MANAGEMENT INFORMATION SYSTEM SCHEDULE AND PROJECT RISK IN CV WIRA BAKTI

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ABSTRACT

CV. Wira Bakti is a company which is engaged in construction services. The previous prior projects were mismatches between planning and implementation caused by several factors, the implementation timetable can not determine the estimated completion of the ongoing project, as the Schedule of Implementation Time uses a certain duration of time. Other factors which cause incompatibility between planning and implementation are problems which arise during ongoing project works such as sick labors, resignation labors, and the possibility of weather factors such as long-lasting heavy rains.

Based on those problems, it is needed the solutions to answer all problems which are frequently happen in ongoing project works to overcome project planning schedule, risk management project, and risk cost project. PERT method (*Program Evaluation and Review Teachnique*) is used to overcome planning schedule project. HOR (*House Of Risk*) method is used to overcome risk management project, EMV **(***Expected Monetary Value***)** is used to calculate risk cost from each risk.

Based on the results of interviews and testing, the system created is enough to assist the Field Officer (Technical) in planning the project schedule to determine the probability of the project schedule, ie whether the schedule can be used on the project. Management project risks by identifying project risks and project risk costs prior to project implementation.

Keyword : Schedule management and project risk, information system, *Program Evaluation and Review Teachnique, House Of Risk, Expected Monetary Value.*

1. INTRODUCTION

CV. Wira Bakti is a company engaged in construction services. The company which was established since July 18 2005 has been doing various construction projects. CV. Wira Bakti usually for a year can handle 2 - 4 projects. The projects covered include the construction of multipurpose buildings, cottage renovations, workspace maintenance, as well as other construction projects. CV. Wira Bakti is a growing company so that the projects being handled are the result of direct appointment from the government agency without going through the tender.

From the interviews conducted with Mr. Kristopo as Field Officer (Technical) (Appendix C-1) in CV. Wira Bakti. The process of making the Schedule of Implementation Time is carried out by way of estimation according to the job description contained in the RAB document to assess each job, so the Existing Time Schedule contains only job description, total weight, price amount, weekly activity schedule, description, and a weekly cumulative plan. Schedule of Implementation Time only shows the exact time of project completion. Based on the Implementing Daily Report (Annex F-9), project implementation is inseparable from the problem causing mismatches between planning and implementation. So that if a job is delayed then the impact on the whole project and certainly impact on the project completion schedule. This occurred on the basis of the executor's daily report (Appendix F-9) on July 17, 2017 the postponement of concrete work, resulting in a mismatch of the Schedule of Implementation Time which impacted the entire project. So the need for project schedule management that can know the estimated project completion time, so that if there is a project that is being done not yet completed and the company get a new project, then the Field Officer (Technical) cannot determine the estimated completion of the current project, because the Schedule of Implementation Time using one duration of time (for sure).

Based on daily reports CV. Wira Bakti in the Cisaranten Pondok Renovation Project is a non-conformity with the project plan due to problems that arise during project work such as sick labor, demanding labor, and the possibility of weather factors such as long-lasting heavy rains. The Field Officer (Technical) performs the recording of the problem through the daily report of the implementer, the recording is done when the problem occurs or at the time of project implementation, in terms of handling and cost has not been prepared. So there is a need for project risk management and project risk costs that can identify the problems that may arise during project implementation and know how to handle the problem and know the costs to be incurred if the problem arises that is done during the planning. So that when further project problems arise they can

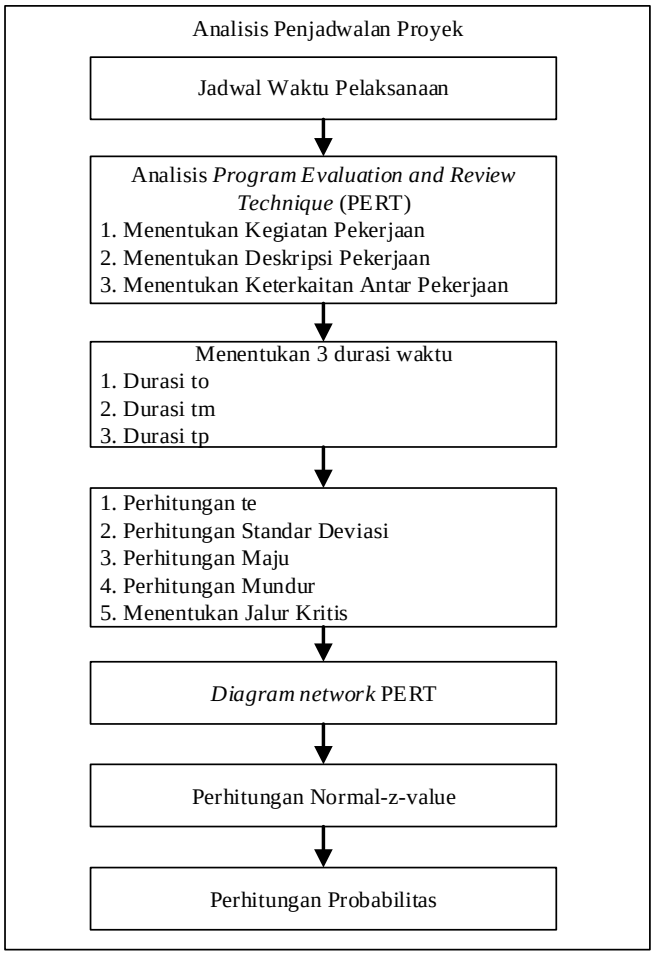
be addressed and minimize the time and cost discrepancies between planning and implementation.

Based on these problems, it is important to find a solution to answer the problems which frequently occur in project work in CV Wira Bakti which is necessary for a system that can assist the Field Officer (Technical) in the project schedule by using PERT (Program Evaluation and Review Technique) method. In this system will assist Field Officer (Technical), So the importance of project risk management, project risk costs and mitigation are done based on the company's ability with HOR (House Of Risk) and EMV (Expected Monetary Value). The built system will be made online in order to facilitate the Field Officer (technical) to oversee the project which sometimes cannot be done directly in the project location to see if the project is in accordance with the schedule as well as the cost.

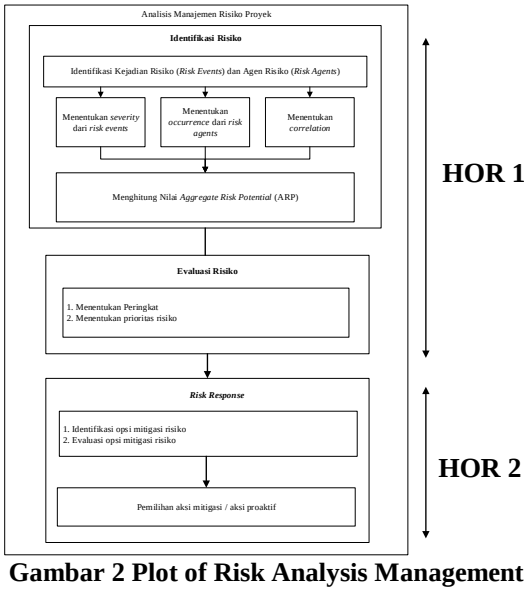
1. CONTENT OF STUDY

Implementation Time Schedule only shows the exact time of project completion. Based on the Project Daily Report (Annex) and reinforced by the interview with Mr Kristopo, the implementation of the project is inseparable from various problems, leading to a mismatch between planning and implementation. So that if a job is delayed then the impact on the whole project and certainly impact on the project completion schedule. So the need for project schedule management can know the estimated time of completion of the project. So if any project being done is not completed and the company gets a new project, then the Field Officer (Technical) must repeat the length of time to enter the work, in order to know the estimated time of completion of the project either being done or the new project.

CV. Wira Bakti performs recording problems through daily reports, recording is done when problems occur or at the time of project implementation, and for handling there has not been preparation in terms of handling and cost. So there is a need for project risk management and project risk costs that can identify the problems that may arise during project implementation and know how to handle the problem and know the costs to be incurred if the problem arises that is done during the planning. So that when further project problems arise they can be addressed and minimize the time and cost discrepancies between planning and implementation.



Gambar 1 Scheduling Analysis Plot Using the (PERT) method



Gambar 2 Plot of Risk Analysis Management using (HOR) method

2.1. Project Scheduling Analysis

Scheduling is one of the important elements in planning. By scheduling, it can be known information about the plan and progress of the project in terms of resource performance

and the duration of the project also the progress of time to complete the project. In this research, scheduling uses Program Evaluation and Review Technique (PERT) method.

A. *Program Evaluation and Review Teachnique* (PERT) Analysis

PERT has much in common with CPM and PDM. The PERT method can be used to estimate the duration of a project and allow computing the probability value of an activity or project as a whole. It can be known three estimations of the duration of each activity in PERT method. [5]

1. Determining Job Activities

The first step in the Analysis of Program Evaluation and Review Technique (PERT) is to determine the activities of work and duration.

2. Determining Job Description

To specify a job description, the event code is firstly created to make it easier on reading the schedule.

3. Determining Interconnected Job Relationships

Determine the interconnection between jobs in order to know which jobs are interrelated.

4. Specify 3 Time Durations

Determining the three time durations which is the most possible (Optimistic estimate / to), the least possible time (Pessimistic estimate / tp), and possibly (Most likely estimate / tm).

a. Effective Duration of Activities

Since there are three times in each activity, it is necessary for computation to get the effective duration of each activity (te). The formula used is as follows :

$t_e = (t_o + 4\ t_m + t_p)/6$ (3.1)

b. Standard Deviation

The standard deviation calculation of each activity is required to calculate the variant of the activity. The calculation is based on the following formula :

$d = (t_p - t_o) / 6$ (3.2)

c. Advanced Calculations

Advanced calculations use the T_e symbol. This symbol is equivalent to EET on CPM. The calculation is based on the following formula :

$T_eij = ESij + Dij$ (3.3)

d. Countdown calculations

On the countdown calculation, T_L symbol is used. This symbol is the same as LET on CPM. The calculation is based on the following formula :

$T_Lij = LFij - Dij$ (3.4)

e. Determining the Critical Path

Each node that has a value of $Te = T_L$ can be said that the node is in a critical path and has no float in the activity. The total float calculation can be done using the following formula :

$TF\ (N) = TL(J) - Te(I) - te(N)$ (3.5)

5. Probability Analysis

The first stage to do is to calculate the event variance (V) of the critical path at nodes 1, 3, 4, 6, 7, 8, 9, 10 and 11, based on the deviation of Table 3.10 with the following formula :

$V = d^2$ (3.6)

$0{,}67^2 + 0{,}5^2 + 0{,}83^2 + 0{,}5^2 + 0{,}5^2 + 0{,}5^2 + 0{,}67^2 + 0{,}33^2 = ...$

Then count the even with the formula as follows :

$V = \sum V_{cp}$ (3.7)

$0{,}4489 + 0{,}25 + 0{,}6889 + 0{,}25 + 0{,}25 + 0{,}25 + 0{,}4489 + 0{,}1089 = 2{,}6956$

After getting the standard deviation, then calculate standard deviation of the event with the formula as follows :

$D = \sqrt{V}$ (3.8)

$D = \sqrt{2{,}6956} = 1{,}64$

Calculate the value of Z, the duration of which by the Field Officer (Technical) CV. Wira Bakti is 42 days, while the result of calculation from PERT method is 49 days. Thus, the value is as follows :

$Z = (42 - 40{,}14) / 1{,}64 = 1{,}1$ standard deviation.

B. Conclusion From Schedule Calculation Using PERT

The conclusion of the schedule calculation using PERT method is expected to assist Field Officer (Technical) in estimating the project completion time, so that if CV. Wira Bakti is working on unfinished projects and the company gets a new project, it will be known the estimation of project completion which is being worked on.

2.2. Project Risk Management Analysis

Project risk management is a very important activity to be undertaken when there is going to work on a project. This project risk management serves to identify possible risks occurred when the project takes place which is then handled, so there will not be result in shortcomings or even project failures. The House Of Risk (HOR) method has 2 phase steps in the calculation.

A. Risk Identification (HOR 1)

Risk identification is how to create a list of risks which can occur when the project is running. The analysis result is assessed by its severity which will be used as risk event and occurrence which will be used as risk agent.

a. Identification of Risks Event and Causes of Risks (HOR 1)

The House Of Risk method is a method of proactively managing risk. There are 2 stages in House Of Risk method: HOR phase 1 and HOR phase 2. HOR phase 1 consists of the event agent (risk event) and risk agent which are identified as the cause of risks that can be managed by giving the value of severity and occurrence. Table 1 describes the reference for the assessment of risk events. [6]

Table 1 Level *Severity*

Level	*Severity*	Information
1	*Low*	The risks are not harmful
2	*Very Low*	Risks with very few hazards
3	*Minor*	The risks are a bit dangerous but do not have a big effect
4	*Very Minor*	Risks are a bit dangerous and have little influence
5	*Moderate*	Risks are dangerous and somewhat influential
6	*Very Moderate*	Risks are dangerous and influential
7	*High*	Risks with high and influential danger level
8	*Very High*	The risks are very dangerous and very influential
9	*Hazardous with warning*	The risks are very dangerous and very serious
10	*Hazardous without warning*	The risks are very dangerous and can threaten the safety of the company

Table 2 describes the reference for cause assessment (risk agent).

Table 2. Level of *Occurance*

Level	*Occurance*	Annotation
1	*Remote*	The cause of risk almost never happens
2	*Very Low*	The cause of the risk can still be controlled
3	*Low*	The cause of risk is still very rare
4	*Moderate*	Causes of risk are rare
5		
6		
7	*High*	Causes of risk are common
8		
9	*Very High*	Causes of risk are very common
10		

The assessment of each risk event can be seen in Table 3.

Table 3. Risk Event

E_i	Risk Event	S_i
E1	Project Planning Error	9
E2	Incompatible Project Implementation	8
E3	Provision of Resources	8
E4	Device and Property Damage	6
E5	Poor Project Finance	4
E6	Bad Human Resources	7
E7	Cheating, Negligence, Dishonesty	8
E8	Unfulfillment of Work Specifications	7
E9	Material Delays	8
E10	Schedule delays	6
E11	Implementation Schedule changing	5
E12	Working Strikes	6
E13	Poor Quality Material	6
E14	Inappropriate Materials	7
E15	Unpredictable weather	5
E16	LSM Who Asks Money	7
E17	Misunderstanding With Client Parties	2

Annotation :

1. Ei = code for Risk Events
2. Si = code for Severity

The assessment of each cause of risk (Risk Agent) can be seen in Table 4.

Table 4 Causes (Risk Agent)

A_j	Risk Agent	O_j
A1	Error in Schedule Creation	5
A2	Error in Budget Plan Creation	3
A3	Error in Surveying Project Location	1
A4	Error in Scheduling	7
A5	Worker Delays	8
A6	Unskilled Workers In Using Tools	6
A7	Bad Tool Quality	7
A8	Company Experiencing Losses	2
A9	Unskilled Workers	6
A10	The Lazy Workers	4
A11	Non-Standard Working application	5
A12	Tools which are brought by workers	2
A13	Lack of Worker Selection	4
A14	Car broke down	6
A15	The Long Journey	5
A16	Bad Street Condition	8
A17	A Difficult Reached of field	3
A18	Sick Workers	7
A19	Shortage of Employee Worker	6
A20	Late Materials	5
A21	Unsuitable between Material and Needs	6
A22	Unsuitable Employment Weight	3
A23	Problems In Working Village	6
A24	Rare Materials	4
A25	Out of Materials of supplier	5
A26	Unconditional Weather	4
A27	Field Condition of Underprivileged Project Work	5

Annotation : :

1. A_j = Code for Causes of Risk (*Risk Agent*)
2. O_j = code for Occurrence

After getting the risk event and the risk agent, the next step is we create a correlation table between risk event and risk agent. The reference for the Correlation Level rating between Risk Event and Risk Agent is seen in table 5.

Table 4 Level Correlation between Risk Event and Risk Agent

Value	Description	Annotation
0	Not Related	There is no link between the cause of risk and the risk event
1	Low linkage (low)	There is a small association between the cause of risk and the incidence of risk
3	Moderate linkage (moderate)	There is a moderate link between the cause of the risk and the risk event
9	High link (high)	There is a very close correlation between the cause of risk and the incidence of risk

b. Value Calculation ARP (HOR 1)

After getting the risk event, risk agent, and its correlation, the next step is calculation phase of HOR 1 which is calculate the ARP_j value with the formula as follows :

Calculating value ARP_j (HOR 1)

$$ARP_j = O_j \sum_i Si\ R_{ij} \quad (3.4)$$

Example Calculation ARP_j

$ARP_5 = O_5 [(S_1 \times R_{15}) + (S_2 \times R_{25}) + (S_3 \times R_{35}) + (S_4 \times R_{45}) + (S_5 \times R_{55}) + (S_6 \times R_{65}) + (S_7 \times R_{75}) + (S_8 \times R_{85}) + (S_9 \times R_{95}) + (S_{10} \times R_{105}) + (S_{11} \times R_{115}) + (S_{12} \times R_{124}) + (S_{13} \times R_{134}) + (S_{14} \times R_{144}) + (S_{15} \times R_{154}) + (S_{16} \times R_{164}) + (S_{17} \times R_{174})]$

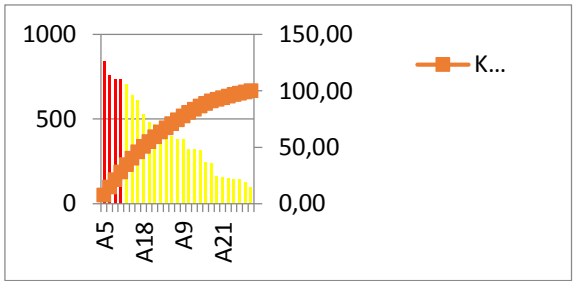
$= 8 \times [(9 \times 0) + (8 \times 9) + (8 \times 0) + (6 \times 0) + (4 \times 0) + (7 \times 0) + (8 \times 0) + (7 \times 0) + (8 \times 0) + (6 \times 3) + (5 \times 3) + (6 \times 0) + (6 \times 0) + (7 \times 0) + (5 \times 0) + (7 \times 0) + (2 \times 0)] = 840$

After cumulative calculation of %percentage of ARP_j value is obtained, then the next step is to create cumulative table% ARP_j value, which can be seen in Table 6.

Tabel 5 Cumulative Percentage Calculation ARP_j

Ranking ARP of O_j	Aj(*Risk Agent*)	Value ARP $_j$	Weight Persentase % ARP_j	Kumulatif %
1	A5	840	7,67	7,67
2	A10	756	6,90	14,57
3	A4	735	6,71	21,27
4	A25	735	6,71	27,98
5	A20	705	6,43	34,42
6	A16	640	5,84	40,26
7	A24	612	5,59	45,84
8	A18	532	4,86	50,70
9	A14	480	4,38	55,08
10	A11	470	4,29	59,37
11	A6	450	4,11	63,48
12	A1	405	3,70	67,17
13	A15	400	3,65	70,82
14	A26	384	3,50	74,33
15	A9	378	3,45	77,78
16	A23	324	2,96	80,73
17	A19	324	2,96	83,69
18	A27	315	2,87	86,57
19	A2	243	2,22	88,78
20	A17	240	2,19	90,97
21	A22	162	1,48	92,45
22	A21	156	1,42	93,88
23	A3	153	1,40	95,27
24	A13	148	1,35	96,62
25	A12	144	1,31	97,94
26	A7	126	1,15	99,09
27	A8	100	0,91	100,00
Total		10957	100,00	100,00

After calculating the cumulative percentage of %percentage of ARP_j value is completed, the next step is to determine the priority of Risk Agent which should be prioritized for mitigation with reference if the cumulative value of percentage weight% ARP_j value has reached 20%, while for risk causes (Risk Agent) for cumulative value of percentage weight% ARP_j value 30 - 100% or remaining 80% will still be mitigated but not too prioritized. then subsequently enter the data in table 6 into the pareto diagram to see the highest level to be prioritized in mitigation, which can be seen in Figure 3.



Picture 3 Pareto Diagram

B. *Risk Response* (HOR 2)

Risk response is the stage which is done after the evaluation phase is completed and has determined where the priority of the cause of the risk to be mitigated first. Risk response has three stages, such as identifying risk mitigation options, evaluating risk mitigation options, and selecting appropriate mitigation for each risk.

a. Identify Risk Mitigation Options

These risk agents will then be incorporated into the HOR phase 2 model for designing mitigation actions. Mitigation action means mitigation action obtained from Mr Kristopo as Field Officer (Technical). The focus of mitigation action design is derived from planning. The focus of mitigation action design is based on the risk causes (Risk Agent) and the mitigation table which can be seen in Table 7.

Table 6 Mitigation Action

P_{Ak}	Prevention Action
PA1	Giving sanctions
PA2	Tightening labor selection
PA3	Tightening Worker Supervision
PA4	Evaluating Workers
PA5	Doing performance evaluation
PA6	Evaluate Supplier
PA7	Looking for New Supplier
PA8	Finding Other Way Routes
PA9	Setting the Delivery Time
PA10	Contacting Contractors to Switch Workers
PA11	Looking for Other Transport Fleets
PA12	Providing Standard Project Tools (Project Helmets, Gloves, Boots)
PA13	Preparing the Tools (Big Tarps, Sacks)
PA14	Contact the Contractor to make additional labor
PA15	Setting up funds for LSM

Information :
P_{Ak} = Code for Risk Prevention (Preventive Action)

The reference for assessment of the linkages of mitigation action with risk agents is shown on table 8.

Table 7 Correlation Between Risk Prevention and Causes of Risk

Value	Description	Information
0	Not Related	There is no link between risk prevention and risk factors
1	Low linkage (low)	There is little correlation between risk prevention and the cause of risk
3	Moderate linkage (moderate)	There is a moderate link between risk prevention and the cause of risk
9	High link (high)	There is a very close relationship between risk prevention and the cause of risk

Information :
E_{jk} = Code of correlation Between Risk Agent with Preventive Action
A_j = code for Risk Agent

b. Evaluation of Mitigation Option

After mapping the mitigation action and giving correlation value between Mitigation Action and linkage assessment with risk agent, the first step is to measure the correlation value between the mitigation action and the risk agent. The second step is to measure the degree of difficulty (D_k). The purpose of measuring the degree of difficulty is to know the degree of difficulty of applying mitigation action. The third step is to measure the total effectiveness by multiplying the correlation value between the risk agent (j) and the preventive action (k). The total effectiveness calculation aims to assess the effectiveness of mitigation action with the following formula :

1. Calculating the value TE_k

$TE_k = \sum_j ARP_j E_{jk}$ (3.7)

$TE_1 = (ARP_1\ E_{11}) + (ARP_2\ E_{21}) + (ARP_3\ E_{31}) + (ARP_4\ E_{41}) + (ARP_5\ E_{51}) + (ARP_6\ E_{61}) + (ARP_7\ E_{71}) + (ARP_8\ E_{81}) + (ARP_9\ E_{91}) + (ARP_{10}\ E_{101}) + (ARP_{11}\ E_{111}) + (ARP_{12}\ E_{121}) + (ARP_{13}\ E_{131}) + (ARP_{14}\ E_{141}) + (ARP_{15}\ E_{151}) + (ARP_{16}\ E_{161}) + (ARP_{17}\ E_{171}) + (ARP_{18}\ E_{181}) + (ARP_{19}\ E_{191}) + (ARP_{20}\ E_{201}) + (ARP_{21}\ E_{211}) + (ARP_{22}\ E_{221}) + (ARP_{23}\ E_{231}) + (ARP_{24}\ E_{241}) + (ARP_{25}\ E_{251}) + (ARP_{26}\ E_{261}) + (ARP_{27}\ E_{271})$

= (405 x 0) + (243 x 0) + (153 x 0) + (735 x 0) + (840 x 9) + (450 x 0) + (126 x 0) + (100 x 0) +
(378 x 0) + (756 x 9) + (470 x 0) + (144 x 9) +
(148 x 0) + (480 x 0) + (400 x 0) + (640 x 0) +
(240 x 0) + (532 x 0) + (324 x 0) + (705 x 0) +
(156 x 0) + (162 x 0) + (324 x 0) + (612 x 0) +
(735 x 0) + (384 x 0) + (315 x 0)
= 15696

After the calculation of the TE_k value is obtained, then the next step is to create the TEk result table which is done to sort or rank from the biggest TE_k value on Table 9.

Table 8 *The calculation results TE_k*

NO	P_{Ak}	Preventive Action	Total Value of Effectiveness (TE_k)
1	PA1	Giving sanctions	15696
2	PA7	Looking for New Supplier	14238
3	PA2	Tightening abor selection	13118
4	PA9	Setting the Delivery Time	11520
5	PA6	Evaluate Supplier	11268
6	PA3	Tightening Worker Supervision	10620
7	PA10	Contacting Contractors to Switch Workers	7704
8	PA4	Evaluating Workers	6804
9	PA8	Finding Other Way Routes	5760

10	PA5	Doing performance evaluation	5194
11	PA11	Looking for Other Transport Fleets	4320
12	PA12	Providing Standard Project Tools (Project Helmets, Gloves, Boots)	4230
13	PA13	Preparing the Tools (Big Tarps, Sacks)	3456
14	PA14	Contact the Contractor to make additional labor	2916
15	PA15	Setting up funds for LSM	2835

After ranking the biggest TE_k value, the next step is to calculate the level of mitigation difficulty. The reference to assess the difficulty level of mitigation can be seen on Table 10.

Tabel 9 Causes and Mitigation Correlations

Nilai	Keterangan
3	Difficulty low (low)
4	Medium difficulty (medium)
5	High difficulty (high)

The fourth step is to measure the effectiveness of difficulty ratio (*effectiveness to difficulty ratio*) by dividing the total effectiveness value (TE_k). The effectiveness calculation of the difficulty degree aims to determine the priority ranking of all actions, with the following formula:

Example Calculation :

$$ETD_k = \frac{TEk}{Dk} \quad (3.8)$$

$ETD_1 = TE_1/D_1$

$ETD_1 = 15696/3$

$= 5232$

After calculation of ETD_k value is obtained, the next step is to create the ETD_k result table which is done to sort or rank the biggest ETD_k value which can be seen on Table 11.

Table 10 The calculation results ETD_k

NO	P_{Ak}	Prevention Action	Value of Mitigation Difficulties (ETD_k)
1	PA1	Giving sanctions	5232
2	PA7	Looking for New Supplier	4746
3	PA9	Setting the Delivery Time	3840
4	PA6	Evaluate Supplier	3756
5	PA3	Tightening Worker Supervision	2655
6	PA2	Tighteing labor selection	2623,6
7	PA10	Contacting Contractors to Switch Workers	2568
8	PA4	Evaluating Workers	2268
9	PA8	Finding Other Way Routes	1440
10	PA12	Providing Standard Project Tools (Project Helmets, Gloves, Boots)	1410
11	PA5	Doing performance evaluation	1298,5
12	PA11	Looking for Other Transport Fleets	1080
13	PA13	Preparing the Tools (Big Tarps, Sacks)	1152
14	PA14	Contact the Contractor to make additional labor	972
15	PA15	Setting up funds for LSM	945

c. Election of Mitigation Action/ Proactive Action

Selection of mitigation actions based on the highest rank with the biggest ETD_k value, which can be seen in table 12.

Table 11 Ranking of mitigation action priorities

Mitigation Action	ETD_k	Priority Ranking
Giving sanction (PA1)	5232	1
Looking for New Supplier (PA7)	4746	2
Setting the Delivery Time (PA9)	3840	3
Evaluate Supplier (PA6)	3756	4

Tightening Worker Supervision (PA3)	2655	5
Tightening labor selection (PA2)	2623,6	6
Contacting Contractors to Switch Workers (PA10)	2568	7
Evaluating Workers (PA4)	2268	8
Finding Other Way Routes (PA8)	1440	9
Providing Standard Project Tools (Project Helmets, Gloves, Boots) (PA12)	1410	10
Doing performance evaluation (PA5)	1298,5	11
Looking for Other Transport Fleets (PA11)	1080	12
reparing the Tools (Big Tarps, Sacks)) (PA13)	1152	13
Contact the Contractor to make additional labor (PA14)	972	14
Setting up funds for LSM (PA15)	945	15

Based on the result of possible cause of risk (Risk Agent) analysis which appear at the time of project implementation along with action of mitigation (Preventive Action) by using House Of Risk (HOR) method. So the mitigation which needs to be done on every project work Cisaranten Pondok Renovation Works refer to table 12.

C. Conclusion of Project Risk Calculation Using HOR

The conclusion of the project risk calculation using the HOR method is expected to assist the Field Officer (Technical) by the HOR method in controlling project risks according to the ability of the company. So that if there are problems in the project, it can be done immediately and minimize the mismatch of time and cost between planning and implementation.

2.3. Determining the Risk Cost Using EMV

Each of these risks spend the risk cost of project which can not be estimated at the time of planning, so the risk cost calculation is needed using the EMV method. [3] At this stage will be calculated how much the cost which have to be incurred to handle the risk using the method of Expected Monetary Value (EMV). The consequences value is the largest estimation of the numbers which have to be spent on each risks to the project. The consequences of risk are addressed in Table 13.

Tabel 12 Risk Consequences

Risk Code	Consequences
R1	5.000.000,00
R2	3.000.000,00
R3	1.000.000,00
R4	500.000,00
R5	3.000.000,00
R6	1.500.000,00
R7	1.500.000,00
R8	1.500.000,00
R9	1.000.000,00
R10	2.500.000,00
R11	1.000.000,00
R12	1.000.000,00
R13	1.500.000,00
R14	2.000.000,00
R15	1.000.000,00
R16	3.000.000,00
R17	500.000,00

The next step is to provide probability value of what percentage of possible risks occur. The risk probability is based on the result of interview with Mr. Kristopo as the Field Officer (Technical) of the company. The probability of risk is shown in table 14.

Table 13 Project Risk Probability

E_i	Risks (event)	Probability (%)
R1	Project Planning Error	30
R2	Incompatible Project Implementation	60
R3	Providing Resources	30
R4	Device and Property Damage	20
R5	Poor Project Finance	30
R6	Bad Human Resources	20
R7	Cheating, Negligence, Dishonesty	15
R8	Unfulfillment of Work Specifications	10
R9	Material Delays	40
R10	Delay from Schedule	50
R11	Implementation Schedule changing	30
R12	Working Strikes	40
R13	Poor Quality Material	20
R14	Inappropriate Materials	15
R15	Unpredictable weather	20
R16	LSM Who Asks Money	30
R17	Misunderstanding With Client Parties	5

After obtaining the value of consequence and probability, then calculate each risk using EMV. EMV calculations use the following formula :

EMV = Probabilitas x Consequences (3.9)

Information :

EMV : *Expected Monetary Value* (The Value of Money Expected).

Probability : Frequency of risk.

Consequences : Compensation of costs to be incurred.

Example Calculation

1. Calculating EMV

EMV_n = Probabilitas x Consequences

EMV_1 = 30 % * 5.000.000

= 1.500.000,00

After finishing the calculation, then next step is to make the calculation of EMV table. The following is the risk cost assessment shown in Table 15.

Tabel 14 EMV calculations

Risk Code	Probability (%)	Consequences	EMV (Rp.)
R1	30	5.000.000,00	1.500.000,00
R2	60	3.000.000,00	1.800.000,00
R3	30	1.000.000,00	300.000,00
R4	20	500.000,00	100.000,00
R5	30	3.000.000,00	900.000,00
R6	20	1.500.000,00	300.000,00
R7	15	1.500.000,00	225.000,00
R8	10	1.500.000,00	150.000,00
R9	40	1.000.000,00	400.000,00
R10	50	2.500.000,00	1.250.000,00
R11	30	1.000.000,00	300.000,00
R12	40	1.000.000,00	400.000,00
R13	20	1.500.000,00	300.000,00
R14	15	2.000.000,00	300.000,00
R15	20	1.000.000,00	200.000,00
R16	30	3.000.000,00	900.000,00
R17	5	500.000,00	25.000,00

Based on table 15 it is known how big the threat value of each risk. Then according to EMV calculation, CV Wira Bakti has to spend money as much as the numbers counted on the EMV column in case one of the risks occurs during the project. The cost used to handle these risks comes from the CV.Wira Bakti backup cost. Thus, the company must allocate funds to overcome in case any of the risks occur.

2. CLOSING

This section will explain the conclusion and suggestion of the research.

3.1. Conclusion

In this chapter the conclusion can be drawn from the discussion of the previous chapters as well as suggestions for improving and developing the system further.

Based on the research and test results which have been done on the Schedule of Management Information System and Project Risk in CV. Wira Bakti, here can be drawn some conclusions are as follows:

1. The built system can assist the Field Officer (Technical) in determining the estimation and knowing the probability of project completion on a project. So that Field Officer (Technical) can determine the time of project completion, but the system can not show the network as done in the analysis phase and can not determine the estimated time of the project if the CV. Wira Bakti get 2 projects simultaneously.
2. The built system can assist the Field Officer (Technical) in determining the highest risks and knowing the handling which can be done firstly by the Field Manager (Technical) when the risks arise during project implementation. So that when the problems in subsequent projects appear, it can be solved immediately, but the system has not been able to determine the mismatch between the time and cost of the project in planning with its implementation.

3.2. Suggestions

Management Information System Schedule and Project Risk in CV. Wira Bakti still has shortcomings which can be added, such as:

1. Management Information system schedule and project risk in CV. Wira Bakti can be added some additional features such as calculating project costs, and also risk control based on the project.
2. Management Information system schedule and project risk in CV. Wira Bakti is expected to have addition such as a feature to calculate the project's holiday on every done project.

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