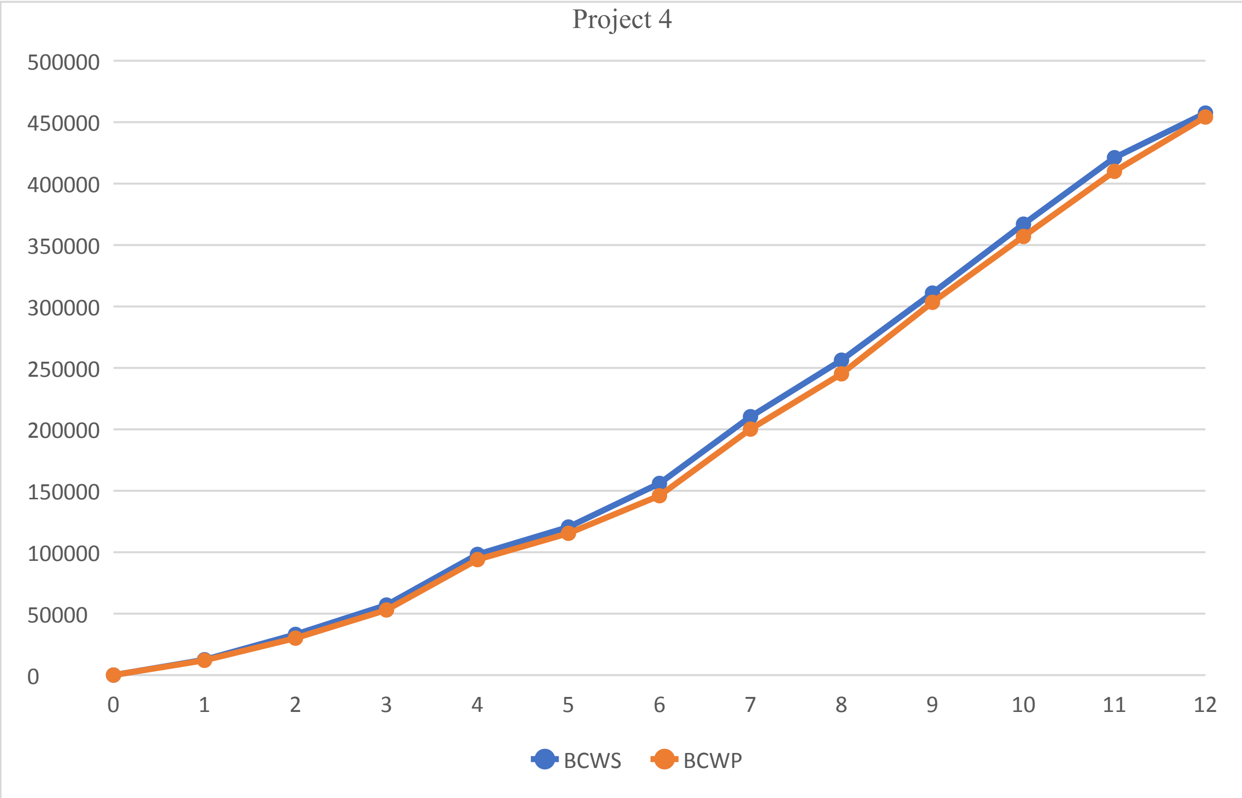
The budgeted cost of the planned and completed work is shown in the graph above in relation to project cost and time interval, from which the projected schedule (ES) and actual time (AT) were derived. Project 3 was finished on time, according to the outcome.

Source: Researchers, 2021

Figure 6: A chart depicting the number of weeks allotted to projects 3, BCWS, and BCWP.

Table 6: Project 4 Weekly Information Observed for Budgeted Cost of Work Scheduled and Performed, as Well as Estimated Schedule and Actual Time

BCWS	BCWP	ES	AT
0	0		
12,500	12,000	0.99	1
33,100	30,050	1.99	2
57,000	53,000	2.91	3
98,200	94,000	3.98	4
120,500	115,400	4.99	5
156,000	146,000	5.94	6
210,300	200,200	6.91	7
256,300	245,200	7.89	8
310,900	303,400	8.98	9
367,000	357,000	9.93	10
421,100	410,000	10.92	11
457,400	454,200	11.97	12



The budgeted cost of the planned and completed work is shown in the graph above in relation to project cost and time interval, from which the projected schedule (ES) and actual time (AT) were derived. Project 4 was finished on time, according to the outcome.

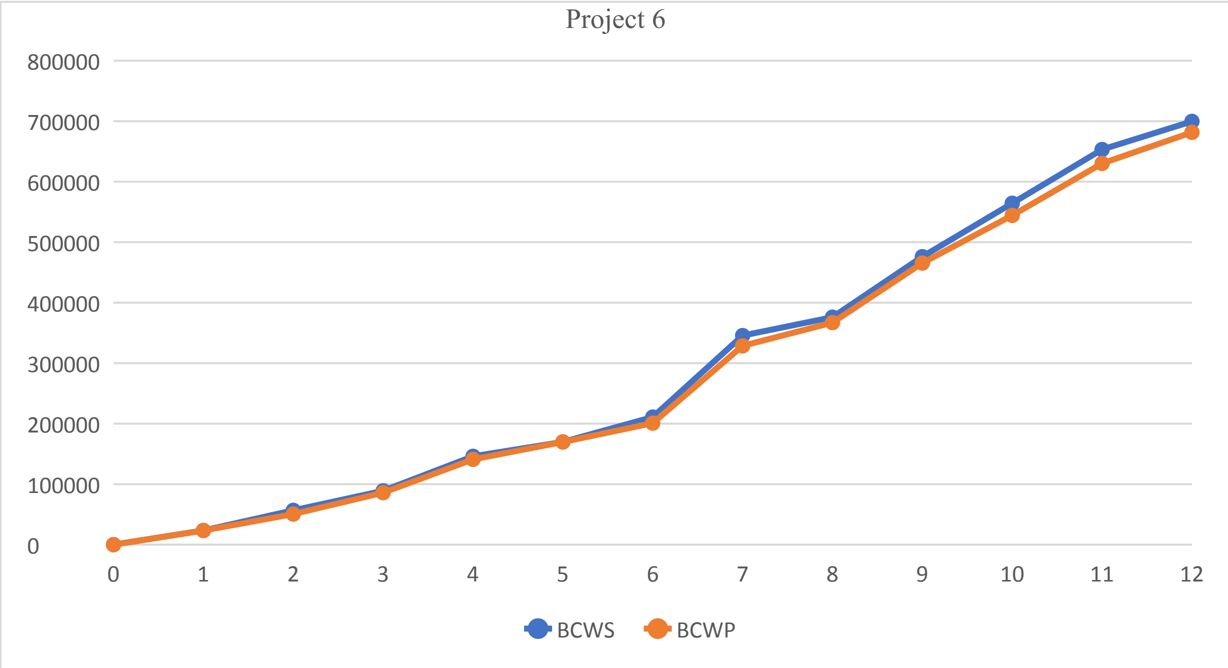
Source: Researchers, 2021

Figure 7: The number of weeks assigned to Project 4, BCWS, and BCWP is shown in this chart.

Table 7: Project 6 Weekly Information Observed for Budgeted Cost of Work Scheduled and Performed, as Well as Estimated Schedule and Actual Time

BCWS	BCWP	ES	AT
0	0		
23,450	23,300	0.99	1
56,700	50,500	1.96	2
89,000	85,900	2.99	3
146,000	140,950	3.98	4
169,800	169,700	4.98	5
210,900	200,850	5.99	6
345,600	328,600	6.91	7
376,000	367,000	7.98	8
476,000	465,500	8.91	9
564,300	544,250	9.93	10
653,200	630,150	10.91	11
699,700	681,600	11.89	12

Source: Researchers, 2021



The budgeted cost of the planned and completed work is shown in the graph above in relation to project cost and time interval, from which the projected schedule (ES) and actual time (AT) were derived. Project 6 was finished on time, according to the outcome.

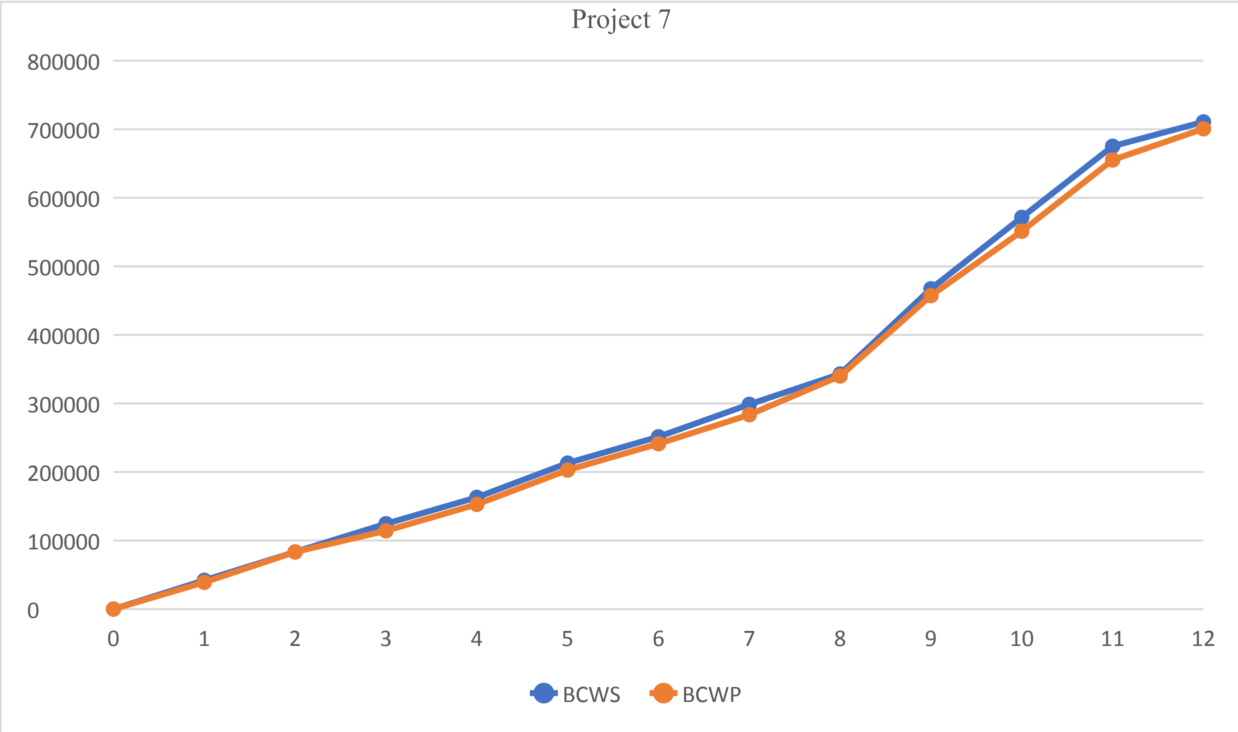
Source: Researchers, 2021

Figure 8: A graph of the weeks assigned to project 6, the BCWS, and the BCWP.

Table 8: Project 7 Weekly Information Observed for Budgeted Cost of Work Scheduled and Performed, as Well as Estimated Schedule and Actual Time

BCWS	BCWP	ES	AT
0	0		
42,000	39,000	0.99	1
83,400	83,300	1.99	2
124,500	114,200	2.93	3
163,000	152,700	3.95	4
213,000	202,800	4.94	5
251,400	241,200	5.95	6
298,700	283,500	6.95	7
343,000	340,000	7.99	8
467,400	457,300	8.98	9
571,500	551,250	9.95	10
675,300	655,250	10.93	11
710,800	700,700	11.89	12

Source: Researchers, 2021



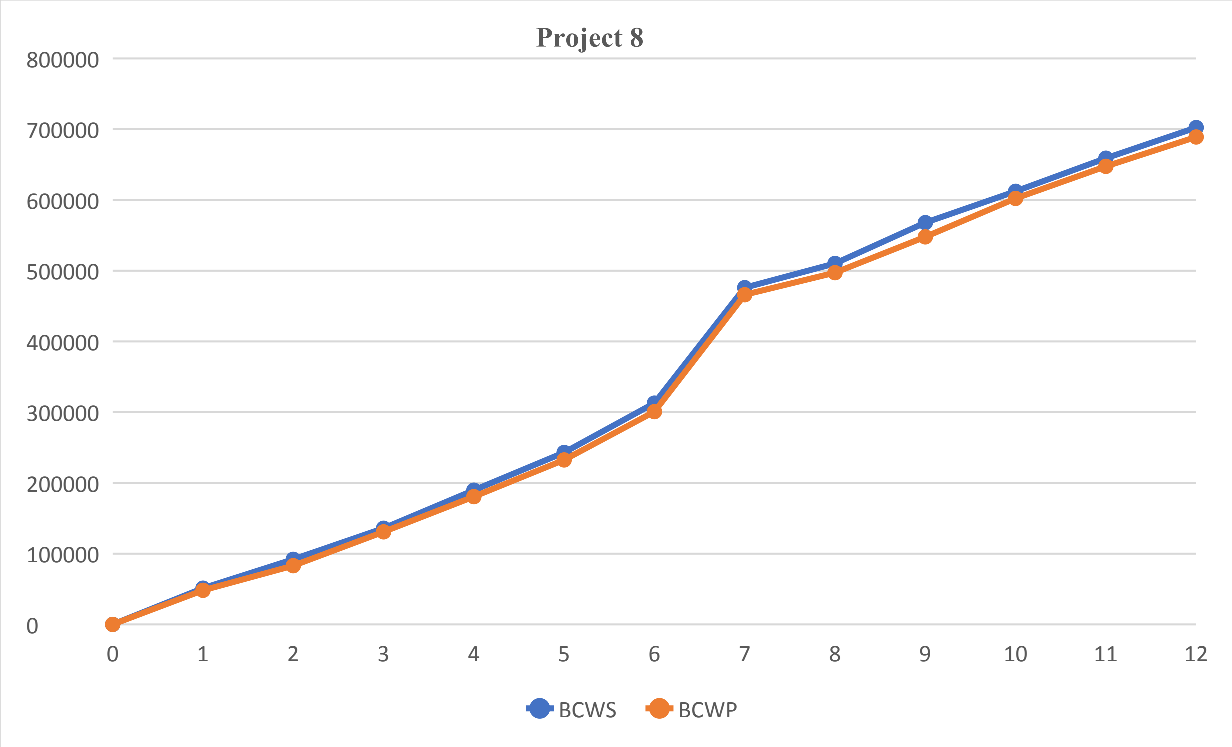
The budgeted cost of the planned and completed work is shown in the graph above in relation to project cost and time interval, from which the projected schedule (ES) and actual time (AT) were derived. Project 7 was finished on time, according to the outcome.

Source: Researchers, 2021

Figure 9: A graph of BCWS, BCWP, and the number of weeks allocated for project 7.

Table 9: Project 8 Weekly Information Observed for Budgeted Cost of Work Scheduled and Performed, as Well as Estimated Schedule and Actual Time

BCWS	BCWP	ES	AT
0	0		
51,200	48,200	0.99	1
92,000	83,000	1.98	2
135,900	130,850	2.97	3
189,700	180,600	3.96	4
243,000	232,500	4.97	5
312,800	300,750	5.97	6
476,000	466,000	6.99	7
510,200	497,200	7.97	8
567,900	547,800	8.78	9
612,200	602,150	9.95	10
659,000	647,500	10.99	11
702,300	689,000	11.98	12



The budgeted cost of the planned and completed work is shown in the graph above in relation to project cost and time interval, from which the projected schedule (ES) and actual time (AT) were derived. Project 8 was finished on time, according to the outcome.

Source: Researchers, 2021

Figure 10: An illustration of the BCWS, BCWP, and the weeks allotted for Project 8 on a graph

Table 10: Project 9 Weekly Information Observed for Budgeted Cost of Work Scheduled and Performed, as Well as Estimated Schedule and Actual Time

BCWS	BCWP	ES	AT
0	0		
17,000	15,900	0.99	1
32,500	27,400	1.99	2
57,600	48,500	2.98	3
73,400	67,350	3.97	4
98,600	96,000	4.99	5
110,500	101,000	5.99	6
261,000	250,500	6.99	7
370,000	365,000	7.98	8
433,000	412,000	8.98	9
476,100	466,000	9.91	10
499,200	490,100	10.89	11
512,000	501,000	11.89	12

Source: Researchers, 2021

The budgeted cost of the planned and completed work is shown in the graph above in relation to project cost and time interval, from which the projected schedule (ES) and actual time (AT) were derived. Project 9 was finished on time, according to the outcome.

Source: Researchers, 2021

Figure 11: A graph of BCWS, BCWP, and the number of weeks allocated for project 9.

Table 11: Results of the Schedule Performance Indexes in the Observed Projects

	Projects								
Weeks	1	2	3	4	5	6	7	8	9
1	1.0	1.0	1.0	1.0	0.5	1.0	1.0	1.0	1.0
2	1.0	1.0	1.0	1.0	0.8	1.0	1.0	1.0	1.0
3	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
4	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
5	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
6	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
8	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
11	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
12	1.0	1.0	1.0	1.0	0.8	1.0	1.0	1.0	1.0

This table shows the performances of each of the nine Crude Oil Storage Tank Maintenance Project observed on a weekly basis (i.e., from week 1 to week 12) using the schedule performance index in the upstream oil and gas industry in Ghana.

Source: Researchers (2021)

Table 12: Mean SPI values obtained for different periods of time.

Projects	Performance at project completion	4th Week	8th Week	12th Week
1	On-Time	1.0	1.0	1.0
2	On-Time	1.0	1.0	1.0
3	On-Time	1.0	1.0	1.0
4	On-Time	1.0	1.0	1.0
5	Delayed	0.8	0.8	0.9

6	On-Time	1.0	1.0	1.0
7	On-Time	1.0	1.0	1.0
8	On-Time	1.0	1.0	1.0
9	On-Time	1.0	1.0	1.0

This table is showing the mean schedule performance indexes for every three weeks on each of the projects (i.e., from week 1 to week 12), which indicate which projects were completed on time, ahead of schedule, or delayed for all the nine *Crude Oil Storage Tank Maintenance Project* observed in Ghana's upstream oil and gas industry.

Source: Researchers (2021)

Results of Schedule Performance Index.

The weekly SPI acquired for each of the projects tracked in this investigation is displayed in Table 2. The details in Table 3 also make clear which projects (Projects 1, 2, 3, 4, 6, 7, 8, and 9) were finished on time. It is significant to note that, as previously mentioned, one of the projects (Project 5) has been delayed. Additionally, Table 3 provides the mean SPI values that were calculated by averaging the SPI values over the course of the project, which are variable for each project as shown in Table 2, from the first week through the end of the fourth, eighth, and twelfth week. For Project 1, the SPI values of the first (1.0), second (1.0), third (1.0), and fourth (1.0) weeks were averaged to produce the mean SPI value until the conclusion of the fourth week. This resulted in a mean SPI value of 1.0 for Project 1 (as seen in Table 3). However, for this part of the analysis, the agreement was to conclude that SPI > 1 means the project finished ahead of schedule, SPI < 1 means the project finished behind schedule, and SPI = 1 means the project finished on time.

Table 13: Results of the Schedule Variance in the Observed Projects

	Projects								
Weeks	1	2	3	4	5	6	7	8	9
1	0.0	0.0	0.0	0.0	-0.5	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	-0.1	-0.2	0.0	-0.1	0.0	0.0
4	0.0	-0.1	0.0	0.0	-0.6	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	-0.8	0.0	-0.1	0.0	0.0
6	0.0	0.0	0.0	-0.1	-0.5	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	-0.1	-0.2	-0.1	0.0	0.0	0.0
8	0.0	0.0	0.0	-0.1	-0.6	0.0	0.0	0.0	0.0
9	0.0	0.0	-0.1	0.0	-0.2	-0.1	0.0	-0.2	0.0
10	-0.1	0.0	-0.1	-0.1	-0.7	-0.1	-0.1	-0.1	-0.1
11	-0.1	0.0	0.0	-0.1	-1.5	-0.1	-0.1	0.0	-0.1
12	0.0	0.0	-0.1	0.0	-2.2	-0.1	-0.1	0.0	-0.1

This table shows the performances of each of the nine Crude Oil Storage Tank Maintenance Project observed on a weekly basis (i.e., from week 1 to week 18) using the schedule variance in Ghana's upstream oil and gas industry.

Source: Researchers (2021)

Table 14: Mean SV values obtained for different periods of time (variance in number of weeks)

Projects	Performance at project completion	4th Week	8th Week	12th Week
1	On-Time	0.0	0.0	0.0
2	On-Time	0.0	0.0	0.0
3	On-Time	0.0	0.0	0.0
4	On-Time	0.0	0.0	0.0
5	Delayed	-0.4	-0.5	-0.7
6	On-Time	0.0	0.0	0.0
7	On-Time	0.0	0.0	0.0
8	On-Time	0.0	0.0	0.0
9	On-Time	0.0	0.0	0.0

This table shows the mean schedule variances for every three weeks on each of the projects (i.e., from week 1 to week 18), giving an indication of which projects were completed on time, ahead of schedule, or delayed for all the nine Crude Oil Storage Tank Maintenance Project observed in Ghana's upstream oil and gas industry.

Source: Researchers (2021)

Results of Schedule Variance

The SV values were obtained for each week of the project's phases. Table 4 includes the weekly SV values, makes clear which projects were completed according to the original schedule, and indicates which projects finished ahead of schedule and which projects were delayed. These SV results depict the number of weeks the project was ahead (i.e., the result was positive) or behind (i.e., the result was negative) of the original schedule (i.e., the budgeted cost of work scheduled). The mean SV values were determined by averaging the SV values from the first week to the conclusion of the fourth, eighth, and twelfth week of the project, according to the examination of the SPI data. Table 4.13 includes these results. For instance, to obtain the mean SV value until the end of the fourth week of Project 1, the SV values (see Table 5) of the first (0.0), second (0.0), third (0.0), and fourth (0.0) weeks were averaged, resulting in a mean SV value of 0.0.

For this part of the analysis, the agreement was to conclude that SV > 0 means this is a positive and indicates the project finished ahead of schedule, SV < 0 means this is a negative and indicates the project finished behind schedule, and SV = 0 means the project finished on time. It is clear from the results for schedule performance and variance that were obtained above that project performance in Ghana's upstream oil and gas industry is very good, despite the fact that one of the projects (Project 5) experienced some delays that the analysis determined were not very serious.

Ranking of Companies based on Schedule Performance Indices

Calculating the schedule performance index allows the best PI to establish a baseline and is one of the simplest ways to determine how well a project is performing with respect to the industry. According to SPI, the example projects are arranged in the following table in order of performance.

Table 15: Ranking of Upstream Oil and Gas Projects Based on Averaged Schedule Performance Indexes

PROJECT	RANK	AVERAGE SPI
1	1	0.996974
2	4	0.993139
3	3	0.993702
4	8	0.991033
5	9	0.864054
6	6	0.992191
7	7	0.991474
8	5	0.992650
9	2	0.994404

This table shows the performances by rating the nine Crude Oil Storage Tank Maintenance Project in Ghana's upstream oil and gas sector according to the project that performed best even though they were all finished on time using the schedule performance index.

Source: Researcher (2021)

Since every project was accomplished and completed on time, this proves that every project was completed successfully. Although all of the projects were completed on time, with the exception of Project 5, which had an average SPI of 0.992650 and was classified as the last, it is vital for us to comprehend that some of the projects came to an end before the others. For instance, the order of performance of the various projects according to their time of completion are 1, 9, 3, 2, 8, 5, 4, 7, and 6.

V. Discussion

The findings showed that eight of the 9 projects were finished on time, and one was delayed. The results obtained are consistent with the findings according to Badgujar et al. (2016) that using schedule performance index for project control would lead to a better estimation of activity time.

Project one, which has an SPI of 0.996974, is ranked first according to the table above, whereas project two, which has an SPI of 0.993139, is ranked fourth. Project Three's SPI of 0.993702 ranked it third as well. Project Four was ranked eighth with an SPI of 0.991033. Project Five was ranked ninth overall with an SPI of 0.864054. Project Six's SPI of 0.992191 put it in sixth place. Project Seven's SPI of 0.991474 ranked it seventh. The SPI for Project 8 was 0.992650, placing it in the fifth position. Project 9 was the last project to be completed; it came in second and had an SPI of 0.994404. Notably, projects with lower overall budgets outperformed those with greater total budgets. This may be because projects with bigger overall expenditures may have some difficulties controlling project deadlines since there will be many objectives to be fulfilled in terms of the work breakdown structure, which may employ a large number of people, and dealing with such individuals could be a little challenging.

VI. Conclusion

The purpose of this research was to learn about the performance of projects in Ghana's upstream oil and gas industries. It was realized that the majority of projects are completed on time, but one project is delayed. To put it briefly: This study revealed that some projects, such as those with the numbers 5, 4, 7, and 6, fared worse than those with the numbers 1, 9, 3, 2, and 8, even though all but project 5 were completed on time. Since the upstream oil and gas industry is driven by projects, it is therefore important that management and policymakers pay close attention to project management. This work serves as a warning to management that failing to continuously train staff in project management in order to upgrade their skills may have a negative impact on various upstream oil and gas companies in Ghana, ultimately affecting the Ghanaian economy.

There are some limitations to this study, but they present fascinating areas for future investigation. Because we only included employees from the Ghanaian upstream oil and gas sector working in the Jubilee Field, Western Region, we may not be able to fully generalize our results. Despite these limitations, future researchers should take our study's methods and results into account. Future scholars could think about looking at the project-time performance in the upstream oil and gas business of two or more developing African nations.

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