

THE RISK MANAGEMENT INFORMATION SYSTEM USED EXPECTED MONETARY VALUE METHOD IN PT. CHIWA INDONESIA

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ABSTRACT

PT. Chiwa Indonesia is a company engaged in contracting services and general suppliers. In the implementation of projects, there is often a problem, namely the occurrence of additional costs due to the absence of a thorough cost risk management, because so far if there is a risk there is no clear cost risk mitigation planning for handling these risks. so that there are difficulties in determining the costs when risks arise during project work which causes project managers to have difficulty in handling risk costs. Based on the existing problems, it is necessary to develop a risk management information system at PT. Chiwa Indonesia. The aim is to help in controlling risks so that the risks that arise can be handled early by using the expected monetary value method and for the evaluation phase to be able to control the deviation of costs and time when implementing projects using the Earned Value Management (EVM) method. Based on the results of the research achieved, it was concluded that this system has helped in risk planning by being able to analyze the risks that might occur during project implementation, as well as providing information on appropriate mitigation actions along with the costs that must be used in managing risks.

Keywords: Management, Risk, Costs, Expected Monetary Value, Earned Value Management.

1. INTRODUCTION

PT Chiwa Indonesia is one of the companies engaged in the "Contractor" and "General Supplier" fields. The company was founded in 2008 as a project or work normally handled by PT. Chiwa Indonesia, namely the piping system and the piping system design, and procurement of goods. Since it was founded until now PT. Chiwa Indonesia has worked on around 180 projects, in the contractor field, 147 projects have been carried out and 33 projects in the procurement of goods. PT. Chiwa Indonesia with a lot of experience in the field of piping and procurement systems is one of the factors of companies that can be considered by private and government companies.

According to the results of an interview with Mr. Ansori as Project Manager of PT. Chiwa Indonesia explained that so far in the execution of a project some of them did not go as planned, due to the not yet created a careful planning of risks in terms of handling and costs incurred, therefore some of the project work experienced obstacles during the project. As in the Hydrant Pipe Installation Project activities that began on 21 February to 11 April 2018 there were obstacles in the work of 3inc Pipe Installation and 2inc Pipe Installation due to damage to work support, resulting in additional costs which were initially Rp.215.xxx.xxx but in implementation costs incurred more than planned at Rp.217.xxx.xxx. If there is an increase in the cost budget when implementing the project, the company uses cash to increase the company's cost budget to increase the project cost budget. Increasing the project cost budget using cash can cause losses for the company. The use of company cash, in the amount of Rp. 1.9x.xxx to overcome the risk, is carried out by adding costs. This control will be detrimental to the company if a similar risk is repeated.

Based on the problems that have been described, it is needed then we need a project risk management information system at PT. Chiwa Indonesia to be able to analyze the risks that might occur during project implementation, namely the need for risk planning, identification of risks and handling of risks as well as an evaluation of risks that could have an impact on the swelling in the cost of project construction. For risk problems that often arise the need to apply risk control using the Expected Monetary Value (EMV) method for controlling project risk costs, which is a statistical concept analysis method that calculates average future expenses that may or may not occur [1]. Whereas at the evaluation stage and in order to be able to find out the cost overruns during project implementation using the Earned Value Management (EVM) method.

2. BASIS OF THEORY

2.1 Information Systems

According to Robert A. Leitch and K. Roscoe Davis, information systems are systems that exist in an organization that meet the needs of daily

transaction processing, support operations, managerial and strategic activities of the organization's time and provide certain outsiders with the necessary reports [2].

2.2 Project Management

Project Management is a combination of application, knowledge, tools and techniques to control projects to meet specified requirements, which usually include, but are not limited to: scope, quality, schedule, budget and risks. where the project management stages or processes are Initiating and Planning, Executing, Monitoring and Controlling, Closing. Stages or project management processes as follows [1].

2.3 Project Risk Management Risiko Proyek

According to Wideman, project risk in risk management is the cumulative effect of the chance of an uncertain event, which affects the goals and objectives of the project. The concept of risk management was introduced in the field of occupational safety and health in the 1980s after the development of the accident model theory from ILCI and also the increasingly widespread environmental and health issues. The purpose of risk management is to minimize losses and increase opportunities or opportunities. When seen the occurrence of losses with the accident model theory from ILCI, then risk management can cut the chain of loss events, so the domino effect will not occur. Basically, risk management is prevention against losses or accidents [3].

2.4 Expected Monetary Value (EMV) Method

The Expected Monetary Value (EMV) method is a statistical concept analysis method that calculates the average future expenses that may or may not occur. A positive EMV value indicates an opportunity, while a negative EMV value indicates a threat or threat that can harm the company. EMV is calculated by multiplying the probability value of each risk multiplied by the likelihood of money being issued when the risk occurs [1].

2.5 Earned Value Management (EVM) Method

Earned Value Management (EVM) method is a method used to manage time and costs, by identifying the performance of all projects and work packages in it and predicting cost and time performance. A concept of calculating the cost budget in accordance with the work that has been completed. (budgeted cost of works performed). In other words, this concept measures the amount of work units that have been completed, at a certain time, when judged based on the amount of budget available for the work. For this reason, the relationship between what has

been achieved physically and the amount of the budget that has been spent can be seen [4].

The basic elements in performance analysis with EVM include PV (Planned Value), EV (Earned Value), and AC (Actual Cost). As for the EVM calculation that is calculating SV (Schedule Variance), CV (Cost variance), SPI (Schedule Performance Index), CPI (Cost Performance Index), ETC (Estimate To Complete), and EAC (Estimate At Completion).

2.6 System Design Concepts

Unified Modeling Language (UML) is a modeling language that has become an industry standard for visualizing, designing and documenting software systems [9].

2.6.1 PHP

PHP is a script for server-side web-based programming. By using PHP, the management of a website becomes easier [7].

3. RESULTS AND DISCUSSION

3.1. Problem analysis

Analysis Analysis of the problem of the ongoing system is that the Project Manager is experiencing difficulties in risk management, and it is difficult to know the mitigation actions that must be carried out due to the absence of project risk planning, so the system to be built can make appropriate planning and mitigation on project implementation.

3.2 Risk identification

The risk management stage can be started by identifying the risks that aim to know and make a list of risks that have the opportunity to occur and may interfere with project implementation. In the process of identifying this incident, it is carried out through a discussion and interview approach with PT. Chiwa Indonesia. Risk identification can be seen in Table 1.

Table 1 Risk Identification

Risk Code	Types of Risk	Variable Risks
R1	Personal	Project laborers were unable to attend while working on the project.
R2		Some workers are resigned.
R3		Workers do not understand the design created by experts
R4		Workers do not understand their respective jobdesk
R5	Labor Safety	Labor (crushed / pinched) tools / materials.
R6		Workers are injured because of supporting equipment
R7	Supporting Tools	Late arrival of project performance support tools.
R8		Project work support equipment is damaged.
R9		The difficulty of using tools that can not be predicted in advance
R10	Eksternal	Natural disasters occur.
R11		A lost or stolen device or material.
R12		Rise and fall of raw material prices.

3.3 Cost Analysis Using the Expected Monetary Value Method

Probability and consequence assessment is obtained by discussing with the Project Manager or the company at PT. Chiwa Indonesia results from interviews and discussions can be seen in Table 2 where in the table shows the value of probability and consequences.

Table 2 Risk Probability

No	Risk Code	Description of Risk	Probability (%)
1	R1	Project laborers were unable to attend while working on the project.	25
2	R2	Some workers are resigned.	25
3	R3	Workers do not understand the design created by experts.	15
4	R4	Workers do not understand their respective jobdesk.	10
5	R5	Labor (crushed / pinched) tools / materials.	50
6	R6	Workers are injured because of supporting equipment.	30
7	R7	Late arrival of project performance support tools	10
8	R8	Project work support equipment is damaged.	30
9	R9	The difficulty of using tools that can not be predicted in advance.	10

No	Risk Code	Description of Risk	Probability (%)
10	R10	Natural disasters occur and rainfall is quite high.	20
11	R11	A lost or stolen device or material	25
12	R12	Up and down material prices	25

the value of the consequence is an estimate of the most numbers that must be issued for each risk. The value of the consequences can be seen in Table 3.

Table 3 Risk Consequences

No	Risk Code	Consequences
1	R1	- 5.xxx.xxx
2	R2	- 4.xxx.xxx
3	R3	- 4.xxx.xxx
4	R4	- 5.xxx.xxx
5	R5	- 8.xxx.xxx
6	R6	- 5.xxx.xxx
7	R7	- -7,xxx,xxx
8	R8	- -6.xxx.xxx
9	R9	- -4.xxx.xxx
10	R10	- 7.xxx.xxx
11	R11	- 4.xxx.xxx
12	R12	- 5.xxx.xxx

To be able to find out the results of the EMV calculation the calculation formula used refers to the following formula.

$$EMV = \text{Probability} \times \text{Consequences}$$

Information :

EMV: Expected Monetary Value (expected money value).

Probability: Frequency of risk occurrence

Consequences: Costs or Compensation that must be incurred.

Table 4 EMV Calculation

No	Risk Code	Probability (%)	Consequences (RP.)	EMV(RP.)
1	R1	25	-5.xxx.xxx	- 1.xxx.xxx
2	R2	25	-4.xxx.xxx	- 1.xxx.xxx
3	R3	15	-4.xxx.xxx	- 6xx.xxx
4	R4	10	- 5.xxx.xxx	- 5xx.xxx
5	R5	50	-8.xxx.xxx	4.xxx.xxx
6	R6	30	- 5.xxx.xxx	- 1.xxx.xxx

No	Risk Code	Probability (%)	Consequences (RP.)	EMV(RP.)
7	R7	10	- 7,xxx,xxx	- 7xx.xxx
8	R8	30	- 6.xxx.xxx	- 1.xxx.xxx
9	R9	10	- 4.xxx.xxx	- 4xx.xxx
10	R10	20	-7.xxx.xxx	-1.xxx.xxx
11	R11	25	-4.xxx.xxx	-1.xxx.xxx
12	R12	25	5.xxx.xxx	-1.xxx.xxx

3.4 Project Control Analysis

Analysis Project control analysis is used to control project costs and time done. In this research the method used is EVM. EVM is a method for knowing the progress of a project greater or smaller than its budget should and faster or slower than the schedule should be [5].

In order to be able to analyze the progress of project implementation using the EVM method a weighting plan is required. Following the weight of the project plan can be seen in table 5.

Table 5 Plan Weight

No	Job Type	Weight (%)
1	Preparatory work	59.222
2	Pipe Installation 4 "	13.698
3	Plumbing installation 3 "	19.287
4	Plumbing installation 2 "	2.302
5	1 1/2 "pipe installation	4.331
6	Test & Commissioning	1.160
Total		100

3.4.1 Variant Analysis

Variant Analysis contains calculations to be able to know Planned Value (PV), Earned Value (EV), Cost Variance (CV), Scheduling Variance (SV). Analysis of variance can be seen in Table 6.

Table 6 Value PV, EV, CV & SV

No	Day	Actual Cost	Planned Value	Earned Value	Cost Variance	Schedule Variance
1	Day 1	42.531.8 49,00	42.531.8 49,00	42.531.8 49,00	0	0
2	Day 2	42.531.8 49,00	42.531.8 49,00	42.531.8 49,00	0	0
3	3rd day	42.531.8 49,00	42.531.8 49,00	42.531.8 49,00	0	0
4	4th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0

No	Day	Actual Cost	Planned Value	Earned Value	Cost Variance	Schedule Variance
5	Day 5	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
6	6th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
7	7th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
8	8th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
9	9th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
10	10th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
11	11th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
12	12th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
13	13th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
14	14th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
15	15th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
16	16th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
17	17th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
18	18th day	1.967.60 0,01	1.967.60 0,01	1.967.60 0,01	0	0
19	19th day	4.155.50 0,21	4.155.50 0,21	4.155.50 0,21	0	0
20	20th day	4.365.48 3,21	4.536.96 2,76	2.408.78 1,76	1.956.70 1	-2.128.181
21	21st day	3.557.78 1,21	4.536.96 2,76	2.981.89 1,76	-575.889	-1.555.071

3.4.2 Performance Index Analysis

Performance Index Analysis, there is a cost performance index (CPI) and a time performance index (SPI). The work index analysis can be seen in Table 7.

Table 7 Value CPI & SPI

No	Day	Actual Cost	Planned Value	Earned Value	CPI	SPI
1	Day 1	42.531.8 49,00	42.532.8 82,12	42.532.8 82,12	1,0 00	1,0 00
2	Day 2	42.531.8 49,00	42.532.8 82,12	42.532.8 82,12	1,0 00	1,0 00
3	3rd day	42.531.8 49,00	42.532.8 82,12	42.532.8 82,12	1,0 00	1,0 00
4	4th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
5	Day 5	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
6	6th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
7	7th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
8	8th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
9	9th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
10	10th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
11	11th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00

No	Day	Actual Cost	Planned Value	Earned Value	CP I	SP I
12	12th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
13	13th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
14	14th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
15	15th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
16	16th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
17	17th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
18	18th day	1.967.60 0,01	1.967.10 0,01	1.967.10 0,01	1,0 00	1,0 00
19	19th day	4.155.50 0,21	4.156.11 8,21	4.156.11 8,21	1,0 00	1,0 00
20	20th day	4.365.48 3,21	4.537.47 3,76	2.408.78 1,76	0,5 52	0,5 31
21	21st day	3.557.78 1,21	4.537.47 3,76	2.981.89 1,76	0,8 38	0,6 57

3.4.3 Analysis of Estimated Time and Cost of Project Completion

Estimate at Completion (EAC) value calculation is obtained from the estimated difference between the cost of the project completion plan or the actual cost (BAC). Analysis of Estimated Time and Costs can be seen in Table 8.

Table 8 Value EAC & BAC

No	Day	ETC	EAC
1	Day 1	172.921.665	215.453.514
2	Day 2	172.921.665	215.453.514
3	3rd day	172.921.665	215.453.514
4	4th day	213.487.447	215.455.047
5	Day 5	213.487.447	215.455.047
6	6th day	213.487.447	215.455.047
7	7th day	213.487.447	215.455.047
8	8th day	213.487.447	215.455.047
9	9th day	213.487.447	215.455.047
10	10th day	213.487.447	215.455.047
11	11th day	213.487.447	215.455.047
12	12th day	213.487.447	215.455.047
13	13th day	213.487.447	215.455.047
14	14th day	213.487.447	215.455.047
15	15th day	213.487.447	215.455.047
16	16th day	213.487.447	215.455.047
17	17th day	213.487.447	215.455.047
18	18th day	213.487.447	215.455.047
19	19th day	211.298.429	215.453.929

No	Day	ETC	EAC
20	20th day	401.318.868	405.684.351
21	21st day	323.314.585	326.872.367

Table 9 Value EAC & ETC

Day Info	Variance Analysis		Performance Analysis		Estimation Analysis	
	CV Cost = E V - AC (Rp.)	SV Schedule = EV - PV (Rp.)	CPI Cost = EV / PV	SPI Schedule = EV / AC	ETC Remaining Fee (Rp.)	EAC Completion Fee (Rp.)
1	0	0	1,005	1,000	174.21 2.238	216.54 5.120
2	0	0	1,005	1,000	174.21 2.238	216.54 5.120
3	0	0	1,005	1,000	174.21 2.238	216.54 5.120
4	0	0	1,021	1,000	214.77 8.020	216.70 5.120
5	0	0	1,021	1,000	214.77 8.020	216.70 5.120
6	0	0	1,021	1,000	214.77 8.020	216.70 5.120
7	0	0	1,021	1,000	214.77 8.020	216.70 5.120
8	0	0	1,021	1,000	214.77 8.020	216.70 5.120
9	0	0	1,021	1,000	214.77 8.020	216.70 5.120
10	0	0	1,021	1,000	214.77 8.020	216.70 5.120
11	0	0	1,021	1,000	214.77 8.020	216.70 5.120
12	0	0	1,021	1,000	214.77 8.020	216.70 5.120
13	0	0	1,021	1,000	214.77 8.020	216.70 5.120
14	0	0	1,021	1,000	214.77 8.020	216.70 5.120
15	0	0	1,021	1,000	214.77 8.020	216.70 5.120
16	0	0	1,021	1,000	214.77 8.020	216.70 5.120
17	0	0	1,021	1,000	214.77 8.020	216.70 5.120
18	0	0	1,021	1,000	214.77 8.020	216.70 5.120
19	0	0	1,021	1,000	214.77 8.020	216.70 5.120
20	- 1.956. 075	- 2.128. .182	1,000	1,000	212.58 9.002	216.74 5.120
21	- 575. .89 0	- 1.555. .072	1,092	1,884	112.65 3.442	116.80 9.561

Based on the recapitulation of EVM analysis results from the 1st to the 21st day in Table 3.26, the ETC and EAC values are generated from the 1st to the 21st day, it can be concluded that the estimated remaining cost (ETC) of Rp. 212,589,002 and estimated final settlement costs (EAC) of Rp. 216,745,120.

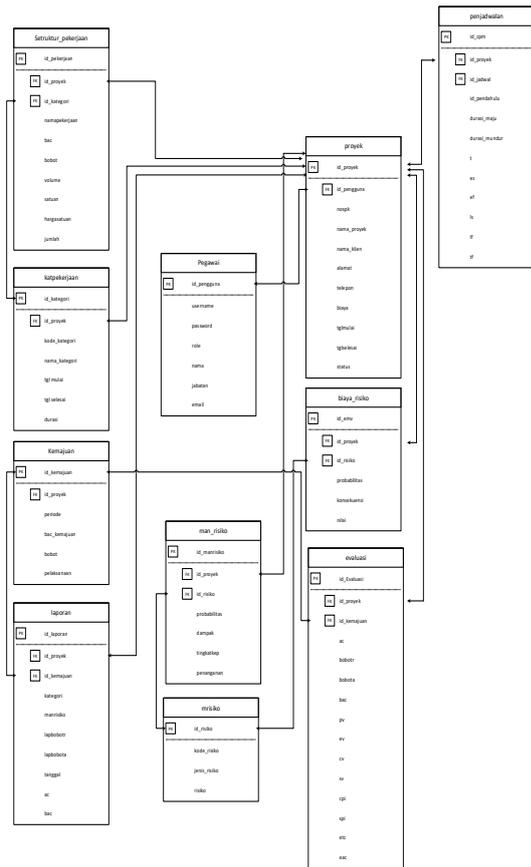


Figure 3 Relationship Scheme

3.9 Perancangan Struktur Menu

a. Admin Menu Structure Design



Figure 4 S Admin Menu Structure

b. Project Manager Menu Structure Design

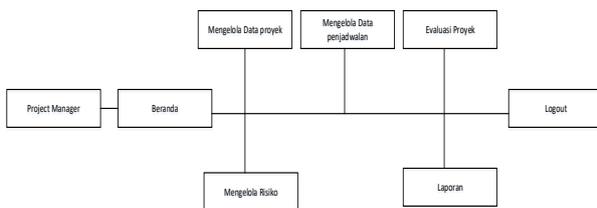


Figure 5 Project Manager Menu Structure Design

c. Site Manager Menu Structure Design

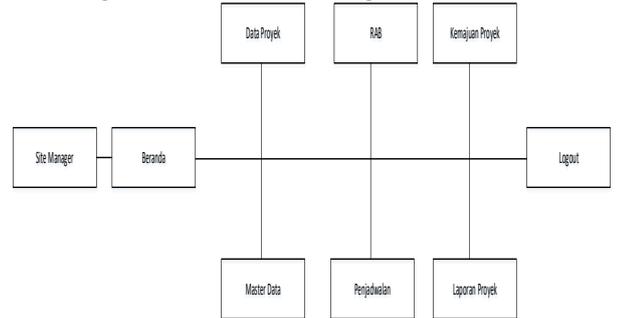


Figure 6 Designing the Site Manager Menu Structure

3.9 System Implementation and Testing

Implementation is the stage carried out to implement the design that has been done in the previous stage. Table device specifications can be seen in table 10.

Table 10 Hardware Specifications Table

No	Hardware	Specifications
1	Processor	Core i3 2.4 GHz
2	RAM	DDR3 2 GB
3	Harddisk	500 GB
4	VGA	On Board (Intel HD 4000)
5	Koneksi	Kecepatan 5 Mbps
6	Monitor	Monitor 1024x768
7	Perangkat pendukung	Keyboard, Mouse, Printer

Table 11 software used

No	Software	Specifications
1	Sistem Operasi	Windows 7
2	Web Browser	Mozilla Firefox, Chrome
3	Code Editor	Sublime Text 3
4	DBMS	MySQL v5.7.25
5	Framework	Codeigniter 3.1.8
6	Web Server	Apache 2.4.38

3.10 Black Box Testing Conclusions

Based on the results of the black box testing system that has been carried out as a whole it is concluded that the process that occurs in the project risk management information system uses the expected monetary value and EVM at PT. Chiwa Indonesia is correct and as expected.

3.9.2 Conclusion of Beta Testing

1. The system built has been able to facilitate the Project Manager in controlling all project activities. Making risk management and receiving report information easier and display the system interface is good enough.

2. The system built has been able to facilitate the Site Manager section in managing project data, such as work data, project schedule data, and Knowing the progress and evaluating the project easier and faster, and with the feature of printing news reports that makes it easy, but needs to be developed further in

terms of entering data to be more efficient and scheduling can be maximized.

3. The system that was built was able to facilitate the Admin section in managing the data of users of project employees who will use the system. The system created also helps minimize operational errors despite having a simple appearance but is easy to use.

4. CLOSING

4.1 Conclusions

Based on the results that have been obtained in the final research project that has been done, it can be concluded that:

The information system that was built was able to assist the Project Manager in identifying risks to risk mitigation with the Expected Monetary Value (EMV) method to help display and calculate costs to be used in managing risks, as well as using the earned value management (EVM) method for controlling project. So that the main results of this risk management can be used as a reference for the Project Manager during project implementation.

4.2 Suggestion

Berdasarkan hasil pengujian yang telah dilakukan Based on the results of tests conducted on the project risk management information system at PT. Chiwa Indonesia obtained a suggestion, namely the need for the development and maintenance of the display interface data import rab, project progress and evaluation to Excel or Microsoft Word in order to facilitate work, so that the system can be used in accordance with the needs for the future.

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