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CPM Analysis on Boarding House Construction Projects in Samarinda City

Suramli[1], Natalia Fredi[2*], I Made Arya Abdi Wijaksana[3], Feby Resti Putri[4], Santa Melisa Sindi Rongko[5]
Politeknik Negeri Samarinda, Indonesia[1]
Politeknik Negeri Samarinda, Indonesia[2]
Politeknik Negeri Samarinda, Indonesia[3]
Politeknik Negeri Samarinda, Indonesia[4]
Politeknik Negeri Samarinda, Indonesia[5]
Corresponding Email: nataliafredi123@gmail.com*

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Abstract

Population growth increases the need for practical and affordable housing, so boarding houses become the main choice. Boarding house construction projects need to be managed through good project management. This research discusses the use of the Critical Path Method (CPM) in the boarding house project on Jl. Mangkupalas Gg. Padai in Samarinda City. The CPM method is used to determine project duration and optimize costs, with information on work, costs and time for each stage. The results show the critical activity path A – B – C – E – F – G – H – I – K, reducing the project duration from 210 days to 173 days, 37 days faster. Using the CPM method saves IDR 19,050,000 from the initial project cost of IDR 298,939,000 to IDR 279,889,000. This research supports the CPM method for cost and time efficiency in development projects and the results of this research are in accordance with previous studies which also discusses the CPM method of project management.

Keywords: Boarding House Construction, Critical Path Method (CPM), Management Project

Introduction

Population growth is a change in population over time which can be calculated as a change in the number of individuals in a population, using time units for measurement (Aritonang Romaito et al., 2023). Population growth increases all needs, including the need for housing. There are several main reasons for choosing a place to live, both in terms of price, facilities and strategic location. Samarinda City's adequate facilities and infrastructure, such as food, health and entertainment, are the reasons why the community, especially students, want to continue their education at university level.

From an economic perspective, the potential for boarding houses in the Samarinda urban area is quite promising, especially since there are universities that are able to attract students from various regions. The flood of students seeking education in Samarinda City has led to the establishment of many boarding houses which are inhabited by many people there. Carrying out a project requires careful planning and scheduling of the energy, time and costs required for the project (Dasović & Klanšek, 2022). To ensure the success of a development project, it is important to establish project management. This is to achieve optimal results and optimal time and by minimizing costs Management is the art and science of planning, organizing, leading, directing and controlling resources in an effort to achieve predetermined goal (Lumingkewas, 2019).

A project is an activity that is temporary and limited in time, within which certain financial resources have been allocated to carry out tasks with predetermined objectives (Ismael, 2013). Project management is the process of combining tools, resources and techniques to achieve predetermined goals including planning, organizing, implementing and directing (Andiyan et al., 2023). The Critical Path Method (CPM) details each activity, predecessor activities, activity time or standard activity time, and costs. This information is needed to create a working network (Astari et al., 2022). This plan acts as a guide for project implementation and ensures that the project is completed within the specified time period and at optimal cost.

Project planning helps show the relationship of each activity to other activities and the overall project, identifying relationships that need to be prioritized between activities and showing time estimates for each activity. Research Sa'adah et al., (2022) states that the CPM and Crashing methods in this research achieve the normal duration for project construction. From the analysis carried out with the option of increasing labor and working hours (overtime), it is more profitable if you use the overtime alternative with a proportion of 0.010%.

Research Amir R H et al., (2021) states that the results of the CPM method obtained in this research are optimal activities for completing an exclusive boarding house construction project with CV. Skyland Building contains 17 activities and the optimal activity duration obtained is 371 days. Different from the research of Putu Kumala Dewi et al., (2023) the duration of project work using CPM (Critical Path Method) using Microsoft Project, work schedule for the construction of the KIA RSUP Prof. Building. Dr. I.G.N.G Ngoerah is 245 working days, using the conventional method the implementation duration is 231 working days, so a time difference of 14 working days is found. Therefore, this research will consider several things when working on a project using the Critical Path Method (CPM) or when processing data using Microsoft Project.

This research looks at how much processing time changes with the CPM method and data processing with Microsoft Project. The aim of this research is to determine materials, workers' wages and costs for building boarding houses based on estimated working hours using the Critical Path Method (CPM).

Literature Review

Project Management

Project management is an application method that includes knowledge, skills, tools and techniques to describe how a project works to meet all user needs. The use of project management makes it easier and faster to find all the people in the company who are involved in the desired project (Wijoyo et al., 2022). According to Hardian Nurcahya & Sulistijo Edhy Purnomo, (2016) project management is a very important science in project management, so that project implementation can be completed efficiently and effectively.

Critical Path Method (CPM)

Critical Path Method (CPM) is a network analysis approach that aims to reduce the overall costs associated with a project by speeding up its completion (Putu Kumala Dewi et al., 2023) . Identification of the projected completion time period is referred to as the critical path (Prawira, 2020). The critical path serves as a tool in the CPM framework to synchronize ongoing activities. By utilizing CPM, one can effectively strategize and oversee time management while reducing costs.

Microsoft Project

Microsoft Project is a planning tool that helps organize a project or series of tasks. A group of teams and human resources as resources can be monitored and controlled using Microsoft Project (Putu Kumala Dewi et al., 2023).

Research Method

In this research, the method used is literature study and field study, the Microsoft Project 2010 application is also used. The research data used is basic data in the form of work drawings, time arrangements, Cost Budget Plans (RAB) and secondary data in the form of field pondering results., photographs in the field and related composing/journals (Harvey & Harvey, 2001).

This research is descriptive quantitative research with the aim of applying the CPM (Basic Way Strategy) method to predict and optimize the duration of add up to projects in boarding house construction project scheduling (Wali & Othman, 2019). According to KBBI, quantitative means quantity or quantitative direction. Quantitative research is research that requires large amounts of data, possibly tens, hundreds or even thousands. This is because the population of quantitative research participants is very diverse.

The research was carried out from January to July 2024. The research location was on Jl. Mangkupalas Gg. Padaidi Samarinda Opposite. The activity begins by collecting various information which will later be used and processed in the Microsoft Project application to produce more efficient results.

There are 2 types of research information used in this research, namely primary and secondary information. (Aini & Caturiyati, 2023) primary information through observation or asking directly to the project implementer through interviews. And secondary information is

obtained from literature studies, project documents, related articles and journals. The object of this research is the construction of a boarding house on Jl. Mangkupalas Gg. Padaidi Samarinda Opposite.

The information collection technique uses the method 1) direct observation in the field; 2) interviews with proprietors and craftsmen; 3) literature study, the process of obtaining information based on results that have been carried out in the form of books, journals or news articles; 4) documentation to take pictures of the situation, place and process of the project being carried out so that it can be the result of observations.

Results

A. Number of Boarding House Workers

Based on the research results, it shows that this restaurant construction project requires three workers, namely a foreman, craftsman and helper.

B. Project Completion Time

The results of interviews with the foreman revealed that the completion of this project was planned to take 210 days.

C. Tools

Table 1. Building Tools

No	Tools
1	Meter
2	Pliers
3	Spades
4	Hoes
5	Crowbar
6	Dodos
7	Hammers
8	Saw
9	Arco
10	Steel Scissors
11	Buckets
12	Brush Rolls
13	Brushes
14	Grinding
15	Electric Drill

D. Materials

Table 2. Building Materials

No	Material	No	Material
1	Nylon Rope	18	White Cement
2	Wood Blocks	19	Ropes
3	Iron 6	20	Door Frame
4	Iron 10	21	Window Frame
5	Cement	22	Bolts
6	Grit	23	Hinge
7	Stones	24	Doors
8	Paralon Pipe	25	Cat
9	Cables	26	Door Handles
10	Switches	27	Oil Paints
11	WIFI Cables	28	Tinner
12	Faucets	29	Lights
13	Tanks	30	Bricks
14	Nails	31	Bendrat
15	Wooden Planks	32	Wooden Blocks
16	Roof	33	Sink
17	Ceramic	34	Toilet

E. Work Activities

Table 3. Work Activities and Duration

No	Job Name	Completion Time
1	Preparation	14 Days
2	Chicken Claw Jobs	15 Days
3	Foundation Construction	35 Days
4	House Frame Making	30 Days
5	Wall Construction	50 Days
6	Roof Installation	20 Days
7	Installation Floors	20 Days
8	Door Installations and Variations	7 Days
9	Painting	10 Days
10	Home Interior Making	7 Days
11	Finishing	2 Days
	TOTAL	**210 Days**

F. Work Activities and Expenditure Costs

Table 4. Work Activities and Expenditure Costs

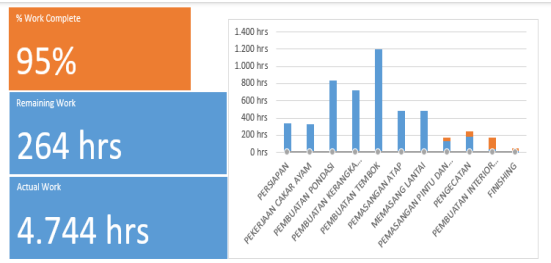
No	Job Name	Expenditure	
1	Preparation	IDR	150.000
2	Chicken Claw Jobs	IDR	7.145.000
3	Foundation Construction	IDR	11.660.000
4	Wall Construction	IDR	62.512.000
5	Roof Installation	IDR	26.075.000
6	Installation Floors	IDR	15.986.000
7	Door Installations and Variations	IDR	16.322.000
8	Painting	IDR	2.250.000
9	Home Interior Making	IDR	19.989.000
10	Finishing	IDR	350.000
	TOTAL	**IDR**	**162.439.000**

G. Workers Salaries

Table 5. Workers Salaries

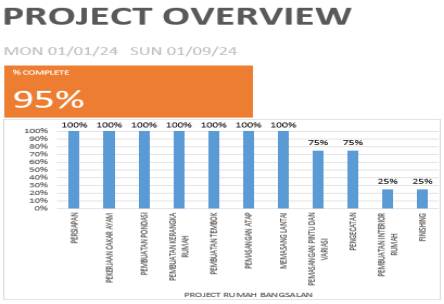
No	Nama Employee	Standard Salary	Total Work	Total Salary
1	Architect (Owner)	-	-	-
2	Foremen	IDR 200.000	210 Days x 1	IDR 42.000.000
3	Handymen	IDR 150.000	210 Days x 1	IDR 31. 500.000
4	Helpers	IDR 150.000	210 Days x 2	IDR 63.000.000
	TOTAL			**IDR 136.500.000**

H. Work Overview



Picture 1. Work Overview

I. Project Overview



Picture 2. Project Overview

Discussion

1. Analysis of the series of boarding house construction activities

Based on the table below, it is a work record for the boarding house construction project with information on previous activities. The first activity (preparation) with code A lasted 14 days and there were no previous activities. The second activity (chicken claw work) with code B takes 15 days and is carried out after work A is completed. The third activity (foundation creation) with code C takes 35 days and is carried out after work B is completed.

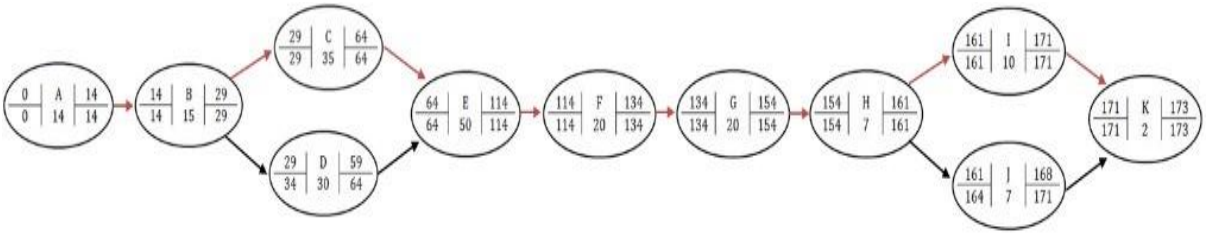
The fourth activity (making house frames) with code D takes 30 days and is completed when work C is completed. The fifth activity (wall construction) with code E lasts for 50 days. This job will take the longest to complete and will be finished when jobs C and D are finished. The sixth work (roof installation) with code F takes 20 days and is carried out after work E is completed. The seventh work (floor installation) with code G takes 20 days and is carried out after work F has been completed. The eighth work (door installation and variations) with activity code H takes 7 days and is carried out after work F is completed. The ninth job (painting) with activity code I takes 10 days and is carried out when job H is completed. The tenth activity (making house interiors) with activity code J takes 7 days and is completed when work I is completed. The last activity ends with an activity code (K) which takes 2 days and this section is an activity with very short work and will end when work J and K are finished. It appears that it took 210 days to build the 7 doors boarding house.

Table 6. Analysis of boarding house development

No	Activity	Activity Code	Previous Activity	Time (In Days)
1	Preparation	A	-	14 Days
2	Chicken Claw Jobs	B	A	15 Days
3	Foundation Construction	C	B	35 Days
4	House Frame Making	D	C	30 Days
5	Wall Construction	E	C, D	50 Days

6	Roof Installation	F	E	20 Days
7	Installation Floors	G	F	20 Days
8	Door Installations and Variations	H	G	7 Days
9	Painting	I	H	10 Days
10	Home Interior Making	J	I	7 Days
11	Finishing	K	I, J	2 Days
	TOTAL			**210 Days**

2. Analysis Critical Path Method (CPM)



Picture 3. Critical Path Analysis

There are two methods for determining the critical path with CPM and the AON approach: forward passing and backward passing. CPM analysis and the AON approach start from start to finish, and both methods use the fastest time for an activity to finish (EF), the fastest time for an activity to start (ES), and the fastest time for an activity to start (E). Next, passing backwards starts from the finish point to the start point to find out the longest activity in progress (LF), the longest time the activity occurred (LS) and the longest time the event occurred (L). Knowing the sequence of project activities can help in determining the critical path. According to the analysis results, the project can be completed using the following 4 (four) completion paths:

a. A – B – C – E – F – G – H – I – K
b. A – B – C – E – F – G – H – J – K
c. A – B – D – E – F – G – H – I – K
d. A – B – D – E – F – G – H – J – K

Some activities have gone through more than one path based on the 4 (four) project completion paths above. Activities coded A, B, C, E, F, G, H, I and K are included in the critical path above. However, paths coded D and I are not included in the critical path above because the fastest time or duration to complete is not the same as the longest time or duration. Therefore, the critical activity path of the project is A – B – C – E – F – G – H – I – K, outlined in red arrows. The results of the CPM analysis show that the boarding house construction project was completed faster than the stipulated time, namely 210 days; that too and could have been completed faster to 173 days, creating a time difference of 37 days.

3. Comparison of Total Project Costs

a. Project Costs Determined by The Project Development Company

Table 7. Total Expenditure Costs According to Project Owner

No	Name of Project Requirements	Amount of Costs	
1	Project Activity Costs	IDR	162.439.000
2	Employee Salary Costs	IDR	136.500.000
	TOTAL	**IDR**	**298.939.000**

b. Project Costs After Using the Critical Path Method (CPM)

Table 8. Total Project Expenditure Costs After Using CPM

No	Name of Project Requirements	Amount of Costs	
1	Project Activity Costs	IDR	162.439.000
2	Employee Salary Costs	IDR	112.450.000
	TOTAL	**IDR**	**279.889.000**

Based on the table above, it can be seen using the critical path method (CPM) on the 7 (seven) door boarding house construction project on Jl. Mangkupalas Gg. Padaidi Samarinda Seberang, the initial cost of IDR 298,939,000 by using CPM can be reduced to IDR 279,889,000 or save costs of IDR 19,050,000.

Conclusion

The activity planning for the boarding house construction project consists of 11 activities, with a series of activities A – B – C – D – E – F – G – H – I – J and K with an estimated construction time of 210 days. with details A (Preparation) 14 days, B (Chicken Claw Work) 14 days, C (Foundation Construction) 35 days, D (House Frame Making) 30 days, E (Wall Construction) 50 days, F (Roof Installation) 20 days, G (Floor Installation) 20 days, H (Door Installation and Variations) 7 days, I (Painting) 10 days, J (Home Interior Making) 7 days, K (Finishing) 2 days. Of the four AON approach activity path patterns obtained, activities or paths A – B – C – E – F – G – H – I – K Critical Path Method (CPM) analysis accelerated project completion time from 210 days to 173 days or 37 days faster. In the boarding house construction project, the CPM method saved IDR 19,050,000 from the initial project cost of IDR 298,939,000 to IDR 279,889,000. This shows that the CPM method optimizes project costs.

Declaration of conflicting interest

There is no conflict of interest in this work

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References

Aini, D. Q., & Caturiyati. (2023). Analisis Jaringan Kerja (Network) pada Proyek Pembangunan Rumah Dua Lantai dengan Metode CPM Network Analysis on Two-Story House Construction Projects with CPM Method. *Jurnal Kajian Dan Terapan Matematika*, *9*, 76–85. http://journal.student.uny.ac.id/ojs/index.php/jktm:

Amir R H, Zakaria W A, Yudistira A, & Hidayatullah I. (2021). Analisis Jaringan Kerja Rute Kegiatan Pembangunan Kost-Kostan Eksklusif 2 Lantai Dengan Metode Critical Path Di CV. Skyland Building. *Bulletin of Applied Industrial Engineering Theor*, *2*(2), 73–80.

Andiyan, A., Faletehan, U., Syamil, A., Munizu, M., Hasanuddin, U., & Samosir, J. M. (2023). *MANAJEMEN PROYEK : Teori & Penerapannya* (Issue June).

Aritonang Romaito, Murbun Luwy, Simatupang Rut, Zuliyansah, & Rangkuty Dewi. (2023). Studi Kajian Pertumbuhan Penduduk Kab Deli Serdang. *Jurnal Mahasiswa Kreatif*, *1*(4), 245–252.

Astari, N. M., Subagyo, A. M., & Kusnadi, K. (2022). Perencanaan Manajemen Proyek Dengan Metode Cpm (Critical Path Method) Dan Pert (Program Evaluation and Review Technique). *Konstruksia*, *13*(1), 164. https://doi.org/10.24853/jk.13.1.164-180

Dasović, B., & Klanšek, U. (2022). A Review of Energy-Efficient and Sustainable Construction Scheduling Supported with Optimization Tools. *Energies*, *15*(7). https://doi.org/10.3390/en15072330

Hardian Nurcahya, K., & Sulistijo Edhy Purnomo, H. (2016). Jurnal Konstruksi Analisis Manajemen Proyek Pelaksanaan Rehabilitasi Bendung Cibogo Sungai Cijangkelok. *CIREBON Jurnal Konstruksi*, *V*(5), 447.

Harvey, A. S., & Harvey, A. S. (2001). *Statistics on Working Time Arrangements Based on Time-Use Survey Data Conditions of Work and Employment Series No . 3 Conditions of Work and Employment Programme Statistics on working time arrangements Institute for Social and Economic Research* (Issue January).

Ismael, I. (2013). Keterlambatan Proyek Konstruksi Gedung Faktor Penyebab Dan Tindakan Pencegahannya oleh. *Februari Jurnal Momentum*, *14*(1), 46–56.

Lumingkewas, E. M. C. (2019). *(Ilmu dan Seni Mengatur Organisasi)*. 1–75.

Prawira, D. (2020). Penerapan Metode Critical Path Metthod (CPM) Pada Network Planning Dalam Efisiensi Waktu dan Biaya Proyek Pembangunan Rumah Minimalis (Studi Kasus: Property Group Medan). *JURIKOM (Jurnal Riset Komputer)*, *2*(1), 80–89. https://doi.org/10.30865/jurikom.v7i4.2266

Putu Kumala Dewi, N., Gede Ngurah Sunatha, I., Gede Angga Diputra, I., & Putu Yana Hermawan, I. (2023). Analisis Perbandingan Waktu Rencana Pelaksanaan Proyek Metode Konvensional Dengan Metode Cpm Berbasis Ms. Project (Studi Kasus: Proyek Pembangunan Gedung KIA RSUP Prof. Dr. I.G.N.G Ngoerah). *Jurnal Ilmiah Teknik*

Unmas, *3*(2), 2023.

Sa'adah, N., Iqrammah, E., & Rijanto, T. (2022). Evaluasi Proyek Pembangunan Gedung Stroke Center (Paviliun Flamboyan) Menggunakan Metode Critical Path Method (CPM) Dan Crashing. *Publikasi Riset Orientasi Teknik Sipil (Proteksi)*, *3*(2), 55–62. https://doi.org/10.26740/proteksi.v3n2.p55-62

Wali, K. I., & Othman, S. A. (2019). Schedule Risk Analysis Using Monte Carlo Simulation for Residential Projects. *Zanco Journal of Pure and Applied Sciences*, *31*(5). https://doi.org/10.21271/zjpas.31.5.11

Wijoyo, A., Putra Laksmana, S., Burhanudin, M., & Wicaksono, D. (2022). OKTAL : Jurnal Ilmu Komputer dan Science Perencanaan Manajemen Proyek Pembangunan Usaha Rumah Kos Millenial di Pamulang. *OKTAL : Jurnal Ilmu Komputer Dan Science*, *1*(11), 1–7. https://journal.mediapublikasi.id/index.php/oktal