# SISTEM INFORMASI MANAJEMEN PROYEK DI CV. SEKAR

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## ABSTRAK

Maintained by the project management CV. SEKAR has several problems, include the monitoring of the execution of the project does not fit between the schedule of the plan with the realization of the project, the emergence of risks that negatively impact resulted in his late completion of the project and the swelling cost of its projects as well as the late reporting of the progress of the project. Then the necessary information systems that can solve the problem. To achieve the goal of the research is to facilitate the monitoring of the project implementation activities, manage the cost for handling risk, cost control of the project and accelerate the reporting of the progress of the project. Then the necessary information systems that can solve the problem. To achieve the goal of the research is to facilitate the monitoring of the project implementation activities, manage the cost for handling risk, cost control of the project and accelerate the reporting of the progress of the project. The methods used in the analysis of project management method Precedence Diagraming Method (PDM) for scheduling the project, the Expected Monetary Value (EMV) to calculate the cost of handling risks, as well as Earned Value Management (EVM) for ease in measuring the performance of the project. As for the software development methodology used waterfall. Based on the results of testing using blackbox, acquired the system functional conclusions can already produce the expected output so that management information systems projects being built already meets the objectives to be achieved.

*Keywords: Information Systems Project Management, Earned Value Management, Precedence Diagraming Method, Expected Monetary Value*.

## 1. PENDAHULUAN

CV. SEKAR is a company engaged in construction services include the areas of development, developers, planning, execution of the construction.

implementation activities in doing the project manager often occurs a schedule mismatch between plans and realization in the field that can lead to an implementation time and swelling costs of project completion so that becomes obstructed. As in an irrigation network improvement project workmanship village Cijambe on that data in the 8th week project has experienced delays so that the impact to the workmanship of the work subsequently became disturbed. His neglected risks are likely to negatively impact or affect on the implementation of the project, such as delays in materials needed to cause delay in the work on the project, materials that are not good or not in accordance with the required result in additional time and cost that must be removed. The above risk factors resulting in the workmanship of projects experienced delays in the schedule where the workmanship not in accordance with the schedule planned before, regarding the expenditure of work that are experiencing delays exceeding predetermined weighting, thereby affecting the estimated project cost and time, in addition to cost control and the time performed a traditional only compare between actual cost and the cost of the plan alone, the impact of the budget issued does not match the deeds. Terlambatnya reporting progress by implementing the project, because the process of reporting the progress done recap every month to report to the Director.

Of these factors gave a big impact to the company, where the company experienced financial losses. The addition of project work time will be penalized fines against any day of delay in completion of the work specified in the contract for the project. It also became the name of the company is not good in the eyes of the organizers of the project.

Based on problems that have been described above, then to overcome these problems required a system of information management project that aims to:

a. Help in the implementation of project activities in order to monitor the project goes according to plan.
b. help to find out the cost for handling risks-risks that occur.
c. assist in the project in the budget in order to monitor project costs incurred in accordance with the plan.

d. assist in reporting progress in accelerating the work.

Here is the methodology used in this study, can be seen in Figure 1:

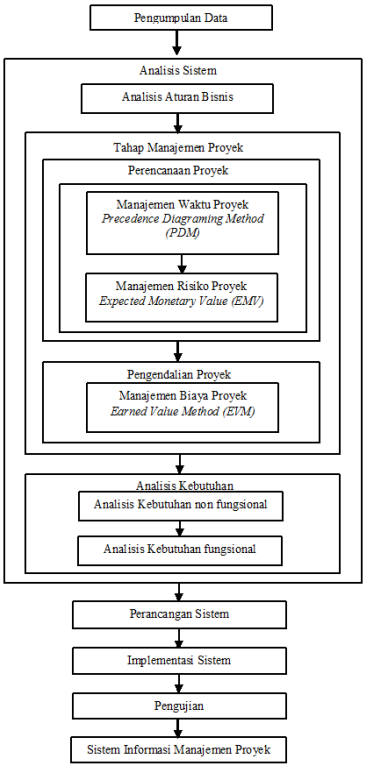



**Figure 1.** Research Methodology

## 2. REVIEW OF THE LITERATURE

### 2.1 Information System

Information system is a system in an organization to meet the needs of daily transaction processing, supporting the operation, activities and strategies of the managerial nature of an organization and provides a certain outside parties with the necessary reports [1].

### 2.2 Project Management

Project management is a science about leading organizations comprising the activities of planning, organizing, implementing and controlling towards sources of limited resources in an attempt to achieve the goals and objectives effective and efficient [2].

### 2.3 Scheduling Project

Scheduling the project was elaboration of planning the project becomes the order of the steps of the implementation of the work has entered the time factor to achieve a goal [3].

### 2.4 Risk Management

According to Wideman, the risk in risk management project is the effect of calculate of the incident uncertain opportunities, that affect the goals and objectives of the project. The scientific risk is defined as the combination of a function of the frequency of occurrence, the probability and consequences of hazards risks occured [4].

Monetery expected Value (EMV) is the concept of statistics to calculate the average results of the future events that occur in the scenario nor does not occur in the scenario. Here are the formulas of Expected Monetery Value [5].

EMV = Probabiltas x Konsekuensi**.....(1)**

### 2.5 Earn Value Method (EVM)

EVM method or method of the value of the result is a concept of cost budget calculations in accordance with the work that has been completed. (Budget Cost Of Works Performed). In other words, the concept of measuring the magnitude of a unit of work that has been completed, at a certain time, when judged on the amount of the budget available for the job. For that would later be known the connection between physically has achieved against the amount of the budget that had been issued [6].

## 3. ANALYSIS AND DESIGN

### 3.1 Case Study

a case study of the project budget plan contains cost and time to the project improvement of the irrigation network located in Subang Regency Cijambe village. The time of project implementation that is 120 calendar days at the start of December 19, s/d 17 April 2017, with the implementation of the budget of Rp. 342,125,000.00

#### 3.1.1 Budget Plan Cost

Budget plan costs is the cost of the planned increase of project work on irrigation network Cijambe village. The following budget plan cost can be seen in table 1.

**Table 1.** Budget Plan Cost

| Kode Kegiatan | Uraian Pekerjaan | Harga Pekerjaan |
|---|---|---|
| I.1 | Pek. Kistdam pasir/tanah | 685.260,00 |
| I.2 | Pek. Pemb. Papan proyek | 198.000,00 |
| II.1 | Pek. Galian tanah | 8.744.310,74 |
| II.2 | Pek. Pasangan batu | 244.723.902,05 |
| II.3 | Pek. Plesteran tebal 1,5 | 56.083.196,61 |
| II.4 | Pek. Timbunan tanah | 588.178,56 |

### 3.2 Analysis Project Management

The analysis of the project management time management contains a risk management and cost management undertaken by CV. SEKAR. In this case for the time management method using Predence Diagramming Method (PDM), management method using Expected Monetary Value (EMV), as well as for cost management using Earn Value Management (EVM).

### 3.1.2 Project Schedule Planning

Planning the project schedule is a job description which contained the initial time and the end time of a job. The following details the structure of the work can be seen in table 2.

**Table 2.** Project Schedule Planning

| Kode | Uraian Pekerjaan | Mulai | Selesai |
|---|---|---|---|
| I.1 | Pek. Kistdam pasir/tanah | 19/12/2016 | 25/12/2016 |
| I.2 | Pek. Pemb. Papan proyek | 19/12/2016 | 20/12/2016 |
| II.1 | Pek. Galian tanah | 26/12/2016 | 22/01/2017 |
| II.2 | Pek. Pasangan batu | 26/12/2016 | 19/02/2017 |
| II.3 | Pek. Plesteran tebal 1,5 | 20/02/2017 | 26/03/2017 |
| II.4 | Pek. Timbunan tanah | 27/03/2017 | 17/04/2017 |

Precedence Diagramming method (PDM) is one of the techniques of scheduling scheduling technique include networking planning or plan network nodes so that activities focusing on the PDM is sometimes also referred to as activity on nonde (AON) [4]. Here's a network can be seen in Figure 2.

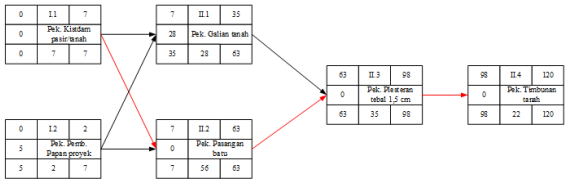



**Figure 2.** PDM Network

From the results of the calculation of the network project, obtained a job that has a slack job I.2, II.1 33 days and obtained critical path I.1, II.2, II.3 and II.4 where the work is on the critical path (red lines) should not be too late.

### 3.2.2 Risk Project Management

Risk management process has several stages, namely identifying risks, determine the value of the likelihood and impact of risks as well as handling against the risk. The following are the stages for risk identification, risk assessment and responses using Expected Monetary Value (EMV)[5].

#### 3.2.2.1 Identification Risk

Risk management process begins with the identification of risks purposed to identify and make a list of the risks that may occur. The process of identifying risks is carried out by means of direct interviews with project manager CV SEKAR. Following the results of the identification of the risk can be seen in table 3.

**Tabel 3.** Identification Risk

| Kode Risiko | Deskripsi Risiko |
|---|---|
| R2 | Hilangnya barang material |
| R4 | Kecelakaan kerja |
| R6 | Keterlambatan pengerjaan proyek |

#### 3.2.2.2 Determine The Cost Of Risk

Assessment of the probability and the consequences are obtained with careful discussion with project manager CV SEKAR results from interviews and discussions can be seen in table 4 and table 5, where in the table shows the value of probability and consequence.

**Table 4.** The Value Of The Probability

| Kode Risiko | Probabilitas |
|---|---|
| R2 | 75 % |
| R4 | 75 % |
| R6 | 50 % |

In table 4, a value probability obtained from interviews or discussions with the project manager, where the probability is obtained from the experience he has worked on projects for the inside.

**Table 5.** The Value Of The Consequen

| Kode Risiko | Konsekuensi |
|---|---|
| R2 | 3.000.000 |
| R4 | 4.000.000 |
| R6 | 5.000.000 |

In table 5, the value obtained with the consequences of the interview. The value of these consequences was the plan costs that the company must be issued for each risk.

After the value of the probability and the consequences have been obtained, and then dikukan the calculation of the individual risk of using EMV, can be calculated with the formula (1).

Following are the results of the calculations of risk assessment using EMV. Can be seen in table 6.

**Table 6.** The Results Value Of EMV

| Kode Risiko | Probabilitas | Konsekuensi | EMV |
|---|---|---|---|
| R2 | 75 % | 3.000.000 | 2.250.000 |
| R4 | 75 % | 4.000.000 | 3.000.000 |
| R6 | 50 % | 5.000.000 | 2.500.000 |

Calculation based on EMV in the table 6. There is the value or cost of each risk.

### 3.2.3 Analisis Monitoring Proyek

Analysis of the monitoring project contains an analysis of the evaluation of the project's budget. In this analysis the evaluation of a project using Earned value method (EVM) [6].

Weights are calculated using the following formula:

$$\textbf{Bobot} = \left(\frac{\textbf{Harga Pekerjaan}}{\textbf{Harga Total Pekerjaan}}\right) x\ \textbf{100\%}$$

The total price and the price of the work at the forefront of table 1. Here is a calculation of weight of work kistdam pasir/tanah dibungkus karung plastik bagor atau terpal uk 45x120 cm :

Harga Total Pekerjaan = Rp. 311.022.847,96
Harga Pekerjaan = Rp. 685.260,0011
Bobot =

$$\left(\frac{\mathbf{685.260,00}}{\mathbf{311.022.847,96}}\right)\boldsymbol{x}\ \mathbf{100}\%$$

= 0.22 %

**Table 7.** Weight Of Work Activities

| No | Nama Kegiatan | Bobot |
|---|---|---|
| 1 | Pek. Kistdam pasir/tanah | 0.22 |
| 2 | Pek. Pemb. Papan proyek | 0.06 |
| 3 | Pek. Galian tanah | 2.81 |
| 4 | Pek. Pasangan batu | 78.68 |
| 5 | Pek. Plesteran tebal 1,5 | 18.03 |
| 6 | Pek. Timbunan tanah | 0.19 |

Value method which can provide information on the progress of the project prosisi within a certain period and can predict the progress of projects in the next period. There are three indicators in the assessment of the results, the value method as follows:

1. BCWS (Budgeted Cost of Work Schedule)
2. BCWP (Budgeted Cost of Work Performed)
3. ACWP (Actual Cost of Work Performed)

A progress report is due to the forefront is done every week activities, therefore, the value of PV, EV and grouped per week.

### 3.2.3.1 The Calculation *Planned Value* (PV)

PV is the budgeted cost of work scheduled during a particular period and is set in the budget.

Here is the calculation of PV 1st week:

BAC = Rp. 311.022.847,96
Bobot PV = 0.28 %
PV = (% progres rencana) x BAC
= 0.28 % x 311.022.847,96
= Rp. 883.260,00

For the next week's PV calculation can be seen in Table 8..

**Table 8.** Analysis Calculation *Planned Value* (PV)

| Minggu | Bobot (%) | PV | |
|---|---|---|---|
| | | Mingguan (Rp.) | Kumulatif (Rp.) |
| Minggu ke-1 | 0,28 | 883.260,00 | 883.260,00 |
| Minggu ke-7 | 9,84 | 30.590.487,76 | 193.170.497,28 |
| Minggu ke-8 | 9,84 | 30.590.487,76 | 223.760.985,03 |
| Minggu ke-9 | 9,84 | 30.590.487,76 | 254.351.472,79 |
| Minggu ke-10 | 3,61 | 11.216.639,32 | 265.568.112,11 |

### 3.2.3.2 The Calculation *Earned Value* (EV)

EV is the value received from the completion of the work during a certain time period, this indicator shows the value results from the perspective of the value of the work that has been completed. The work is said to be completed, if the percentage of execution reaches 100%.

Calculation of the EV in week 1:
BAC = Rp. 311.022.847,96
Bobot EV = 0.28 %
EV = (% progres aktual) x BAC
= 0.28 % x 311.022.847,96
= Rp. 883.300

**Table 9.** Analysis Calculation *Earned Value* (EV)

| Minggu | Bobot (%) | EV | |
|---|---|---|---|
| | | Mingguan (Rp.) | Kumulatif (Rp.) |
| Minggu ke-1 | 0,28 | 883.300 | 883.300 |
| Minggu ke-7 | 9,84 | 30.590.500 | 193.170.700 |
| Minggu ke-8 | 7,87 | 24.472.400 | 217.643.100 |
| Minggu ke-9 | 8,85 | 27.531.400 | 245.174.500 |
| Minggu ke-10 | 5,84 | 18.150.500 | 263.325.000 |

### 3.2.3.3 The Calculation *Actual Cost* (AC)

Analysis of the Actual Cost actual cost is the amount of work that has been carried out. The AC value obtained on the basis of expenses from a job that has already been implemented.

**Table 10.** Analysis Calculation Actual Cost (AC)

| Minggu | AC | |
|---|---|---|
| | Mingguan (Rp.) | Kumulatif (Rp.) |
| Minggu ke-1 | 850.000 | 850.000 |
| Minggu ke-7 | 30.500.000 | 191.850.000 |
| Minggu ke-8 | 30.500.000 | 222.350.000 |
| Minggu ke-9 | 30.500.000 | 252.850.000 |
| Minggu ke-10 | 11.500.000 | 264.350.000 |

### 3.2.3.4 The Calculation Analysis Variance

Variant analysis done by searching for the value of the Cost Variance (CV), and Schedule Variance (SV). The calculation of CV obtained from EV minus AC, while the SV retrieved from EV minus the PV.
The calculation of CV in week 1:
EV = Rp. 883.300
AC = Rp. 850.000
CV = EV – AC
= Rp. 883.300 – Rp. 850.000
= Rp. 33.300

**Tabel 11.** Analisa Perhitungan *Cost Variance* (CV)

| Minggu | EV (Rp.) | AC (Rp.) | CV = EV – AC (Rp.) |
|---|---|---|---|
| Minggu ke-1 | 883.300 | 850.000 | 33.300 |
| Minggu ke-7 | 193.170.700 | 191.850.000 | 1.320.700 |
| Minggu ke-8 | 217.643.100 | 222.350.000 | -4.706.900 |
| Minggu ke-9 | 245.174.500 | 252.850.000 | -7.675.500 |
| Minggu ke-10 | 263.325.000 | 264.350.000 | -1.025.000 |

Based on table 11, earned value CV > 0 from week 1 to week 7, it is that the work was completed at a cost lower than planned, and in week 8 to week 10 value CV < 0, this showed greater spending.

Calculation of the SV in week 1:

EV = Rp. 883.300
PV = Rp. 883.300
SV = EV – PV
= Rp. 883.300 – Rp. 883.300
= 0

**Table 12.** Analysis Calculation *Schedule Variance* (SV)

| Minggu | EV (Rp.) | PV (Rp.) | SV = EV – PV |
|---|---|---|---|
| Minggu ke-1 | 883.300 | 883.300 | 0 |
| Minggu ke-7 | 193.170.700 | 193.170.700 | 0 |
| Minggu ke-8 | 217.643.100 | 223.761.200 | -6118100 |
| Minggu ke-9 | 245.174.500 | 254.351.700 | -9177200 |
| Minggu ke-10 | 263.325.000 | 265.568.300 | -2243300 |

Based on table 12, obtained the value of SV = 0 in week 1 to week 7, this indicates that the project work that is being carried out in compliance of the planned. week 8 until week 10 value SV < 0, this shows the level of job experience delays from the schedule.

### 3.2.3.5 Calculation Analysis Of Work Index

Analysis of the performance index is done by searching for the value of the Schedule Performance Index (SPI) and the Cost Performance Index (CPI). The calculation of SPI is obtained from the comparison between the EV with PV, while CPI is obtained from the comparison between the EV with AC.

The calculation of SPI in week 1:

EV = Rp. 883.300
PV = Rp. 883.300
SPI = EV/PV
= Rp. 883.300/ Rp. 883.300
= 1.000

**Table 13.** Analysis Calculation *Schedule Performance Index* (SPI

| Minggu | EV (Rp.) | PV (Rp.) | SPI = EV / PV |
|---|---|---|---|
| Minggu ke-1 | 883.300 | 883.300 | 1,000 |
| Minggu ke-7 | 193.170.700 | 193.170.700 | 1,000 |
| Minggu ke-8 | 217.643.100 | 223.761.200 | 0,973 |
| Minggu ke-9 | 245.174.500 | 254.351.700 | 0,964 |
| Minggu ke-10 | 263.325.000 | 265.568.300 | 0,992 |

Based on the table 13, SPI value in week 1 to week 7 the value of SPI = 1, show the projects planned in the schedule, while in week 8 to week 10 the value of SPI < 1, show that the work done is experiencing delays. Calculation of the CPI value as follows:

CPI calculations week 1::

EV = Rp. 883.300
AC = Rp. 850.000
CPI = EV/AC
= Rp. 883.300/ Rp. 850.000
= 1,039

**Tabel 14.** Analisa Perhitungan *Cost Performance Index* (CPI)

| Minggu | EV (Rp.) | AC (Rp.) | CPI = EV / AC |
|---|---|---|---|
| Minggu ke-1 | 883.300 | 850.000 | 1,039 |
| Minggu ke-7 | 193.170.700 | 191.850.000 | 1,007 |
| Minggu ke-8 | 217.643.100 | 222.350.000 | 0,979 |
| Minggu ke-9 | 245.174.500 | 252.850.000 | 0,970 |
| Minggu ke-10 | 263.325.000 | 264.350.000 | 0,996 |

Based on table 14, the obtained value of the CPI in week 1 to week 7 CPI values > 1.00 this indicates that the job was completed with a smaller cost than planned, while in week 8 to week 10 value CPI < 1.00, this indicates that the work done was completed with a cost greater than planned.

### 3.2.3.6 The Calculation Analysis Of Estimation And Time Resolution

Analysis of the performance index is done by looking for the estimation of cost or Estimate At Completion (EAC) and Estimate To Complete (ETC) is an estimate of the time for a particular job with the performance of the project, however, until the end of the project. Calculation, EAC is obtained from the total cost of the project or Budget At Completion (BAC) and the CPI. ETC is obtained from the comparison between the duration of the project or the Original Duration (OD) with SPI.

Calculation of the EAC week 1:

BAC = Rp. 311.022.847,96
CPI = 1,039
EAC = BAC / CPI
= Rp. 311.022.847,96/ 1,039
= Rp 299.297.400

**Table 15.** Analysis Calculation *Estimate at Completion* (EAC)

| Minggu | BAC (Rp.) | CPI | EAC = BAC / CPI (Rp.) |
|---|---|---|---|
| Minggu ke-1 | 311.022.847,96 | 1,039 | 299.297.400 |
| Minggu ke-7 | 311.022.847,96 | 1,007 | 308.896.400 |
| Minggu ke-8 | 311.022.847,96 | 0,979 | 317.749.200 |
| Minggu ke-9 | 311.022.847,96 | 0,970 | 320.759.800 |
| Minggu ke-10 | 311.022.847,96 | 0,996 | 312.233.500 |

Table 15 shows the estimated cost to complete the project on a cost that already issued in any activity.

Based on the table 13 the analysis calculation of the Schedule Performance Index (SPI) was obtained by calculations ETC as follows:

Calculation of the ETC week 1 :

OD = 120 hari
SPI = 1.00
ETC = OD / SPI
= 120 / 1.00
` = 120 hari

**Tabel 16.** Analysis Calculation *Estimate To Completion* (ETC).

| Minggu | OD | SPI | ETC = OD / SPI |
|---|---|---|---|
| Minggu ke-1 | 120 | 1.000 | 120 |
| Minggu ke-7 | 120 | 1.000 | 120 |
| Minggu ke-8 | 120 | 0,973 | 123 |
| Minggu ke-9 | 120 | 0,964 | 124 |
| Minggu ke-10 | 120 | 0,992 | 121 |

Table 16 shows the estimated time of completion of the project based on the time spent in each activity of the project.

#### 3.2.3.7 The Calculation Earned Value Method (EVM)

Based on the results of the analysis of the variants, performance index, and estimation obtained recapitulation analysis results can be seen in table 17.

**Tabel 17.** Rekapitulasi Hasil *Perhitungan Earned Value Method* (EVM)

| Minggu ke | Analisis Varian | | Analisis Kinerja | | Analisis Estimasi | |
|---|---|---|---|---|---|---|
| | Waktu SV (Rp) | Biaya CV (Rp) | Waktu SPI | Biaya CPI | Waktu ETC (hari) | Biaya EAC (Rp) |
| Minggu ke-1 | 0 | 33.300 | 1,000 | 1,039 | 120 | 299.297.400 |
| Minggu ke-7 | 0 | 1.320.700 | 1,000 | 1,007 | 120 | 308.896.400 |
| Minggu ke-8 | -6.118.100 | -4.706.900 | 0,973 | 0,979 | 123 | 317.749.200 |
| Minggu ke-9 | -9.177.200 | -7.675.500 | 0,964 | 0,970 | 124 | 320.759.800 |
| Minggu ke-10 | -2.243.300 | -1.025.000 | 0,992 | 0,996 | 121 | 312.233.500 |

Green color indicator shows the working of the project according to the schedule planned and cost less than the budget. Red color indicator shows the work of late and cost more than the budget, on week the delay caused by the risk that appears as follows:

**Tabel 18.** Analisa Risiko Yang Terjadi

| Periode | Kode Risiko | Biaya | Jenis Risiko |
|---|---|---|---|
| 8 | R2 | Rp. 2.250.000 | Eksternal (Dapat diprediksi) |
| 9 | R4 | Rp. 3.000.000 | Internal (Non Teknik) |
| 10 | R6 | Rp. 2.500.000 | Internal (Non Teknik) |

Then the conclusion that the project improved irrigation networks are being worked on cijambe village for 10 weeks experienced a delay in the schedule and the cost is greater than the cost of the planned Rp. 312.233.500 until Rp. 311.022.847,96 plan fees and expenses to handle the risks happening Rp 7.750.000

### 3.3 Design System

The design is a description, planning, and production sketches or settings of some separate elements into a unified whole. This step includes configuring the components of software and hardware of a system.

#### 3.3.1 Use Case Diagram

Use case diagram is a diagram that shows the functionality of a system. Can be seen in Figure 3.

#### 3.3.2 Class Diagram

Class diagram illustrates the structure and relationships between objects that exist on the system. The structure includes the following attributes and methods that exist in each class. Can be seen in Figure 4.

#### 3.3.3 Design Database

The design Database is a series of relationships between multiple tables in the database system. Can be seen in Figure 5.

## 4. IMPLEMENTATION

### 4.1 Implementasi Sistem

System implementation is the stage of development of software, the continuation of the activities of the design of the system.
Implementation of the evaluation menu interface is menu overall project report. Can be seen in Figure 6.
The graphic menu interface Implementas EVM is a whole menu of the project report form a graph that shows the deviation in terms of cost and implementation time of the project. Can be seen in Figure 7.

## 5. CLOSING

Based on the results of the testing that has been done to the System project management CV. SEKAR, the conclusion can be drawn as follows:

1. The system can help in the monitor project implementation activities in terms of the schedule so that the project goes according to plan, where there is a system of notification in the form of a color indicator so that it can be known quickly when there are discrepancies between the plan and relaisasi in terms of the schedule, so that the system is quite helpful in keeping an eye on the time of completion of the project.
2. This system can help knows the risks that may occur in the implementation of the project and can prepare action responses with costs that must be incurred when the risk occurs.
3. The system in the project cost in order to monitor the budget issued in accordance with the plan, which on this system, there is a notification in the form of a color indicator so that it can be known quickly when there are discrepancies between the plan and relaisasi in terms of cost, so that the system is quite helpful in keeping an eye on the cost of completion of the project.
4. The system can help in accelerating progress reporting work progress reporting process so

that it can be directly known by the Director each week.

Suggestions on the development of management information system project, the addition of features to send a message so that project managers can exchange information about the work with the other clerk, as well as the addition of a human resource management features so that the project manager can determine the number of workers that are effective for handling each work project.

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## ATTACHMENT

a. Use Case Diagram

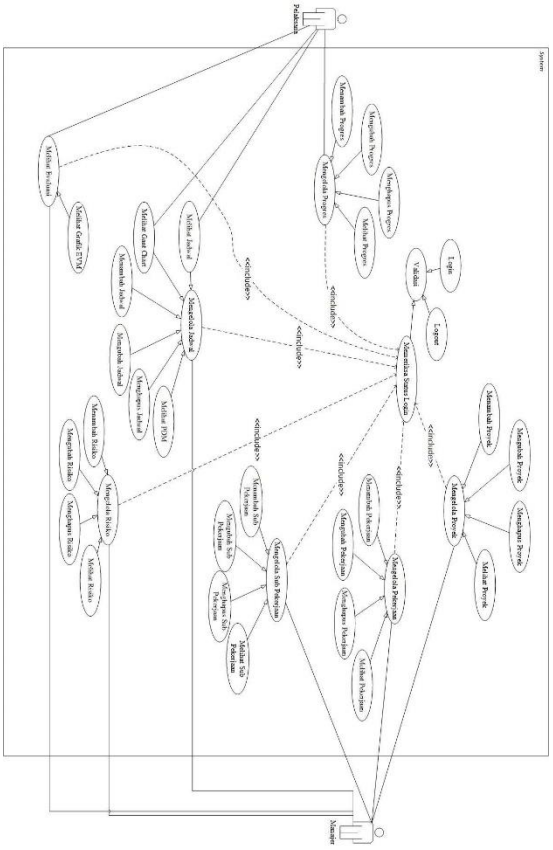


**Figure 3.** Use Case Diagram

b. Class Diagram

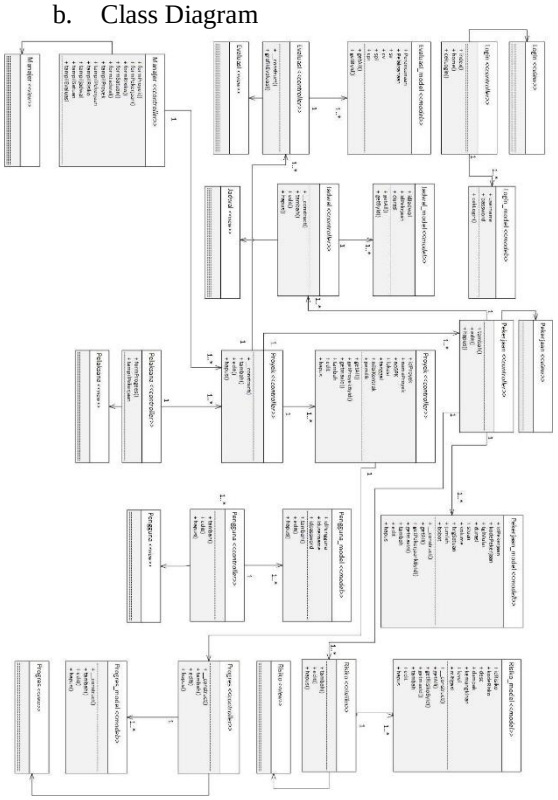


**Figure 4.** Class Diagram

c. Design Database

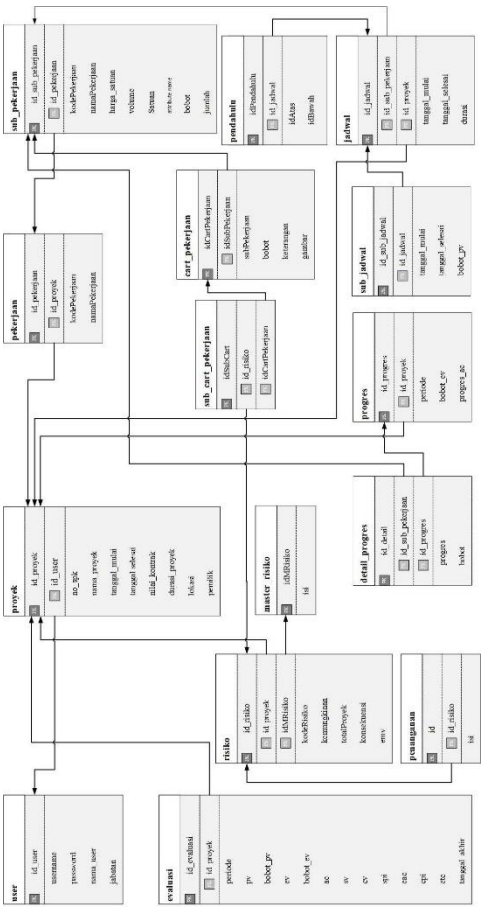


**Figure 5.** Database Design

d. Interface Menu Evaluasi

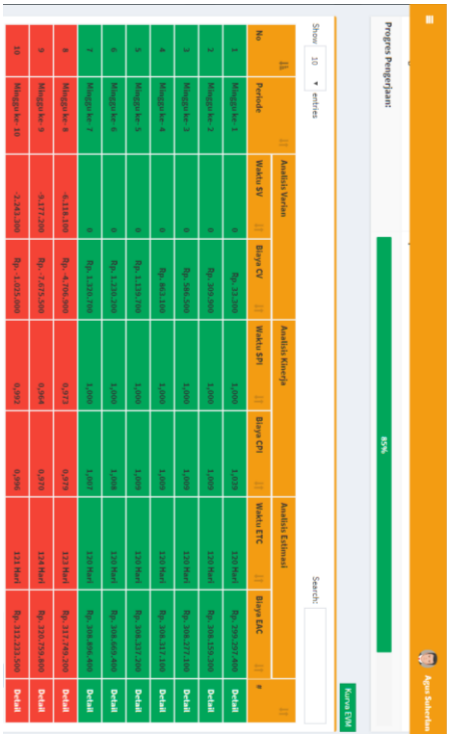



**Figure 6.** Interface Evaluasi

e. Interface Menu Grafik EVM

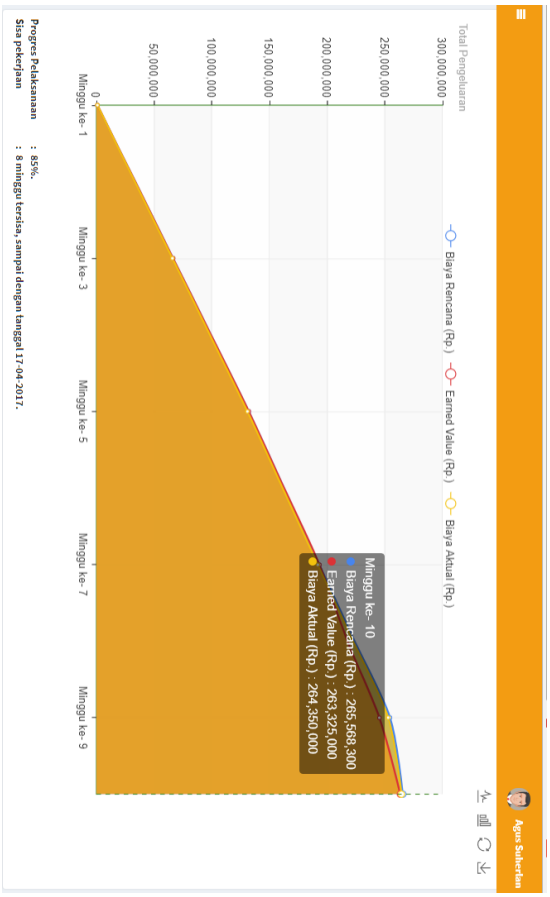



**Figure 7.** Interface Grafik EVM