Project Performance Analysis of Document Digitalization Projects (A Case Study)

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Abstract

PT. EDS is a company engaged in archives management and provides technology products. Archives arrangement and digitalization project of PT. PP in 2020 conducted by PT. EDS has many disruptions due to COVID-19 pandemic such as holidays and activity restrictions. This resulted in the project implementation which was planned to be completed in the 18th week (October 2020), to be unfinished (project completion progress at 76.62%). The purpose of this study was to determine the performance of the project using the Earned Value analysis method. The data collected were project details, project planning S curves, budget plan, progress and costs project weekly reports. Then, the data is processed using the Earned Value method which is supported by Microsoft Project software to gets Status Report which is then analyzed for performance (time and cost) by describing the problems that arose during the research. The analysis result show that the actual implementation of the project is not in accordance with the project planning. The project was 5 weeks late compared to the plan, so the project costs was over budget (CPI of 0.77). The lowest CPI and SPI was in the 8th week and 13th week, while the highest CPI and SPI was in the 2nd week and 1st week. The solution to overcome similar problems in the future is to increase work effectiveness by using changing workday programs for low CPI problems and doing overtime or increasing resources such as workspace, laptop, scanner, and operator for low SPI problems.

Keywords
Archive Project, Digitalization, Earned Value, Project Management, Time and Cost Performance.

1. Introduction
According to (Abidin and Husin, 2018) digitalization of archives has been requesting frequently by many agencies or organization in recent decade due to advancement of digital technology. This project of achive management is as important as e-commerce, green building project, and many similar projects that aimed to be environmental friendly. In general, agencies or organizations that require archive management services are government agencies or private companies. PT. EDS is a company engaged in archive management and provides technology products. PT. EDS provides various solutions for the archive management needs of government and private organizations to create a modern administrative system that is implemented and supported by the latest technology. PT. EDS is used as the object of research because PT. EDS is an archive management service company that is growing and has a good reputation in several government agencies and state-owned companies.

The implementation of the archive management service project is a series of activities that depend on each other, so it needs management, scheduling, and project control (project management) for the project to run and finish properly. Project management includes time, cost, and quality management so that projects can be carried out effectively and efficiently. If project management is not handled properly, various problems will arise such as delays in project

completion, quality deviations, bloated financing, waste of resources and so on which are very detrimental to project implementers (Czemplik, 2014; Kim et al.2015; Almeida et al., 2021).

One of the stages in project management is project control. Project control is carried out so that the project can be carried out properly and completed before the deadline. One of the stages in controlling the project is performance analysis of the project implementation to measure the conformity of the implementation with the project plan (Bryde and Joby, 2018; Ibrahim et al., 2019). The project that will be discussed this time is "Performance Analysis of Archives Arrangement and Digitalization Project of PT. PP Year 2020 Conducted By PT. EDS". The performance of this project was analyzed because in its implementation, the project received many disturbances or interruptions such as holidays and activity restrictions because the project implementation site imposed activity restrictions and lockdowns due to the COVID-19 pandemic. This resulted in the progress of project implementation, which was planned to be completed in the 18th week (October 2020), to be unfinished (actual project completion progress was 76.62%). Therefore, it is necessary to analyze the project performance to find out the cause of the deviation so that this can be avoided in the future. In measuring project performance, there are several methods that can be used. One of them is the Earned Value method. The reason the use of Earned Value method in this study is because this method can measure the performance of projects, analysis of variance, as well as the performance index of the element in an integrated time and expense, where it can not be done when using other methods such as analysis of variance method and the curve S method. Earned Value method is a project control method used to measure project performance with an integrated cost and time element (De Marco and Narbaev, 2013; Barrientos-Orellana et al. 2022; Zahoor et al., 2022; Khesal et al.,2019). Therefore, thi study will evaluate PT. EDS performance project using EVM

2. Literature Review

2.1. Archives Arrangement and Digitalization

In Indonesian Law No. 43 of 2009 about Archives it is stated that "archives are recordings of activities or events in various forms and media in accordance with the development of information and communication technology made and received by state institutions, local government institutions, educational institutions, companies, political organizations, community organizations, and individuals in the implementation of community life, nation and state". From some of the definitions above, it can be seen that the archive acts as a source of information and a monitoring tool needed by every organization in its operation . Archives assist organizations in carrying out planning, development, policy formulation , analysis, decision making, reporting, accountability, assessment and control activities as precisely as possible (Ojo et al., 2022).

According to (Abidin and Husin, 2018) archive arrangement is the arrangement of files/records based on the classification pattern code which is equipped with an index or cross-instruction. Archive or file arrangement is a set of activities to organize files in order to form a set of files according to the type and its use for the benefit of the work. Preparing the facilities and placing files in the storage area is included in the filing activities. Based on the opinions of the experts above, it can be concluded that archive arrangement is an activity of organizing, compiling, and organizing archives based on the type and classification pattern assisted by indexes or cross instructions, then placing them in a predetermined place. Remembering archives have an important role for the survival of the organization, the safety of archives storage is very important. Arranging and storage archives must be done by systematically so that the archive can be recovered quickly and appropriately.

Digitalization is one of the activities in the archives which has a role as a collection and management of digital resources to be conveyed to the users concerned. According to Lee, digitalization is a conversion process from analog or physical form or form to digital form. According to Atmoko, digitalization is the process of transferring analog information media to digital media media. This is often referred as “Conversion” or “Capture” which is basically a synonym for digitalization. The purpose of digitalization is as an effort to preserve archives and also maintain accessibility so that it can provide the widest possible access for the community, besides that with the digitalization of archives it can be used for research, documentation and publication purposes. Another opinion reveals that archive digitalization is expected to be an alternative to save archives in the long term. There are four purpose of document digitalization, as follows : 1. Save document information; 2. Rescuing physical document; 3. Overcoming the constraints of space limitations; 4. Speed up the flow of information (Abidin and Husin, 2018; Gowan et al., 2006). PT. EDS Digitalization process will be given as depicted by Figure 1 :

Figure 1. Archives Arrangement and Digitalization Process (Source : Proceed Data*)*

2.2. Project Management and Performance

Project management is a collection of activities to plan, organize, lead and control company resources in order to achieve predetermined short-term goals. Another view reveals that project management is the application of knowledge, expertise and skills, as well as the best technical methods and limited resources, to achieve predetermined goals and objectives to obtain the best results in terms of cost performance, quality, time, and work safety. The purpose of project management is to be able to manage management functions to obtain the best results in accordance with existing and predetermined requirements, and to manage resources as efficiently and effectively as possible. Project performance is a comparison between the results of actual work with work estimates in the employment contract agreed upon by the parties. In reality, the project could take place ahead of schedule as expected. However, the costs incurred may exceed the predetermined budget. This can result in the project not being completed in its entirety due to lack of funds (Khesal et al.,2019; Ojo et al., 2022; Chen et al., 2016).

2.3. Project Earned Value

The Earned Value method is a method of measuring project performance that calculates the cost according to the budget according to the work that has been complete. This method measures the amount of work units that have been completed at a time based on the amount of the budget provided for the work , when viewed from the amount of work completed. The relationship between the actual achievement and the amount of the budget that has been issued can be known by this calculation. With this method, the performance of the ongoing project can be known, thus corrective steps can be taken if there is a deviation from the initial project plan. In the analysis of project performance with Earned Value method, the information presented in the form of quantitative indicators. This indicator informs the progress of work and project costs within a certain period of time. These indicators are as follows:

- *Planned Value (PV)* : This indicator is a baseline for the planned time stages of the value of the scheduled work. In other words, an approved cost estimate of a scheduled resource in a time-stepped cumulative baseline [The old acronym for this value was BCWS - budgeted cost of work scheduled].
- *Earned Value (EV)* : The earned score (EV) for a task is simply the percentage of completion times the original budget. In other words, EV is the percentage of the initial budget earned from the work actually completed. [BCWP — budgeted cost for work performed].
- *Actual Cost (AC)* : AC is the actual cost of the job performed. In other words, the amount of costs incurred to complete the work. [ACWP — actual cost of work done].

From the previous three indicators, analysis of variance can be carried out to find out to what extent the actual results are from what is predicted as can be seen in Figure 2. The analysis of variance consists of :

- *Cost Variance (CV)*. Cost Variance (CV) is a value that displays the difference between budgeted costs and actual costs for the work that has been done. A positive CV value indicates that the value of the work completed is greater than the costs incurred to do the work. Conversely, a negative value indicates that the value of the work completed is lower than the cost already incurred. Equation as given : CV = EV – AC.
- *Schedule Variance (SV).* Schedule Variance (SV) is a value that displays the deviation between the implementation plan schedule and the actual schedule for the work that has been done. A positive SV value indicates that more project work has been carried out than planned. Conversely, a negative value indicates that the value of the work carried out is less than planned. Equation as follows : SV = EV – PV.

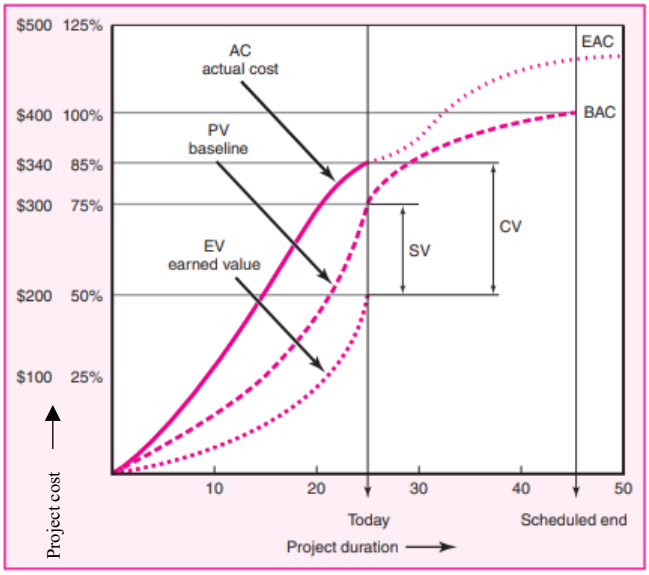

Figure 2. Cost/Schedule Graph (Gowan et al.,2006)

From the three indicators and the previous two analysis of variance, a performance index can be determined to determine the efficiency of resource use (Khesal et al., 2019; Ojo et al., 2022; Chen et al., 2016; Bryde et al., 2018). The performance index consists of :

- Cost Performance Index (CPI) is an index of cost efficiency performance that has been issued. This index can be determined by comparing the value of work completed (EV) with costs incurred in the same period (AC). With equation CPI = EV / AC. If CPI = 1 means costs according to budget/plan. Meanwhile CPI > 1 refers to lower cost/saving. Finally CPI < 1 means higher cost/wasteful
- Schedule Performance Index (SPI) is an index of time efficiency performance in completing work. This index can be known by comparing the value of the work that has been completed (EV) with the planned expenses incurred based on the work plan (PV). With equation of SPI = EV / PV. If SPI = 1 means project is on time. Then, if SPI > 1 : project is ahead of plan. And if SPI < 1 equals with project is slower than planned.

3. Methods

The research is started by early identification stage which is divided into several sub-stages, namely research design, field study, problem identification, study of literature, and research purposes. Research design determines the topic, method, and object of the research, while field study determines the location and observation time. The topics of this study is project performance analysis, the method used is the Earned Value method since this method is best fit to evaluate project performance (De Marco and Narbaev, 2013; Gowan et al., 2006; Sruthi and Aravindan, 2020), and the object of the study was the Archives Arrangement and Digitalization Project of PT. PP Year 2020 conducted by PT. EDS to determine the performance of project implementation as a work evaluation material. After all of the components of early identification stage are obtained, research continues to the next stage which is stages of data collection, data processing and data analysis. In this stage the object of study was observed until the required data are fulfilled. The data collected were Project Details, WBS, Activity Description, CPM, Budgeting Plan, Work Progress Report, Planning S Curve, and Project Expenditure Report from verified sources. Next, the data obtained is processed by the Earned Value (EV) method and supported by Microsoft Project software so that it gets a Status Report which containing the progress of implementation, Planned Value, Earned Value and Actual Cost each week. From this data, the value of Schedule Variance, Cost Variance, Schedule Performance Index, Cost Performance Index can be determined, and a performance graph can be made. Based on the data that have been obtained above, the performance of the project can be analyzed. Then, solutions that can be used to improve project work in the future can be determined. This paper closed by conclusions and suggestions. Where the conclusions answer the existing problems based on the results of data processing and analysis in a brief, concise, and clear manner. Meanwhile, suggestions are opinions that can provide a solution or benefit to the research and subsequent research (Figure 3).

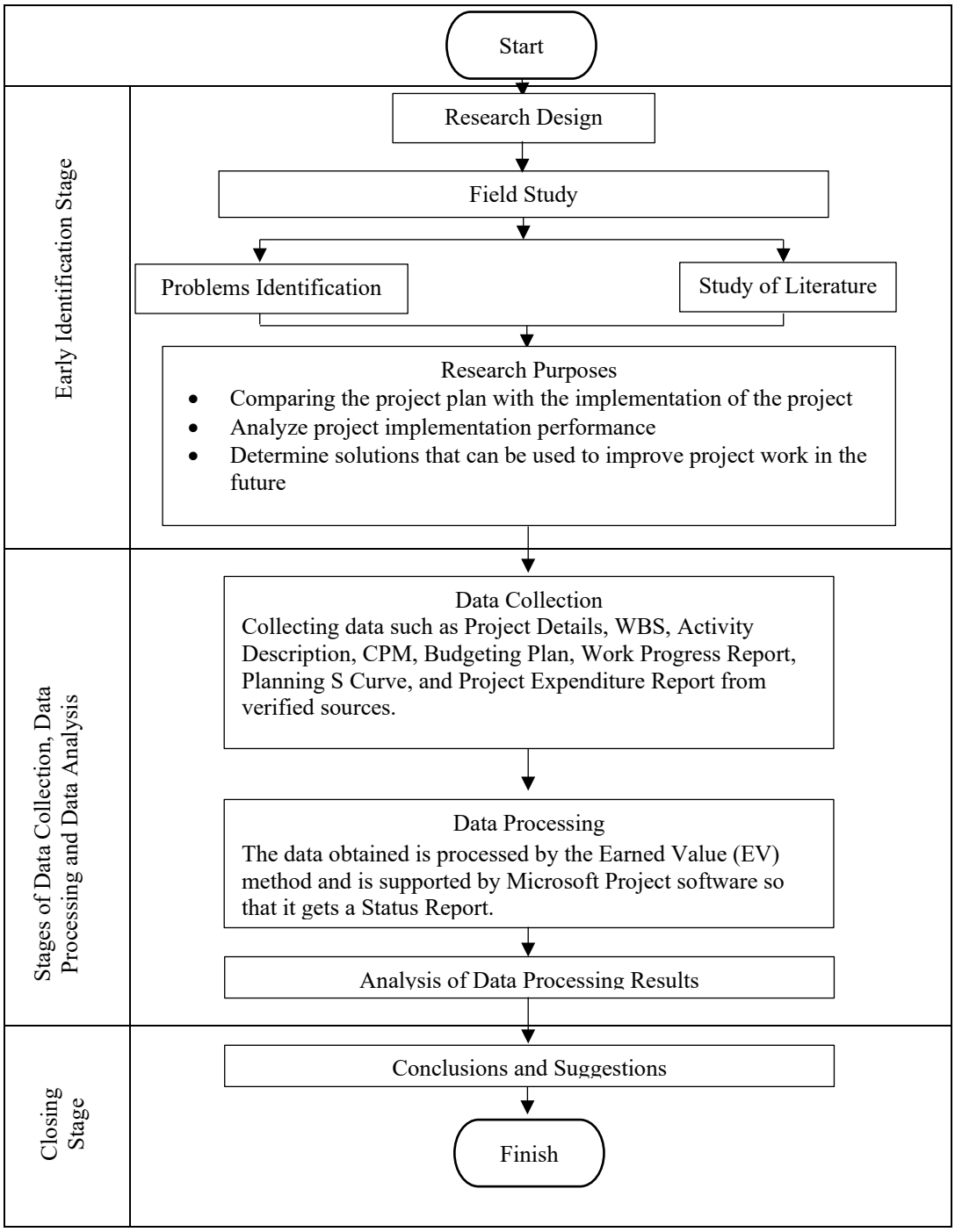

Figure 3. Research Methods Flowchart (Source: Data Proceed)

4. Data Collection

The collected data are divided into two types, which is primary data and secondary data. Primary data were collected through observations and collecting data such as project activities and conditions that occur at the project location. Besides observation, the primary data was also collected through interview which is conducted by unstructured way of question and answer by those people associated namely, Mrs. FS as Director of PT. EDS, Mrs. IY as Project Manager, and Mr. AT as Project Team Leader. Secondary data were obtained by surveys on the internet and experts

related to related topics and studying company files and project activities such as Work Agreements, work activity details, work reports, project budget plan, and financial reports.

5. Results and Discussion

5.1 Overall Project Performance Analysis

The overall performance of the implementation of the Archives Arrangement and Digitalization Project of PT. PP Year 2020 conducted by PT. EDS is analyzed from the Status Report and the discussion is seen at Table 1:

Table 1. Overall Status Report

Status Report									
Week-	*% Plan*	PV	*% Actual*	EV	AC	CV	SV	CPI	SPI
M1	0.68%	Rp1,280,000	0.92%	Rp3,160,000	Rp2,180,000	Rp980,000	Rp1,880,000	1.45	2.47
M2	3.65%	Rp6,920,000	5.48%	Rp14,449,738	Rp11,800,000	Rp2,649,738	Rp7,529,738	1.22	2.09
M3	8.92%	Rp16,916,095	10.30%	Rp22,858,157	Rp20,460,000	Rp2,398,157	Rp5,942,062	1.12	1.35
M4	16.48%	Rp31,258,624	16.19%	Rp33,291,091	Rp34,505,400	-Rp1,214,309	Rp2,032,467	0.96	1.07
M5	24.05%	Rp45,601,153	19.97%	Rp40,083,780	Rp44,165,400	-Rp4,081,620	-Rp5,517,373	0.91	0.88
M6	31.61%	Rp59,943,682	24.10%	Rp47,550,839	Rp53,825,400	-Rp6,274,561	-Rp12,392,843	0.88	0.79
M7	39.18%	Rp74,286,211	28.62%	Rp55,696,080	Rp63,485,400	-Rp7,789,320	-Rp18,590,131	0.88	0.75
M8	46.74%	Rp88,628,740	31.32%	Rp60,502,931	Rp93,205,900	-Rp32,702,969	-Rp28,125,809	0.65	0.68
M9	54.30%	Rp102,971,269	38.51%	Rp73,808,163	Rp102,865,900	-Rp29,057,738	-Rp29,163,107	0.72	0.72
M10	61.87%	Rp117,313,798	39.40%	Rp75,448,762	Rp104,475,900	-Rp29,027,138	-Rp41,865,036	0.72	0.64
M11	69.43%	Rp131,656,327	42.93%	Rp81,869,792	Rp112,525,900	-Rp30,656,108	-Rp49,786,535	0.73	0.62
M12	77.00%	Rp145,998,856	46.80%	Rp88,873,909	Rp122,185,900	-Rp33,311,991	-Rp57,124,947	0.73	0.61
M13	84.56%	Rp160,341,385	49.99%	Rp94,496,337	Rp142,755,400	-Rp48,259,063	-Rp65,845,048	0.66	0.59
M14	90.92%	Rp172,403,914	56.54%	Rp106,472,797	Rp152,415,400	-Rp45,942,603	-Rp65,931,117	0.70	0.62
M15	94.94%	Rp180,026,443	63.20%	Rp118,730,386	Rp162,075,400	-Rp43,345,014	-Rp61,296,057	0.73	0.66
M16	98.57%	Rp186,900,000	67.65%	Rp126,897,728	Rp168,515,400	-Rp41,617,672	-Rp60,002,272	0.75	0.68
M17	99.64%	Rp188,940,000	71.76%	Rp134,503,708	Rp185,516,400	-Rp51,012,692	-Rp54,436,292	0.73	0.71
M18	100.00%	Rp189,620,000	76.62%	Rp143,705,125	Rp195,176,400	-Rp51,471,275	-Rp45,914,875	0.74	0.76
M19	100.00%	Rp189,620,000	80.82%	Rp152,147,074	Rp202,816,400	-Rp50,669,326	-Rp37,472,926	0.75	0.80
M20	100.00%	Rp189,620,000	87.02%	Rp164,178,738	Rp214,276,400	-Rp50,097,662	-Rp25,441,262	0.77	0.87
M21	100.00%	Rp189,620,000	94.04%	Rp177,755,714	Rp225,736,400	-Rp47,980,686	-Rp11,864,286	0.79	0.94
M22	100.00%	Rp189,620,000	99.85%	Rp189,212,000	Rp246,264,400	-Rp57,052,400	-Rp408,000	0.77	1.00
M23	100.00%	Rp189,620,000	100.00%	Rp189,620,000	Rp246,672,400	-Rp57,052,400	Rp0	0.77	1.00

Source: Data Processing

Based on the Overall Status Report table above, it can be seen that the project was completed in the 23rd week, while the project is scheduled to be completed in the 18th week, which means there is a difference of 5 weeks. By looking at the weekly CPI and SPI in the table above, it can be seen that the project implementation did not go according to schedule starting from the 4th and 5th weeks, because the 4th and 5th week were the beginning of the decline in the CPI and SPI values becoming less from 1. The 4th week has a CPI value of 0.96 and the 5th week has a CPI value of 0.91 and an SPI of 0.88. The activity that most affected the decline in the CPI value in the 4th week was digitalization activities because only digitalization activities had a CPI value (0.30) less than 1. The activity that most affected the decline in the CPI value in the 5th week was digitalization activities because digitalization has a CPI (0.41) and SPI (0.29) value of less than 1. Digitalization activities have low performance in the 4th and 5th weeks because the progress of the work is not good since the beginning of the activity, while the costs incurred remain the same. According to source person, this is the impact of restrictions on work activities due to the COVID-19 pandemic.

Based on the Overall Status Report table above, it can be seen that the lowest CPI (the most over cost) is in the 8th week with a value of 0.65. This is because the CPI value in identification activities (0.87) and especially digitalization activities (0.28) is less than 1. This is because in this 8th week some work teams are required to tidy up the work area that will be left behind in the context of the Eid al-Adha holiday which causes a decrease in work progress and EV

value, while the company also has to pay monthly equipment rental fees that are due. Based on the Overall Status Report table above, it can be seen that the lowest SPI (most behind schedule) is in the thirteenth week with a value of 0.59. This is because the SPI value for identification activities (0.73) and especially digitalization activities (0.37) is less than 1. This is because in the 13th week there are restrictions on work activities (reduction of working hours) due to the COVID-19 pandemic. Meanwhile, it also can be seen that the highest CPI (most under cost) is in the second week with a value of 1.22. This is because in the second week, all activities went according to plan, even work preparation and identification activities were ahead of schedule and under cost (work preparation activities had an EV of Rp9,400,000 and AC of Rp7,020,000, while identification activities has an EV of IDR 4,709,738 and an AC of IDR 4,440,000). Based on the Overall Status Report table above, it can be seen that the highest SPI (most ahead of schedule) is in 1st week with a value of 2.47. This is because in the 1st week, the archive handover activity was in accordance with the plan, and even the work preparation activities which in the 1st week plan had 10% progress had been completed by 30% (Figure 4).

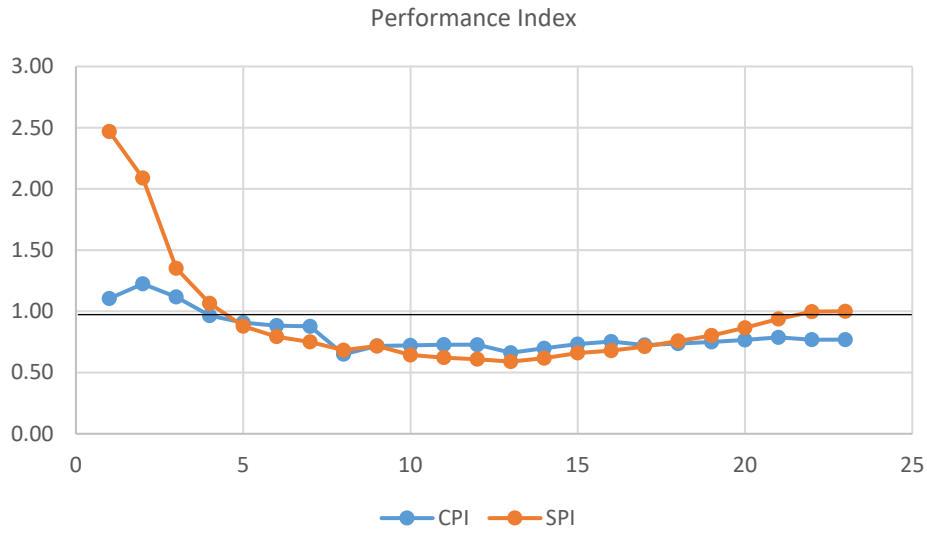

Figure 1. Graph of Weekly Performance Index of Archives Arrangement and Digitalization Project of PT. PP Year 2020 conducted by PT. EDS
Source: Data Processing

Based on the weekly performance index chart above, it can be seen that the project implementation went very well in the 1st week to the 3rd week, because the performance index was more than 1, however, it can be seen that there is a downward trend in SPI caused by increasing work complexity where it is also affected by the COVID-19 pandemic . The implementation of the project did not start according to the schedule starting from the 4th and 5th weeks, because the workforce had to change the way of working to comply with the health protocol (wearing masks, keeping a distance in a limited workspace and wearing gloves) while working which led to a decrease in performance. so that the 4th week and 5th week became the beginning of the decline in the CPI and SPI values to less than 1. From the 4th and 5th weeks, the performance index had a downward trend until the 13th week because it was hindered by several problems such as adjustments to the way working towards health protocol (keep a distance in a limited workspace and wear gloves) when working, holidays because lockdown COVID-19, as well as screening COVID-19 in turns on labor. Then starting from the 14th week until the end of the project, the SPI began to increase (upward trend), while the CPI had a flat trend because the workforce had started to get used to working in accordance with the health protocol so that weekly output could continue to increase even though it still could not meet the weekly work targets and more stable project costs. Adjusting to new work culture due to force majeur will require more time and resource (Bryde and Joby, 2007; Bryde et al., 2018; Chen et al., 2016).

5.3 Proposed Improvements

Based on the results of the analysis above, it can be seen that the main problem that causes the decline in performance is the implementation of projects that are affected by the COVID-19 pandemic. Therefore, the solution that can be

used to improve project work in the future is to make a work plan such as how to work and work targets in a more optimal pandemic condition, then provide training to workers on the work plan as a whole, then carry out control the performance of time and costs on a regular basis, and if there is a decrease in performance, the root cause of the problem is addressed as soon as possible and if this results in a delay in the work schedule, overtime may be carried out, add more human resources, or add more equipment so that the schedule does not get delayed.

To solve specific problems such as low SPI (less than 1) on this project, the first solution that can be done is to do overtime. The intended overtime work is the staff implementing activities working beyond normal working hours in order to increase work output in order to achieve work targets. Overtime can be carried out on weekdays or holidays according to the agreement between the implementer and the project manager. This inline with previous research that overtime working time with more incentives could faster work speed (Sruthi and Aravindan, 2020; Gowan et al., 2006). The second solution option is to add a work team consisting of a workspace (work desk), tools in the form of laptops and scanners, as well as HR (operators) which of course will increase project costs (laptop and scanner rental costs and operator salaries)) so that further calculations are needed regarding the amount of overtime or additional work teams needed to improve SPI optimally. To solve specific problems such as the low CPI (a value of less than 1) in this project, then the solution is to do is improve the effectiveness of work. Arranged to get right schedule of the activities of the government and the client that can reduce the effectiveness of the work such as reduced working hours and so on before the day of implementation. So, if it is judged to be very ineffective to work at that time, the experts can apply the strategy work, one of which is the change work days so as to avoid the effectiveness of the work that is not optimal.

6. Conclusion

The actual implementation of the project is not in accordance with the project planning. The project experienced a delay of 5 weeks when compared to the plan (5th to 21st weeks have SPI < 1) , this also resulted in the actual project costs exceeding the budget (CPI 0.77 and CV -Rp57,052,400) due to costs such as employee salaries, equipment rental, and so on increase because the project lasts longer than planned. Overall, the project has an unsatisfactory performance when compared to the plan because the project has been delayed for 5 weeks and has a CPI value of 0.77 (over cost). The lowest CPI (the most over cost) is in the 8th week with a value of 0.65 and the lowest SPI (the most behind schedule) is in the 13th week with a value of 0.59, while the highest CPI (the most under cost) is in the 2nd week. with a value of 1.22 and the highest SPI (most ahead of schedule) was in the 1st week with a value of 2.47. The solution that can be used to improve project work in the future is to increase work effectiveness , for example by implementing a workday change program at a time that is considered not optimal for low CPI problems (worth less than 1) and doing overtime (increasing working hours) or adding a team workspace consisting of a workspace (work desk), tools in the form of a laptop and scanner, as well as HR (operators) for low SPI problems (worth less than 1).

This paper can be used as an evaluation to the company for project archives arrangement and digitalization in the future so it could run according to plan and have a good performance. In this paper there are no optimization regarding the amount of overtime or additional work teams needed to improve the SPI value, waste analysis, and have not taken into account the quality aspect, so this final project can be developed again regarding further amount calculations of overtime or additional work teams needed to improve the SPI value optimally, analyze the waste of archives arrangement and digitalization project in the pandemic era and other related topics.

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