PROJECT RISK MANAGEMENT INFORMATION SYSTEM IN CV. NOVETA SAMUEL

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ABSTRACT

CV. Noveta Samuel is a company engaged in construction services. In the implementation of the project, problems often occur, namely the Director has difficulty in dealing with emerging and difficult risks in mitigating risks that must be done because there is no prior risk planning, and the difficulty of evaluations that can control by calculating deviations from costs and time which results in cost overruns, so the Site Manager needs a solution so that the project that is done gets a match between the cost of expenditure and the planned one. Based on the current problems, a project risk management information system is needed at CV. Noveta Samuel. The aim is to help risk planning using the Probability and Impact Matrix (PIM) and Expected Monetary Value (EMV) methods and for the evaluation phase and to be able to control the cost and time deviations during project implementation using the Earned Value Management (EVM) method. The results of the research achieved, it was concluded that this system has assisted in risk planning by being able to analyze the risks that might occur during project implementation, displaying the results of a high and low risk and providing information on appropriate mitigation actions and costs that must be used in handling those risks, and evaluation carried out can display the results of the calculation of irregularities in the event of a discrepancy between the cost and time of the project.

Keywords: Project Management, Risk, Control, Probability Impact Matrix, Expected Monetary Value, Earned Value Management.

1. INTRODUCTION

CV. Noveta Samuel is a company engaged in construction services, especially in the field of development, including planning, implementing, leasing buildings, bridges, roads, irrigation water, civil engineering, and others. Located on Jl. No.204K Urban Village of Cimahi City CV. Noveta Samuel has completed several construction project works.

Based on the results of interviews with Mr. Gerhard Pardede as Managing Director of CV. Noveta Samuel stated that currently the company does not have a risk record so that during the project implementation it is often difficult to deal with emerging risks and difficult in mitigating the risks that must be done due to the absence of prior risk planning. At present, mitigation is only based on previous experience, so that errors often occur in dealing with the results of delays in project implementation for the following week and even causing losses in terms of costs as happened in one of the projects carried out, namely Arrangement of Jalan Aruman Cimahi which has excess costs where the cost previously budgeted is Rp. 1,764.xxx.xxx, but the implementation of costs that exceed the planned amount is Rp. 1,819.xxx.xxx.

Based on the recapitulation of data on the schedule for the implementation of the Aruman Cimahi Road Arrangement project, the cost overruns caused by constraints on work on the 2nd and 3rd weeks of the 2nd month, the K-250 concrete excavation and structural work channel where there are some risks, namely bad weather, landslides in earthworks, miscalculations in steel construction, labor cannot attend, and repetition of work which results in increased expenditure from the plan because it requires spending twice or more for the same work.

Next, in an interview with Mr. Gerhard Pardede as Managing Director of CV. Noveta Samuel, he also added that the mismatch between planned expenditure and project costs is because when risks occur, it is difficult to take control measures for the costs and time that will be used for the next work phase, because currently evaluating project costs and time comparing between actual costs and plan costs, so that it creates a problem of recurring cost overruns on each project job because there are no control measures that can calculate deviations from time and costs. Therefore Site Manager in charge of evaluating the course of the project requires a solution to answer the problems that often occur in controlling the cost and time of the project, so that the project work gets a cost between planned costs, so that if the solution to the problem is reached can minimize the occurrence of excess costs that cause loss for the company.

Based on the problems described, a risk management information system project is needed at CV. Noveta Samuel to be able to analyze the risks that may occur during project implementation, find out high and low risks and provide information on appropriate mitigation actions that must be done using Probability and Impact Matrix (PIM) and Expected Monetary Value (EMV) methods. to help calculate the costs used in dealing with risk [1]. While at the evaluation stage and to find out the swelling of costs that arise during project implementation using the Earned Value Management (EVM) method.

2. RESEACRH STAGE

The stages of research in the construction of the Project Risk Management Information System at CV. Noveta Samuel can be seen in Figure 2.1.
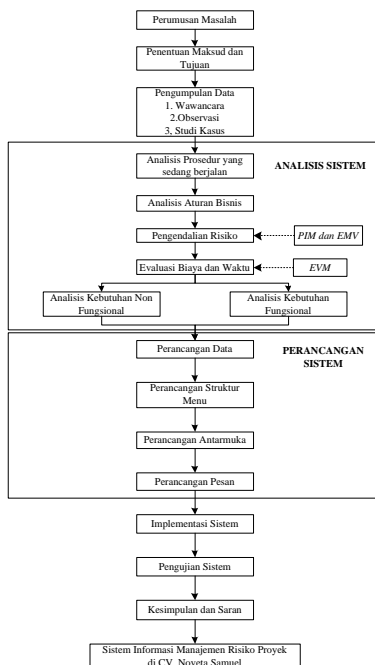

Figure 2.1 Research Stage

3. LITERATURE REVIEW

3.1. Definition and Basic Concepts of Information Systems

According to Robert A. Leitch and K. Roscoe Davis Information systems, namely a system in an organization wherein it includes, among others, the needs of daily transaction processing, which also supports operations, is managerial and acts as a strategy and provides elements or parties from outside with various reports needed. [2]

3.1. Project Management

Project Management is the application of science, as well as expertise, skills, and also the best technical means with limited resources so that it can achieve the targeted goals and objectives to also get optimal results in terms of cost performance, quality and time and work safety. [3]

3.2. Project Risk Management

Risk Management is defined by Wideman as a cumulative effect of uncertain event opportunities, affecting project goals and objectives. The purpose of own risk management is to minimize losses from risks and increase opportunities or opportunities. Basically, risk management is prevention against efforts to incur losses or accidents. [3]

3.3. Probability Impact Matrix (PIM) Method

Probability Impact Matrix (PIM) is a developing risk approach using two criteria to measure risk, namely:
a. Probability or possibility, which means that the possibility that a risk will occur.
b. Impact or impact, namely the impact on the project if the risk occurs.

PIM is a matrix that is built on the process of providing a level of risk (very low, low, medium, high, and very high) to the risk as measured by a combination of probability and impact scales. [1]
The PIM calculation formula:

$$Risk\ Score\ =\ Probability\ *\ Impact$$

Where :
Risk Score   = Level of risk importance.
Probability   = Possible risk will occur.
Impact   = Impact if the risk occurs.

The general description of grouping and the level of risk importance with the PIM method refers to Figure 3.1 below.

Figure 3.1 Map Risk Probability Impact Matrix

3.4. Expected Monetary Value (EMV) Method

The method of Earn Monetary Value (EMV) is a statistical concept analysis method that calculates the average expenditure in the future that may or may not occur. Positive EMV values indicate opportunities, while negative EMV values indicate a threat or threat that can harm the company. EMV is calculated by multiplying the probability value of each risk multiplied by the possibility of money issued when the risk occurs. [4]

3.5. Earned Value Management (EVM) Method

Earned Value is a technique in project management that measures project performance objectively and gives a warning as early as possible if there are performance problems. EV measures the performance and progress of the project through integrated management with three important elements in the project, namely cost, scheduling and scope, in conclusion Earned Value provides a performance index of cost and time, and for completeness of project estimates. [4]

Basic elements in performance analysis with EVM include PV (Planned Value), EV (Earned Value), and AC (Actual Cost). While for EVM calculations, namely calculating SV (Schedule Variance), CV (Cost variance), SPI (Schedule Performance Index), CPI (Cost Performance Index), ETC (Estimate To Complete), and EAC (Estimate At Completion).

4. RESULT AND DISCUSSION

4.1. Risk Analysis with PIM

The stages in risk analysis using the PIM method refer to the journal published by Ultima InfoSys and made by Sufa'atin in 2017 entitled "Implementation of Probability Impact Matrices (PIM) to Identify Possible and Impact of Project Risks" Vol. VIII [5]. The following stages in risk analysis can be seen in Figure 4.1
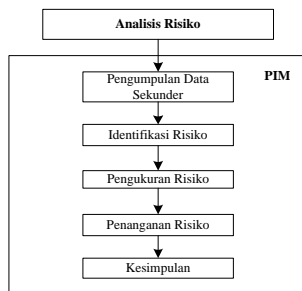

Figure 4.1 Flow of Project Risk Analysis

4.1.1 Risk identification

The results of the risk identification process carried out by conducting literature studies (journals and relevant research) and by approaching discussions and interviews with the company, namely Mr. Gerhard Pardede as the Managing Director at CV. Noveta Samuel can be seen in Table 4.1.

Table 4.1 Risk Identification Recap

Kode Risiko	Jenis Risiko	Risiko
R1	Estimasi	Jadwal tidak sesuai dengan rencana
R2		Biaya tidak sesuai dengan rencana
R3	Eksternal	Faktor cuaca yang buruk
R4		Kerusakan dan kehilangan material dan perlengkapan peralatan
R5		Kenaikan harga material
R6		Terlambatnya pengiriman bahan baku
R7		Terlambatnya pengiriman alat penunjuang kinerja proyek
R8		Kualitas material buruk
R9	Personal	Tenaga kerja ada yang berhalangan hadir
R10		Tenaga kerja kurang memahami rancangan yang dibuat oleh tenaga ahli
R11		Tenaga kerja SDM yang kurang terampil
R12		Tenaga kerja ada yang resign
R13	Alat Penunjang	Kesulitan menggunakan alat yang tidak dapat diprediksi sebelumnya
R14	Keselamatan Tenaga Kerja	Kecelakaan tenaga kerja
R15	Operasional	Longsornya galian
R16		Kesalahan perhitungan pada kontruksi baja
R17		Kesalahan dalam membuat patok pokok/utama
R18		Pemadatan tanah kurang maksimal
R19		Pengulangan pekerjaan

4.1.2 Risk Measurement

Risk measurement using the PIM method aims to determine the relative importance of a risk by multiplying the probability value and the impact of a risk which is then mapped from each risk to the risk matrix.

The results of the assessment and level of interest in risk can be seen in Table 4.2 and mapping the risk matrix in Figure 4.2.

Table 4.2 Interest Rates

Kode Risiko	Probabilitas	Dampak	Tingkat Kepentingan
R1	0.7	0.4	0.28
R2	0.7	0.8	0.56
R3	0.5	0.2	0.1
R4	0.3	0.1	0.03
R5	0.5	0.2	0.1
R6	0.5	0.2	0.1
R7	0.5	0.2	0.1
R8	0.3	0.2	0.06
R9	0.5	0.2	0.1
R10	0.1	0.1	0.01
R11	0.3	0.1	0.03
R12	0.5	0.2	0.1
R13	0.1	0.05	0.005
R14	0.5	0.2	0.1
R15	0.5	0.2	0.1
R16	0.1	0.1	0.01
R17	0.3	0.1	0.03
R18	0.3	0.1	0.03
R19	0.7	0.8	0.56

Figure 4.2 Risk Matrix

4.2. Risk Cost Analysis with EMV

Risk cost analysis is conducted in order to determine the amount of costs that must be incurred by the company in handling a risk. Where for the analysis of risk costs carried out quantitatively that is using the EMV method. At this stage identified risks that affect costs during project implementation, which can be seen in Table 4.3

Table 4.3 Identification of Project Risks to Costs

Jenis Risiko	Risiko
Estimasi	Jadwal tidak sesuai dengan rencana
	Biaya tidak sesuai dengan rencana
Eksternal	Faktor cuaca yang buruk
	Kerusakan dan kehilangan material dan perlengkapan peralatan
	Kenaikan harga material
	Kualitas material buruk
Personal	Tenaga kerja ada yang berhalangan hadir
	Tenaga kerja SDM yang kurang terampil
	Tenaga kerja ada yang resign
Keselamatan Tenaga Kerja	Kecelakaan tenaga kerja
Operasional	Longsornya galian
	Kesalahan perhitungan pada kontruksi baja
	Pengulangan pekerjaan

To be able to find out the results of the EMV calculation, the calculation formula that is used refers to the formula as follows.

$$EMV = Probabilitas * Konsekuensi$$

Where :
EMV : Expected value for money
Probability : The frequency of risk events
Consequences : Costs or other compensation that must be incurred

The results of the EMV calculation can be seen in Table 4.4

Table 4.4 EMV Calculation Results

Jenis Risiko	Risiko	Proba bilitas (%)	Konsekuen si dan Biaya (Rp.)	EMV (Rp.)
Estimasi	Jadwal tidak sesuai dengan rencana	40	12,xxx,xxx	-4,xxx,xxx
	Biaya tidak sesuai dengan rencana	50	17,xxx,xxx	-8,xxx,xxx
Eksternal	Faktor cuaca yang buruk	70	7,xxx,xxx	-5,xxx,xxx
	Kerusakan dan kehilangan material dan perlengkapan peralatan	30	3,xxx,xxx	-900,xxx
	Kenaikan harga material	20	1,xxx,xxx	-200,xxx
	Kualitas material buruk	30	1,xxx,xxx	-300,xxx
Personal	Tenaga kerja ada yang berhalangan hadir	40	500,xxx	-200,xxx
	Tenaga kerja SDM yang kurang terampil	30	1,xxx,xxx	-300,xxx
	Tenaga kerja ada yang resign	20	1,xxx,xxx	-200,xxx
Keselamatan Tenaga Kerja	Kecelakaan tenaga kerja	40	1,xxx,xxx	-400,xxx
Operasional	Longsornya galian	20	3,xxx,xxx	-600,xxx
	Kesalahan perhitungan pada kontruksi baja	30	1,xxx,xxx	-300,xxx
	Pengulangan pekerjaan	40	15,xxx,xxx	-6,xxx,xxx

4.3. Risk control

Based on a series of stages in risk management analysis, the output of the results of the application of risk management in the Project Risk Management Information System at CV. Noveta Samuel is a system capable of printing reports with risk control which is an addition based on the reporting system that runs on CV. Noveta Samuel.

Figure 4.3 Project Report

4.4. Analysis of Project Control with EVM

Project control analysis is useful for controlling the costs and time of the project being worked on. In this study the method used was EVM. EVM is a

method used to determine the progress of a project that is bigger or smaller than the budget that should be and is faster or slower than the schedule that should be [6].

In order to be able to analyze the progress of project implementation using the EVM method we need weekly plan weight data and weekly realization weight data that can be seen in Table 4.5 and Table 4.6 of the West Java Regional Police SPN Dojo Construction project T.A. 2018.

Table 4.5 Project Work Plan

No.	Pengerjaan	Bobot %
1	Minggu ke-1	0.10
2	Minggu ke-2	2.73
3	Minggu ke-3	7.55
4	Minggu ke-4	8.48
5	Minggu ke-5	7.46
6	Minggu ke-6	5.48
7	Minggu ke-7	4.66
8	Minggu ke-8	4.77
9	Minggu ke-9	16.20
10	Minggu ke-10	21.90
11	Minggu ke-11	11.21
12	Minggu ke-12	6.35
13	Minggu ke-13	3.12
Total Bobot		**100.00**

Table 4.6 Project Progress

No.	Pengerjaan	Bobot %	Actual Cost (AC) (Rp.)	Original Time Estimate
1	Minggu ke-1	0.10	1,xxx,xxx	13 Minggu
2	Minggu ke-2	2.73	42,xxx,xxx	13 Minggu
3	Minggu ke-3	7.55	118,xxx,xxx	13 Minggu
4	Minggu ke-4	6.48	134,xxx,xxx	13 Minggu
5	Minggu ke-5	7.46	117,xxx,xxx	13 Minggu
6	Minggu ke-6	6.48	87,xxx,xxx	13 Minggu
7	Minggu ke-7	4.66	73,xxx,xxx	13 Minggu
8	Minggu ke-8	5.27	74,xxx,xxx	13 Minggu
9	Minggu ke-9	12.20	250,xxx,xxx	13 Minggu
10	Minggu ke-10	21.00	343,xxx,xxx	13 Minggu
11	Minggu ke-11	13.11	178,xxx,xxx	13 Minggu
12	Minggu ke-12	8.15	101,xxx,xxx	13 Minggu
13	Minggu ke-13	4.81	50,xxx,xxx	13 Minggu
Total Bobot		**100.00**	1,xxx,xxx,xxx	13 Minggu

4.4.1 Variant Analysis

Variant analysis contains calculations to determine Planned Value (PV), Earned Value (EV), Cost Variance (CV), Scheduling Variance (SV).

Table 4.7 Value of PV, EV, CV and SV

No.	Pengerjaan	Analisa Varian			
		PV (Rp.)	EV (Rp.)	CV (Rp.)	SV (Rp.)
1	Minggu ke-1	1,499,857	1,499,857	857	0
2	Minggu ke-2	42,797,154	42,797,154	0	0
3	Minggu ke-3	118,417,333	118,417,333	332	0
4	Minggu ke-4	133,104,938	101,722,472	-32,382,466	-31,382,466
5	Minggu ke-5	117,018,328	117,018,328	0	0
6	Minggu ke-6	86,010,036	101,701,269	14,391,269	15,691,233
7	Minggu ke-7	73,157,215	73,157,215	0	0
8	Minggu ke-8	74,780,632	82,692,170	7,911,539	7,911,539
9	Minggu ke-9	254,175,719	191,410,786	-58,764,933	-62,764,933
10	Minggu ke-10	343,612,134	329,521,407	-14,090,727	-14,090,727
11	Minggu ke-11	175,961,672	205,775,015	26,815,015	29,813,343
12	Minggu ke-12	99,569,128	127,883,487	26,323,267	28,314,360
13	Minggu ke-13	49,019,177	75,537,361	25,518,184	26,518,184

4.4.2 Job Index Analysis

Performance Index Analysis has a cost performance index (CPI) and time performance index or schedule performance index (SPI).

Table 4.8 Value of CPI and SPI

No.	Pengerjaan	CPI	SPI
1	Minggu ke-1	1.00	1.00
2	Minggu ke-2	1.00	1.00
3	Minggu ke-3	1.00	1.00
4	Minggu ke-4	0.76	0.76
5	Minggu ke-5	1.00	1.00
6	Minggu ke-6	1.16	1.18
7	Minggu ke-7	1.00	1.00
8	Minggu ke-8	1.11	1.11
9	Minggu ke-9	0.77	0.75
10	Minggu ke-10	0.96	0.96
11	Minggu ke-11	1.15	1.17
12	Minggu ke-12	1.26	1.28
13	Minggu ke-13	1.51	1.54

4.4.3 Analysis of Estimated Cost and Time of Project Completion

Estimated Cost and Time Analysis of Settlement done by looking for cost estimation or Estimate at Completion (EAC) and the estimated duration of the project completion or Estimated Time to Complete (ETC).
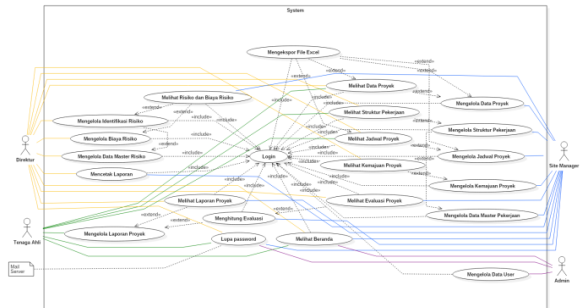
Table 4.9 EAC and ETC values

No.	Pengerjaan	EAC (Rp.)	ETC (Minggu)
1	Minggu ke-1	1,568,227,049	13
2	Minggu ke-2	1,569,123,321	13
3	Minggu ke-3	1,569,118,917	13
4	Minggu ke-4	2,068,640,119	17
5	Minggu ke-5	1,569,123,321	13
6	Minggu ke-6	1,347,084,056	11
7	Minggu ke-7	1,569,123,321	13
8	Minggu ke-8	1,418,998,107	12
9	Minggu ke-9	2,050,859,113	17
10	Minggu ke-10	1,636,220,901	14
11	Minggu ke-11	1,364,647,259	11
12	Minggu ke-12	1,246,138,295	10
13	Minggu ke-13	1,039,038,906	8

Table 4.10 Recapitulation of Analysis of EVM Methods

Minggu ke-	AnalisaVarian		Analisa Indeks Kerja		Analisa Estimasi	
	Waktu	Biaya	Waktu	Biaya	Waktu	Biaya
	SV (Rp.)	CV (Rp.)	SPI (Rp.)	CPI (Rp.)	ETC (Minggu)	EAC (Rp.)
1	0	857	1.00	1.00	13	1,568,227,049
2	0	0	1.00	1.00	13	1,569,123,321
3	0	332	1.00	1.00	13	1,569,118,917
4	-31,382,466	-32,382,466	0.76	0.76	17	2,068,640,119
5	0	0	1.00	1.00	13	1,569,123,321
6	15,691,233	14,391,269	1.18	1.16	11	1,347,084,056
7	0	0	1.00	1.00	13	1,569,123,321
8	7,911,539	7,911,539	1.11	1.11	12	1,418,998,107
9	-62,764,933	-58,764,933	0.75	0.77	17	2,050,859,113
10	-14,090,727	-14,090,727	0.96	0.96	14	1,636,220,901
11	29,813,343	26,815,015	1.17	1.15	11	1,364,647,259
12	28,314,360	26,323,267	1.28	1.26	10	1,246,138,295
13	26,518,184	25,518,184	1.54	1.51	8	1,039,038,906
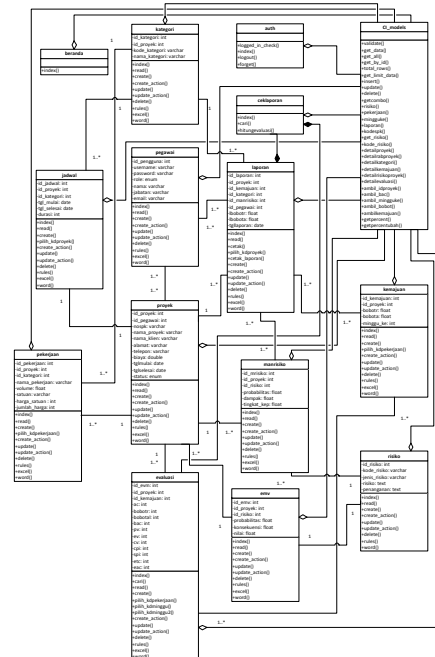
Based on the results of the project performance recapitulation (analysis of variance, performance index, and estimation) using the EVM method, the data is obtained as follows:
Total Planned Time = 13 Weeks
BAC = 1,569,123,321
PV = 1,569,123,321
AC = 1,573,411,518
CV = -4,288,197
Estimated remaining cost of settlement = 1,569.123,321 - 1,573,411,518 = -4,288,197

Project for the Construction of the West Java Regional Police SPN Dojo 2018 has a project completion fee known to be Rp. 4,288,197, meaning that the cost of completing the project exceeds the planned cost.

4.5. Functional Needs Analysis

Analysis of functional requirements in the form of use case diagrams can be seen in Figure 4.4

Figure 4.4 Use Case Diagram

For class diagrams can be seen in Figure 4.5.

Figure 4.5 Class Diagram

4.6. Data Design

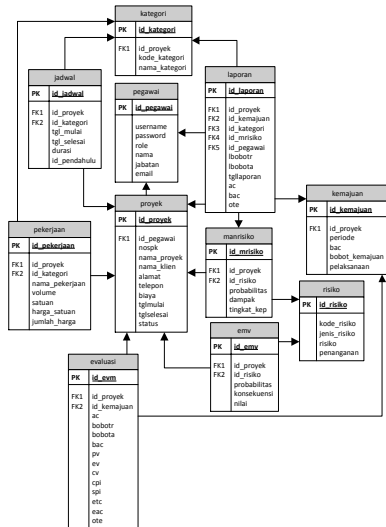Designing data in the form of a relation scheme can be seen in Figure 4.6.

Figure 4.6 Relation Scheme

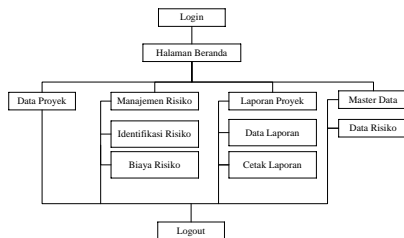## 4.7. Designing Menu Structure

a. Director's menu structure

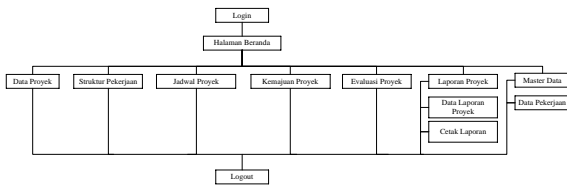**Figure 4.7 Director's menu structure**

b. Site Manager's menu structure

Figure 4.8 Site Manager's menu structure

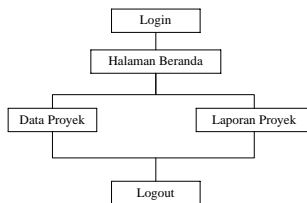c. Tenaga ahli*'s menu structure*

Figure 4.9 Tenaga Ahli*'s menu structure*
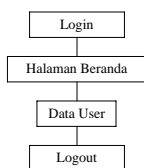
d. Admin's menu structure

Figure 4.10 Admin's menu structure

4.8. Implementation and Testing

Implementation is a series of steps carried out to apply the results rather than the designs that have been carried out in the previous stage.

Table 4.10 Hardware used

No	Perangkat Keras	Spesifikasi
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 4.11 Software used

No	Perangkat Lunak	Spesifikasi
1	Sistem Operasi	*Windows 7*
2	*Web Browser*	*Mozila 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

4.9. Conclusion of Blackbox Testing

Based on the results of the blackbox system testing that has been carried out as a whole, it can be concluded that the process of implementing the project risk management information system at CV. Noveta Samuel in the system functionality has been able to answer the problems that exist in the company at this time, namely the system can assist the President Director in carrying out risk management for project implementation and with the implementation of the EVM method that functions as a time and cost manager that helps Site Manager in controlling the course of the project, in order to minimize the loss and mismatch on the cost of the plan and the final cost of the project.

4.10. Conclusion of Beta Testing

Based on the results of beta testing, it can be concluded that the project risk management information system at CV. Noveta Samuel is in accordance with the expected goals.

a. The system built has been able to facilitate the Director's part in controlling all project activities. Doing risk management and receiving report information is easier and the system interface is good enough.

b. The system built has been able to facilitate the Site Manager part in managing project data, such as job data, project schedule data, and in receiving weekly reports from experts. Knowing progress and evaluating projects is easier and faster, and with the feature of printing minutes that makes it easy, but needs to be further developed in terms of entering data to be more efficient and scheduling can be maximized.

c. The system that was built has been able to facilitate the Expert Staff in the management

and the process of sending the project weekly report to the boss and the system interface is quite good and interesting.

d. *The system that was built has been able to facilitate the Admin section in managing the data of project employee users who will use the system. The system created also helps minimize operational errors even though it has a simple but easy to use display.*

5. CLOSING

Based on the results obtained in this thesis research, it can be concluded that the system built has been able to assist the Director in carrying out risk planning with the risk recording feature in the system which is the application of the PIM method, which can also help calculate the level of each risk and provide information on handling actions that have been identified. Then EMV that helps calculate the costs that will be used in dealing with these risks. So that the main results of this risk planning can be used as a reference for the Director during project implementation. Then the system built can also help Site Managers to control the running of the project in terms of cost and time, with the EVM method of evaluation being carried out can calculate the time and cost deviations from the project, so that if there is a discrepancy between the costs incurred and planned can be known directly.

Based on the results of the tests that have been carried out on the system, it can be obtained suggestions that can be developed and need to be maintained in the display interface, such as work structure data so that available display features per job category make it easier for users to read work structure data and expected can be added to the management of the List of Raw Material Prices, List of Rental Equipment Prices, List of Labor Prices, which is then carried out price analysis in the Work Unit Price Analysis before going to the Budget Plan (RAB).

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