

COMPARISON BETWEEN CRITICAL CHAIN AND CRITICAL PATH METHOD IN TELECOMMUNICATION TOWER CONSTRUCTION PROJECT MANAGEMENT

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Abstract

The purpose of this research is looking for appropriate method in Telecommunication Tower Construction Project Management by doing comparison between critical chain and critical path method.

Researching in project time management of telecommunication tower construction which researcher made two scheduling, critical chain and critical path, base on Project Management Body of Knowledge and compare the result with triple constraint factor and general factor as comparator factors.

The result of this research are total of duration of critical chain method is 197,75 days and total of duration critical path method is 207 days. Conclusion of comparison is critical chain method is better in scope, time and output factors whereas critical path method is better in input and process factors.

Keywords: *Project time management, critical path method, critical chain method, telecommunication tower construction.*

1. Introduction

Telecommunication industry in Indonesia growth rapidly at this term, it make telecommunication provider especially in cellular race to get market share by improve their service. One of the way to improve their service is enlarge the coverage area by add BTS tower in the blind spot area of signal. This phenomena also make demand of BTS tower increase, but if this phenomena are not supported by good project time management it will effect project delay. It come because their have limitation especially in resource and time.

Project time management is needed to solve delay problem in tower construction project and to improve project quality that are combination of triple constraint factors[1]. Expancement of project management knowledge is very fast, so at this time this knowledge is not only use in

construction industry but it used widely in other industry like telecommunication industry.

Waktu, biaya, dan ruang lingkup merupakan tiga faktor dalam *triple constraint*, dimana untuk mendapatkan kualitas proyek maka harus didapatkan titik optimum diantara tiga hambatan tersebut. Untuk itu diperlukan suatu metode penjadwalan yang baik yang dapat mengatasi masalah keterlambatan proyek tersebut. Maka dibuatlah penelitian dalam rangka menentukan metode terbaik dalam proyek pembangunan menara telekomunikasi yaitu memperbandingkan dua metode penjadwalan yakni *critical chain* dengan *critical path*. Perbandingan 2 metode penjadwalan ini pernah dilakukan tetapi dalam ruang lingkup yang masih terlalu besar yaitu karakteristik metode, dimana dihasilkan bahwa penurunan durasi proyek mencapai 25% atau lebih, memastikan proyek berjalan tepat waktu, dan tanpa adanya penambahan sumber daya[2]. Selain itu terdapat penelitian yang menyimpulkan bahwa metode *critical chain* dapat digunakan sebagai dasar penjadwalan dimana terdapat ketidakpastian dari segi durasi[3]. Ataupun terdapat penelitian yang melihat apakah metode *critical chain* merupakan metode baru atau hanya bentuk pengemasan baru dari metode *critical path*[4]. Untuk itu penelitian ini berfokus pada perbandingan antara dua metode pada bidang industry telekomunikasi, yaitu pada manajemen proyek pembangunan menara telekomunikasi.

Time, cost, and scope are three factors in triple constraint, so in getting good project quality we have to find optimum point among triple those factors. For the reason it need a good scheduling method to prevent project delay. This research was made to find best method in telecommunication tower construction project by compare two scheduling method there are critical chain and critical path method. Comparison between critical chain and critical path method have been made but the comparison only in wide scope and only touched the characteristic of method. Base on previous research result, using critical chain method scheduling will make reductions of 25% or more on project duration, ensure that each project finishes on time, and complete more project without adding

resources [2]. Another research show critical chain method can be use as scheduling baseline in uncertainty in project duration [3]. Previous research observed critical chain to answer the question, “is it a new method or only current method in new packaging?” [4]. There is no research that compare critical chain and critical path method deeply because of that this research is focusing in comparison between critical chain and critical path method on telecommunication industry especially in telecommunication tower construction project management.

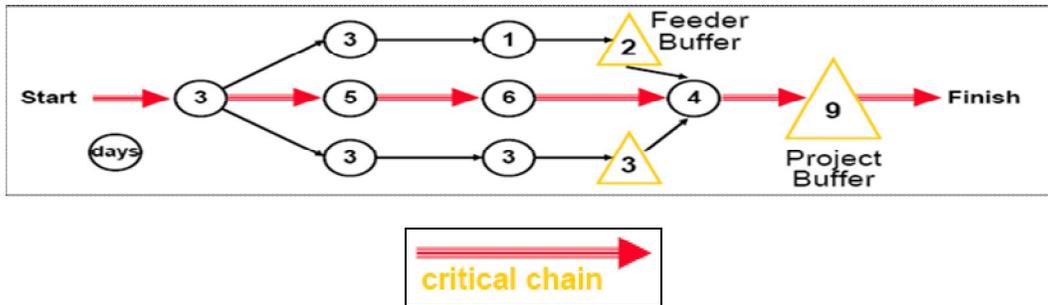
2. Theory

Two methods that is compared have different characteristic on each project. It is very important to choose appropriate method on each project.

2.2 Critical Chain Method

Critical chain method was developed and publicized by Goldratt (1997). Critical chain method is an extension of Theory of Constraint (TOC) designed specially for project environment[5].

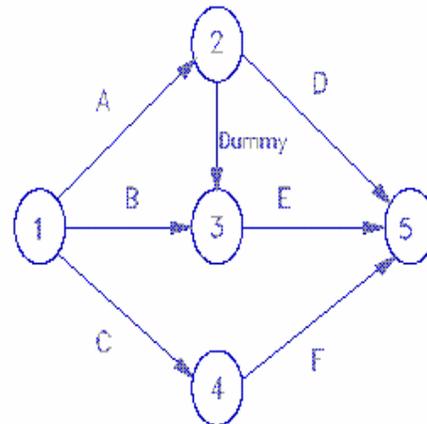
Critical chain method is scheduling method to protect the entire project from delays, caused by uncertainty and task duration variation, by inserting buffer in the end of the critical chain path of the project. Critical chain path is defined as a longest chain of dependent task and also consider about resources availability of each task. Critical chain method relocate safety time on each task and put it on the end critical chain path as project buffer, ideally it size 50% duration of critical chain path [6].



Picture 1. Critical Chain Network Illustration

There are 9 approaches on using critical chain method that are different with another scheduling method:

1. Estimating
2. Buffer
3. Student Syndrome & Parkinson’s Law
4. Bad Multitasking
5. Early finishes
6. Backward Scheduling and As Late As Possible (ALAP) Scheduling
7. Relay Race Approach
8. Buffer management
9. Resource allocation



Picture 2. Critical Path Method Network Illustration

2.2 Critical Path Method

Critical path method in the first time was develop by DuPont in 1957, that used to handled project management of maintenance chemical plants. Critical Path Method is a procedure for using network analysis to identify those tasks which are on the critical path or mathematically based algorithm for scheduling a set of project activities.

In this method we can use two kinds technique to reduce project duration. First, fast tracking technique that make two task run parallel. Second, crashing the critical path that reduce duration by add resources of the task.

3. Methodology

In comparing two method, first we have to make scheduling with those methods and evaluate projects of

telecommunication tower construction during June up to December 2007 that are 549 projects base on two methods. Methodology that used in make scheduling are base on project time management in project management body of knowledge. That are have six step in make scheduling [7]:

1. Activity Definition: identifying the specific schedule activities that need to be performed to produced to produce the various project deliverables.
2. Activity Sequencing: identifying and documenting dependencies among schedule activities
3. Activity resources estimating: estimating the type and quantities of resources required to perform each schedule activity.
4. Activity duration estimating: estimating the number of work periods that will be needed to complete individual schedule activity.
5. Schedule development: analyzing activity sequences, duration, resource requirement, and schedule constraint to create the project schedule.
6. Schedule control: controlling changes to the project schedule.

Methodology in evaluate project is looking for differences between actual project duration and schedule duration. Measurement in duration differences use two techniques, Time slip and Schedule Performance Index (SPI). Time Slip is technique to find differences between actual project duration and plan duration of the task in the project.

$$\text{Time Slip} = \text{actual duration} - \text{Plan duration (1)}$$

SPI is a technique to calculate comparison ratio between plan duration and actual duration of the task in the project. The best ratio of this technique is 1.

$$SPI = \frac{\text{Plan Duration}}{\text{Actual Duration}} \quad (2)$$

After get the result of scheduling and evaluation project base on two methods then next step is compare the result with triple constraint factor and general factor as comparator factor.

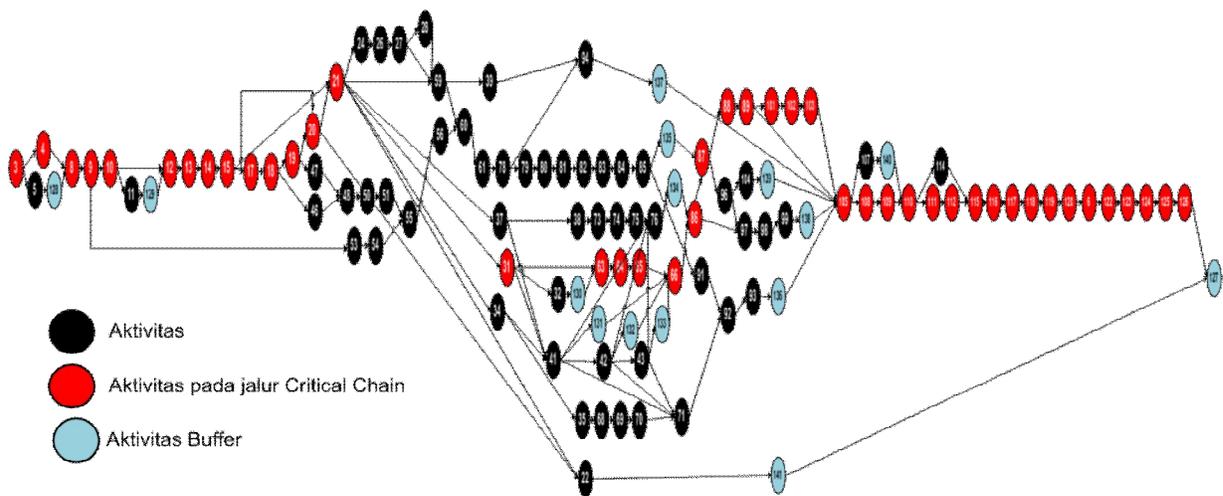
4. The Result

4.1 Scheduling Result

Scheduling that used critical chain method have total duration about 197,75 days. And there are 141 activities that included 14 feeding buffer activities and 1 project buffer activity. Schedule baseline and network diagram of this method will be show bellow.

Table 1. Schedule Baseline of Critical Chain Method

Schedule Baseline		
No	Aktivitas	Critical Chain
1	PO	-
2	PO - RFC	26
3	RFC - Konstruksi	6
4	Konstruksi - RFI	73
5	RFI - BAUF	18
6	BAUF - BAPS	28
7	BAPS - On Air	3



Picture 3. Network Diagram of critical Chain Method

4.2 Evaluation Project Result

Result of evaluation project that used critical chain method approach are: average differences between scheduling duration and duration of company target is 8,33 days; average percentage of project that finished on time is 44,7%; average time slip of each step is 18,1 days; and average SPI ratio of each step is 0,9.

Result of evaluation project that used critical path method approach are: average differences between scheduling duration and duration of company target is 16,67 days; average percentage of project that finished on time is 55,2%; average time slip of each step is 21,2 days; and average SPI ratio of each step is 1,17.

4.4 Research Result

Triple constraint factor and general factor used in comparison two methods as comparator factors. Triple constraint factor consist of three factors that are scope, time, and cost. Whereas general factors consist of three factors that are input, process, and output. Result of comparison two method in each factor are:

- Scope Factor

Critical chain method have total duration of schedule baseline up to 154 days, and average differences between scheduling duration and duration of company target in this method is 8,33 days. Whereas critical path method have total duration of schedule baseline up to 204 days and average differences between scheduling duration and duration of company target in this method is 16,67 days.

- Time Factor

Critical chain method have total duration up to 197,75 days; average percentage of project that finished on time on this method is 44,7%; average time slip of each step is 18,1 days; and average SPI ratio of each step is 0,9. Whereas Critical path method have total duration up to 207 days; average percentage of project that finished on time on this method is 55,2%; average time slip of each step is 21,2 days; and average SPI ratio of each step is 1,17.

- Cost Factor

There is no different between using critical chain or critical path method on cost factor because project contract is not base on duration project.

- Input Factor

Critical chain method need complex input because it need data of optimist duration estimation and need software that uncommon use in company. Whereas critical path method need simple input that is most likely duration estimation and this method can use common software to help in scheduling.

- Process Factor

Critical chain method have long process because it have to calculate buffer duration. Whereas critical path method don't have to calculate buffer duration because the process complete up to get critical path duration so this method have sorter process.

- Output Factor

Critical chain method have buffer management in the result. It is an added value that make process control easier. Critical path method doesn't have any added value in the result.

5. Conclusion

The result of this research is critical chain method scheduling have shorter total duration than critical path method scheduling. Total duration of critical chain method is 197,75 days whereas total duration of critical path method is 207 days.

Base on comparator factor that used, the conclusion are critical chain method is better in scope, time, and output factors. Whereas critical path method is better in input and process factors. There is no different between critical chain and critical path method in cost factor.

Conclusion of this research are critical chain method is better than critical path on project of telecommunication tower construction because this method have sorter total duration and have more number strength factor on triple constraint and general factors.

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