SCHEDULING AND PROJECT RISK MANAGEMENT INFORMATION SYSTEM IN CV. ARDECON MULTI DESIGN

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ABSTRACT

CV. Ardecon Multi Design is a partnership company engaged in construction. At the time of project execution there was a delay in the completion of the project due to several factors, namely Site Manager had difficulty in determining which work could be done together and took precedence when working on the project. As well as the risk of the project there has been no management, this has resulted in Site Manager experiencing difficulties in terms of handling risks that occur due to not knowing the level of importance of the risk and calculating the costs caused by these risks. Based on the problems that occur at this time, it requires a scheduling information system and project risk management at CV. Ardecon Multi Design. The stages to solve the problem use the Critical Path Method to determine which work must take precedence, whereas the Probability Impact Matrix method to identify risks and the level of risk that arises, and with the Expected Monetary Value method to calculate the cost of losses incurred from each this risk. Based on the results of the tests achieved, the system built has been able to display work that can be done together and can be prioritized in the critical path and can display new schedule information and assist in emerging risk management in the form of interest levels and handling and costs incurred and results evaluation of the entire project.

Keywords: Project, Scheduling, Risk, Critical Path Method, Probability Impact Matrix, Expected Monetary Value

1. *INTRODUCTION*

CV. Ardecon Multi Design was inaugurated on June 15, 2015 with the status of the Limited Company Company engaged in construction. The company is engaged in the field of engineering and supervision services and construction implementation services. The company has completed various projects such as infrastructure development and building construction.

Based on the results of interviews with Mr Abdullah as Site Manager at CV. Ardecon Multi Design. At present, in the execution of projects, delays often occur where the project that is done is not in accordance with the time set. In 2016, the company worked on the project, one of which was the construction of toilet, washing and toilet infrastructure (MCK) that had been completed, the weight of realization at week 3 was not in accordance with the weight plan. The planned weighting project should have been completed at 85.70% but the realization of the weight was only 76.40%, resulting in a delay of 9.3%. In 2017 the company has worked on the Golf Maintenance Facility construction project which is addressed at Jakarta's Soekarno-Hatta International Airport, the project has been delayed by 0.07% at the 8th week. The weighting plan until the 8th week is 33.05%, but when it is realized, the processing weight is 32.98%. In 2018 the company worked on one of the projects, namely the construction of a WSO parking infrastructure, this project did not experience delays like previous projects but at week 5 the realization weight of the weekly physical report did not match the weight of the plan. Two of the three projects experienced project completion delays, which were caused by incompatibility with the predetermined weight plan because the Site Manager did not know the work that should be prioritized, as a result the project completion was not in accordance with the set time.

Some projects that experience delays are due to the risk factors that occur and the absence of risk management. In 2016 the project of making bath, washing and toilet infrastructure (MCK) took place with risks with categories of risks that often occur consultants and materials, the impact of which was carried out in the project work carried out first and decided what was done in the process of handling the risk. In 2017 the Golf Maintenance Facility development project took risks with the category of physical risks and consultants, the impact of the delay in the construction of the project resulted in the overall realization of the project to be too late and increasing processing time. In 2018 the risk of making WSO parking infrastructure occurs with the risk categories that often occur are physical and material, the impact of the risk affects the project work process. Recording of problems is rarely done when the project takes place and there is no handling of the risks that occur. Therefore the risks that have an impact on project delays can be minimized. So that

the identified risk can be identified as the result of the loss from the impact of the risk.

Based on the results of the interview described by Mr. Abdullah as the Site Manager at CV. Ardecon Multi Design, a solution is needed to answer the existing problems, namely the need for a system that can plan project risk management and scheduling so that the risks that occur and are unexpected can be minimized or prevented.

From the problems described above, it is intended to create a Project Risk Scheduling and Management Information System at CV. Ardecon Multi Design. The thing that is expected with the construction of this information system is the project carried out by CV. Ardecon Multi Design can be planned, executed and managed well.

2. RESEARCH METHOD

The research method that will be used in this study will be visualized in Figure 1.

Figure 1. *Research Methodology*

3. CONTENTS OF RESEARCH

3.1. Project Implementation Scheduling Analysis

Project scheduling which is one or the elements of planning results, which can provide information obtained about the schedule of plans and progress of the project in terms of the performance of resources, equipment and materials as well as the project duration plan and the progress of time for project completion. In the scheduling process, the preparation of an activity and the relationship between activities are made in more detail and also very detailed. This is in the form intended to help implement the evaluation results of the project. Scheduling is the allocation of time that can be available to implement each work in order to complete a project until an optimal result is achieved by considering the limitations that exist. [1]

Critical Path Method (CPM) also known as the critical path name, which is a path that has a series of components - activities, with the longest total number of times obtained and which shows the fastest time frame for project completion. So, the critical path consists of a whole series of critical activities, starting from the first activity to the last activity. [2]

a. Advanced Calculation

In how to identify critical paths, a method is called a forward calculation with the applicable rules. [1]

$$EF(i\text{-}j) = ES(i\text{-}j) + D(i\text{-}j) \quad \text{.....(1)}$$

b. Reverse Calculation

The most recent start time for an activity is the same as the last finish time minus the period of time the activity in question uses the formula. [1]

$$LS(i\text{-}j) = LF(i\text{-}j) - D(i\text{-}j) \quad \text{.....(2)}$$

c. Calculation Float

Total Float is the amount of time allowed for a project activity to be delayed, without affecting the overall project schedule. [1]

$$TF = L(j) - E(j) - D(i\text{-}j) \quad \text{.....(3)}$$

After successful calculation, forward calculation and float calculation, then the next step is to recap the data from the results of the overall CPM calculation. The following results from the recap of all the above calculations from advanced calculations to float calculations then to determine the results of the CPM method analysis, which can be seen in Table 1 below.

Table 1. *CPM Analysis Results*

No	Pekerjaan		Durasi (hari)	Paling Awal		Paling Akhir		Total Float (TF)
	i-node	j-node		Mulai (ES)	Akhir (EF)	Mulai (LS)	Akhir (LF)	
1	0	A1	5	0	5	0	5	0
2	A1	A2	4	5	9	5	9	0
3	A1	A3	2	5	7	7	9	2
4	A2	A4	2	9	11	9	11	0
5	A3	A4	2	7	9	9	11	2
6	A4	B1	8	11	19	11	19	0
7	B1	C1	7	19	26	19	26	0
8	C1	C2	7	26	33	26	33	0
9	C2	C3	7	33	40	33	40	0
10	C3	C4	6	40	46	42	46	2
11	C3	C5	4	40	44	40	46	0
12	C4	C6	3	46	49	46	49	2
13	C5	C6	3	44	47	46	49	0
14	C6	C7	3	49	52	49	52	0
15	C7	D1	5	52	57	52	57	0
16	D1	D2	7	57	64	57	64	0
17	D2	D3	4	64	68	64	68	0
18	D3	D4	5	68	73	68	73	0
19	D4	D5	5	73	78	73	78	0

Based on Table 1. The results of CPM analysis that can be known that which work includes the critical path or a job which cannot be delayed. Because if a job is postponed, it will affect the total time spent on the project. The following is a picture that is multiplied by the project network diagram that was formed. [7]

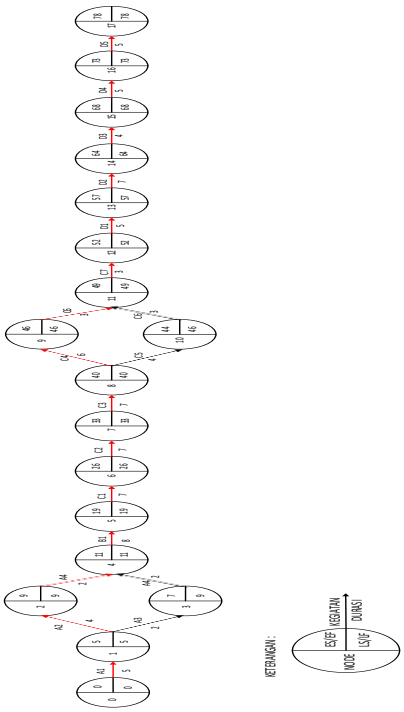

Figure 1. *Project Work Network Diagram*

Based on the results of the data obtained from Figure 2. Project Network Work Diagram which can be seen that the critical path can be shown is the path indicated by the red line. The critical path that is formed is 0 - A1 - A2 - A4 - B1 - C1 - C2 - C3 - C4 - C6 - C7 - D1 - D2 - D3 - D4 - D5 with a total time of 78 days the estimated time for completion. The results of the CPM analysis also aim to find out which work can be done simultaneously and are on a critical path which means that the work must take precedence because if it is not able to cause something late in completing the project. [8]

3.2. Project Risk Management Analysis

In scientific theory risk can be defined as a combination of functions of a frequency of events, probabilities and consequences of hazards arising from the risks that occur. [3] One method that can be used in risk control is the Probability Impact Matrix (PIM) method.

PIM is a method for analyzing risk qualitatively with the possibility of a risk that will arise. The risk assessment is carried out based on opportunities / probabilities and their consequences / impacts. This can be done to provide an assessment of the probability of each risk and the impact is by scaling the index at risk. [4]

After knowing all the values of the level of risk, the next step is to analyze what categories of risks occur. It can be concluded that all identification of categories and risk factors are based on the results of research conducted by previous researchers. [5]

Table 2. *Project Risk Management Analysis*

Kode Risiko	Tingkat Risiko	Kategori Risiko	Penanganan Risiko
R3	Tinggi	Fisik	Perhitungan kembali volume tanah agar tidak terjadinya kesalahan.
R5	Tinggi	Fisik	Menutup area cor dengan plastik.
R9	Tinggi	Konsultan	Koordinasi dengan staff ***drafter*** harus sering dilakukan agar tidak salah dalam desain.
R11	Tinggi	Konsultan	Koordinasi dengan staff ***engineering*** harus sering dilakukan.
R1	Sedang	Konsultan	Pengukuran harus dilakukan dengan orang yang berpengalaman dan paham akan tujuan proyek.
R2	Sedang	Fisik	Disaat hujan dipasang tutup berupa plastik agar tanah tidak basah.
R4	Sedang	Fisik	1. Pemadatan tanah harus dilakukan lebih dari satu kali. 2. Melakukan pengecekan ulang setelah proses pemadatan.
R6	Sedang	Material	Menentukan penjual material yang terdekat dengan lokasi proyek.
R7	Sedang	Fisik	Dipasang tutup berupa plastik agar air tidak masuk.
R8	Sedang	Material	Memesan kembali material yang kurang.
R10	Sedang	Tenaga kerja dan tenaga ahli	1. Memaksimalkan pekerja yang ada. 2. Menambah pekerja.
R12	Sedang	Keselamatan dan kecelakaan	1. Alat P3K harus selalu ada. 2. Memakai ***safety suit*** ketika pengerjaan proyek.
R13	Sedang	Peralatan	Menyewa perlatan yang baru agar pekerjaan proyek dapat berlangsung.
R14	Sedang	Material	Memesan material yang baru dengan kualitas yang baik.
R16	Sedang	Material	Berkoordinasi dengan penjual barang untuk menukarkan kembali.
R15	Rendah	konsultan	Menghitung kembali pengukuran.

Based on Table 2 can be obtained, the conclusion is that it is not always every mitigation and the level of importance of project risk is definite. Because on each project different values of probablility and value can be assessed on the impact. The level of risk that has taken place and its mitigation can be used as a reference for the site manager in handling risks that will occur in the future project. [9]

3.3. Project Risk Cost Analysis

At the risk cost analysis phase it is a stage where the way to calculate the amount of costs that must be spent to deal with such a risk using the Expected Monetary Value (EMV) method. [6]

At this stage where you will get the consequences by conducting an interview with the site manager and adm section to get a number of values from the value of the risk consequences.

The formula that can calculate the value of the EMV can be seen as follows:

$$EMV = \text{Probabilitas} \times \text{Konsekuensi} \quad \text{.....(4)}$$

The results of all EMV calculations can be seen in Table 3.

Table 3. *Project Risk Cost*

No	Deskripsi Risiko	Konsekuensi (Rp)	Probabilitas (%)	Hasil EMV (Rp)
1	Kesalahan pemasangan patok	-500.000	100	-500.000
2	Cuaca hujan mempengaruhi kontur tanah	-850.000	66.67	-566.695
3	Kesalahan dalam urugan tanah	-1.000.000	33.33	-333.300
4	Pemadatan tanah kurang maksimal	-1.000.000	33.33	-333.300
5	Cuaca hujan mengakibatkan cor tidak cepat kering	-750.000	33.33	-249.975
6	Material yang dikirim terlambat datang	-500.000	66.67	-333.350
7	Galian tanah tergenang oleh air	-850.000	33.33	-283.305
8	Jumlah material yang dikirim tidak sesuai dengan pesanan	-1.000.000	33.33	-333.300
9	Adanya kesalahan desain	-1.500.000	33.33	-499.950
10	Pekerja tidak masuk	-750.000	66.67	-500.025
11	Kesalahan perhitungan pada kontruksi baja	-2.000.000	33.33	-666.600
12	Kecelakaan kerja	-1.000.000	33.33	-333.300
13	Peralatan ruksak	-1.000.000	33.33	-333.300
14	Kualitas material buruk	-1.250.000	33.33	-416.625
15	Kesalahan mengukur dan memotong keramik	-500.000	33.33	-166.650
16	Barang yang dipesan tidak sesuai	-900.000	33.33	-299.970

Costs that are caused or caused by these risks can be seen in table 3 above. The result of the emv is a reference for evaluating the risks that have occurred so far. So that the company is required to pay the amount of money in accordance with the figures obtained if one of the risks occurs in a project. So the company must allocate a fund to be able to handle if there is a risk. [10]

3.4. Functional Needs Analysis

In building a project scheduling and risk management information system at CV. Ardecon Multi Design uses modeling that is structured ERD analysis of the system to be built which can be seen in Figure 3.

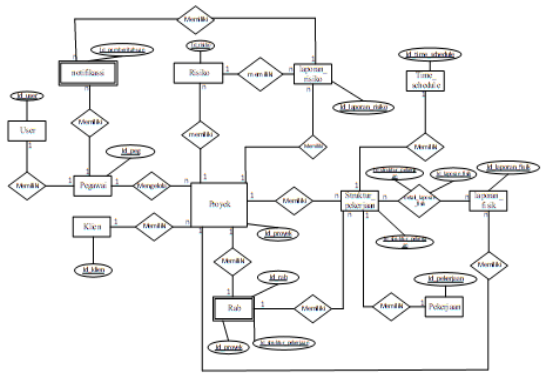

Figure 2. *ERD*

The context diagram of the system to be built can be seen in Figure 4.

Figure 3. *Diagram Konteks*

Level 1 DFD of the system to be built can be seen in Figure 5

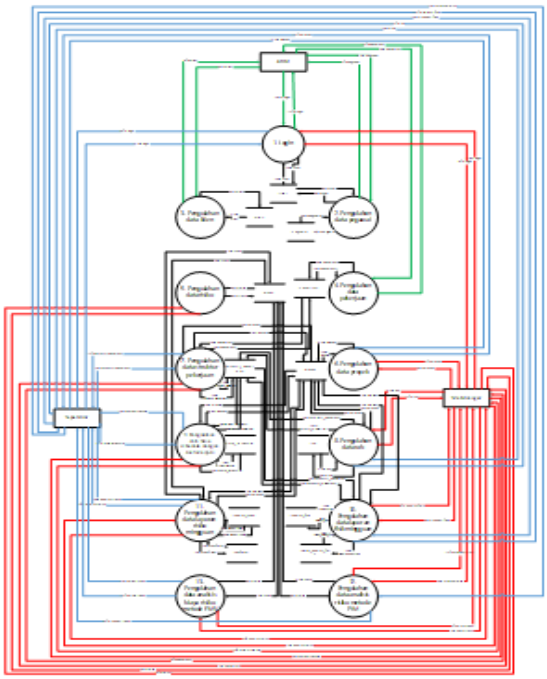

Figure 4. *DFD Level 1*

3.5. Design

Designing is a definition of functional requirements and is also a preparation for designing and building a system implementation or can be interpreted how to describe a system that will be formed. The following is a table of information system relations scheduling and project risk management at CV. Ardecon Multi Design is what can be seen in Figure 6.

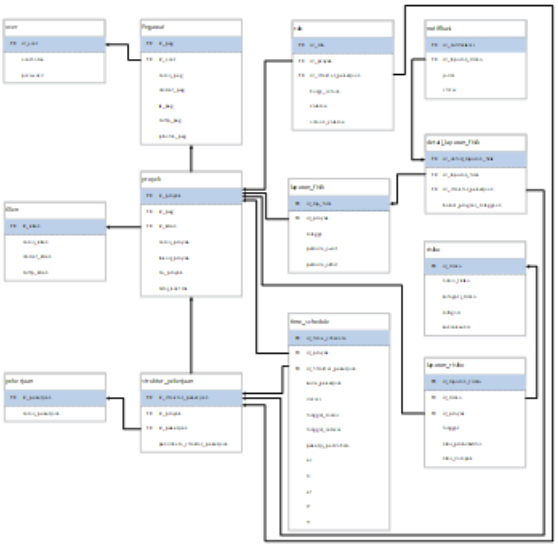

Figure 5. *Relation Table*

For an overview of the menu structure of the information system scheduling and risk management of the project at CV. Ardecon Multi Design which can be seen in Figure 7

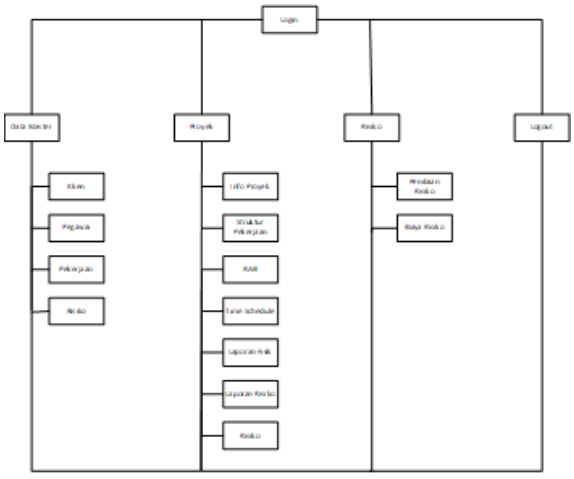

Figure 6. *Menu Structure*

3.6. Testing

Software testing that aims to evaluate all attributes or all capabilities of a program or system and can determine that software testing meets the results needed. The testing that has been done is by Black Box testing and beta testing.

Based on the results of black box testing that has been done with a test case that has been done before, it can be concluded that the data input from the entire scheduling information system and project risk management at Cv. Ardecon Multi Design has produced output data which is certainly expected, namely information about work that can be done together and on a critical path that cannot be postponed, further information is the level of risk interest and its mitigation and information on costs caused by these risks.

Based on the results of the answers that have been made with the speakers, namely ADM, Site Manager, and Supervisor at CV. Ardecon Multi Design can be concluded that:

a. ADM can easily manage employee, client and work data.

b.Site Manager can easily manage project management data starting from structuring work, making rab, scheduling, risk management and weekly physical and risk reports.

c.Supervisors can easily get information about all project management and can manage weekly risk reports.

3.7. Interface Implementation

The following are some forms of system interface visualization that have been built and can be seen in Figure 8, Figure 9, Figure 10 and Figure 11.

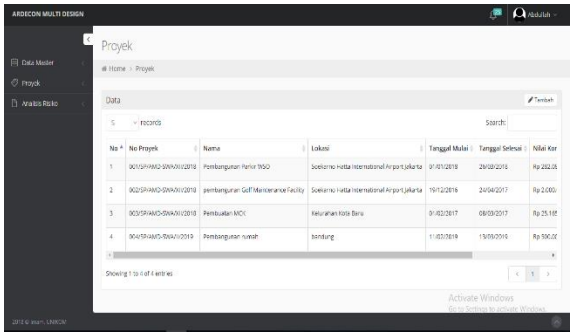

Figure 7. *Interface Project*

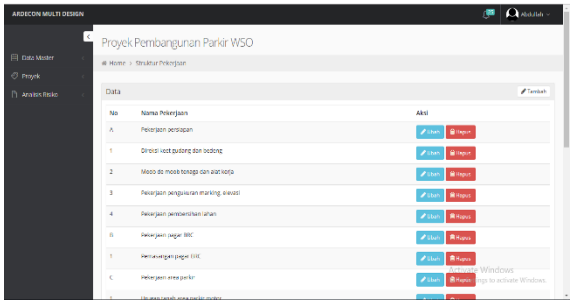

Figure 8. Interface *Structure Work*

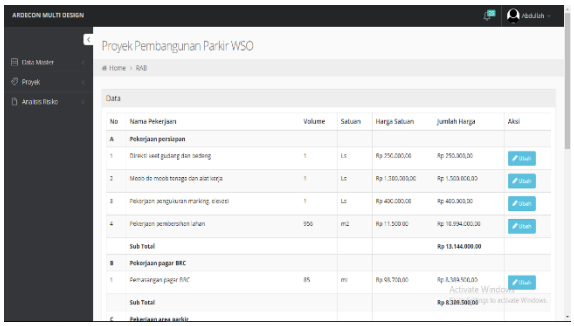

Figure 9. *Interface RAB*

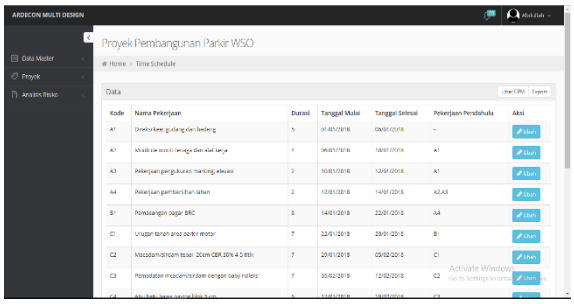

Figure 10. *Interface Time Schedule*

4. CLOSING

Based on the research and the results of testing that can be done on the Risk Management Scheduling and Management Information System Project at CV. Ardecon Multi Design, which can be concluded as follows:

1. *The system that was built can help Site Manager in making schdeule time, where previously there was often a delay in project work due to not knowing which jobs were on the critical path. This system will provide information on work that can be done simultaneously and work that is on a critical path whose meaning must not be missed and must take precedence in the form of work diagram images which show work that is on the critical path meaning cannot be missed which is marked with a red line. The result of this system output is that it can print a new schedule but cannot yet be translated into a gant chart.*
2. *The system built can help Site Managers where previously the site manager still had difficulties in handling the risks that occurred. So that the system will provide information in determining the risks prioritized based on their level and mitigation. And the system will provide information on losses caused by the risks that occur. This system will also provide overall project risk evaluation information with the red mark being high, yellow is medium, and green is low.*

Based on the results of all system tests, we get suggestions that can be taken into consideration for the next, namely:

1. *The project risk scheduling and management information system is expected to have a forgotten password validation.*
2. *The project scheduling and risk management information system is expected to be able to print time schedule data in the form of a gant chart.*
3. *The project risk management and scheduling information system is expected to display project risk notifications from the supervisor's report to a clearer site manager and can go to the risk report page.*
4. *The project scheduling and risk management information system is expected to be able to calculate the company's profits on each project undertaken.*
5. *It is hoped that this project scheduling and risk management information system will be evaluated in terms of costs and time so that project monitoring can be easily carried out.*
6. *The project risk scheduling and management information system is expected to export and import data.*

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