Critical Chain Project Management and the Construction Industry in Romania

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Abstract

The present paper aims at presenting some of the real problems that the Constructions Industry in Romania faces, along with a method that can improve the performance of the projects facing the already named problems. Thus, the Critical Chain Project Management permits higher gains without significant investment. Based on the study of the relationship system of precedence among tasks, and also on the dependency between tasks and resources, the Critical Chain method changes the way in which we must look at project management, taking into account the fact that the resources are never available in unlimited quantities. Aiming at a moderate loading of all resources involved in the project, this theory manages to keep the project on schedule.

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JEL classification: L74

Examples of exceeding project delivery date and planned costs are extremely frequent throughout project management history, maybe the best example being the Indian Government's attempt to build an energetic plant in the Jammu and Kashmir areas. The project started in 1985, with a planned cost of 1,6 billion INR[1]. In 2004 the project was still not finished, although the expenses at that moment were way over 1 billion $. The reports back then said that not even 50% of the key elements of the plant were not ready yet, and the final project expenses forecast was in the area of 1,6 billion $. Although the project was eventually finished in 2007, we can see the huge difference between the planned and actual costs, not to mention the time it took to complete the plant, which was way over any expectation.

Although this example is a failure of epic proportions, and very hard to match, our country doesn't lack projects that don't meet their scheduled delivery dates or planned costs.

[1] Approximately 50 million $

According to the Trilex Group statistics[2], one of the most important project management consultancy institutions in Romania, around 50% of the projects end with exceeded budget extended term of delivery, 25% are a complete failure and only 25% end successfully.

Along my doctoral research, I have also come up with a study that defines a couple of key features of the Romanian project management in the construction industry. The study involved 150 companies, and some of its results state that[3]:

- Project management is not formalized according to 24,44% of the respondents. The others told me of some formal documents that define their company's project management, but only 17,77% could name some of the key elements of those documents, which led me to the idea that they aren't well enough promoted inside the companies;
- Most respondents are using performance indicators in their projects tracking (82,22%);
- Most respondents (86,66%) told me that they have archives of previous projects, but consulting them is difficult, due to the physical form their are kept in, thus making them useless;
- In regards to planning resources into projects according to all of the other projects they take part in, 48,88% of the respondents said that their company doesn't do that;
- 27 of the respondents (60%) stated that in their company, the projects are regarded as profit centers, and treated as such;
- 68,8% of the respondents said that, frequently, the planned cost of a project is less than the actual cost. Only 0,4% of the respondents said that they never go over the planned cost of a project;
- The project plan is reviewed and updated weekly by 22,2% of the respondent companies, monthly by 0,66%, and whenever the need arises to, by the rest;
- 55,56% of the respondents said that the projects they work on are constantly late, 28,8% stated that it happens from time to time, and the rest said it's never happened to them;
- 84,44% of the respondents are frequently involved in more than one project that their company develops;
- 91,11% of the respondents said it happens quite often that the amount of work they have to do for the projects they work on means extra working hours;
- 57,78% of the respondents admitted that sometimes they add extra safety times to the initial activity duration estimations they give. 22,22% said they never do that, and the rest stated that they do it frequently;

[2] www.trilex.ro

[3] The complete research study can be accessed in my research report *Analysis of Romanian Project Management and the main means of improving it*, Mihai Vrîncuț, June 2008.

- 33,33% of the respondents stated that their company constantly lowers the initial duration estimations provided by the project staff;
- 31,11% of the respondents said that they're never in a hurry to report the early ending of and activity because this allows them to take care of other tasks, 26,66% said that they don't do it because the extra time permits them to improve the result of the activity, and the rest mentioned they always report the early ending of a task they're working on;
- None of the respondents said anything about Critical Chain Project Management being used in their companies' project management.

As stated, a method currently used abroad in solving the deficiencies identified by the above research is Critical Chain Project Management, a product of the Theory of Constraints created by Mr. Elyiahu Goldratt.

Critical Chain Project Management[4] is a theory that focuses mainly on the resources needed to accomplish a project.

In traditional project management, 30% of the wasted time and resources are usually spent on the account of bad multi-tasking, Student Syndrome and lack of prioritization.

Note. *The Student Syndrome refers to a phenomenon that many of us witness, that of avoiding full dedication to a task up until the time almost ran out, when we can clearly see the deadline approaching.*

In project management, the critical chain is the system of precedence relations between tasks, and also their dependency on different resources, which prevents a project from being done in a shorter time, due to limited resources availability. The critical chain of a project is the same as the traditional critical path only if **resources are always available, in infinite quantities**, which rarely happens in real life.

CCPM brings together the safety times given to different sub-projects in the so-called buffer reserves, that have the role of protecting project delivery dates, and also avoiding the waste of safety time through bad multitasking, Student Syndrome, Parkinson law and weak synchronization of project tasks.

Note. *Parkinson law states that an activity which was allocated more time than it actually needs to finish tends to shift its work volume so as to match the entire time it has been given.*

CCPM uses resource management instead of added-value management in order to rate project performance. Some project managers think that added-value management can be deceiving, because it doesn't differentiate among progress made at the project's constraint (on the critical chain) and progress made at the other, non-constraint tasks (tasks that are on alternate project paths). *Event chain methodology*[5] can be used to determine the size of a project and the amount of resources needed to complete it.

[4] CPM in short

[5] A technique of analyzing-planning the sequence of activities in a project based on uncertainty, which focuses on identifying and managing events and chains of events that have an impact on the project plan. It is the next CCPM step.

CCPM has many things to say about causes of wrong project activities duration estimations. First of all, real world is subject to statistical variations, so, according to CCPM, trying to establish a fixed duration for a task makes no sense, which leads to the lack of meaning of most duration estimations. Deming[6] would say that this process (of estimating project activities duration) is yet another example of the project team's inability to understand variation. Still, even in the case of time interval duration estimations we can stumble upon a lot of problems that can distort the correct estimation. Most of them are behavioral rather than technical, as Goldratt says (they relate more to human nature that to lack of technical means of evaluating duration). Specifically, CCPM suggests that there are a series of methods that project members use to willingly add safety time to the estimated durations of the tasks within the project.

Method 1: Overestimation of individual activity durations. When estimating the duration of tasks, usually team members build their estimates including sufficient safety time as to feel secure about finishing the job in time. For example, when someone going on a business meeting in Chitila is asked how long will it take him to drive from Bucureşti to Chitila, the sensible answer would be 30 minutes. If penalties are associated to being late at the meeting though, it's possible that the person's answer to contain safety time as well, meant to cover for unexpected events that can delay the travel (flat tire, speeding ticket, traffic jams and so on). With these things in mind, a better estimate of the drive time would be an hour, even two, for a travel that usually takes 30 minutes. Same judgement applies to project tasks. A project team member in charge of a task will take into his duration estimation a safety time big enough to ensure its finishing on time.

Method 2: Manager's safety time. Once every team member estimated durations for the tasks they are part of, the project manager or the project planner aggregates these estimates to plan total project duration. Alas, project managers tend to also apply some safety time of their own, to be certain that they won't be held responsible in case the project is late. Let's think of four project team members that supply their manager with 1 week duration estimation each for the tasks they're responsible for. We also assume that each of them is responsible for only one activity and that these activities are linked in a finish-to-start relation, meaning the successor task cannot start until the previous task isn't done. In this case, total project duration would be 1+1+1+1=4 weeks. We assume that the project team members already added 2 days safety time each for the initial estimations, which means in reality the project would only last 20 days, so not even 3 full weeks. If in this case the project manager also adds his safety time, and it's plausible that he will, afraid the deadlines won't be met, the 4 weeks can turn into 6, 7 or even 8 as planned project time.

[6] W. Edwards Deming (14 Oct. 1900-20 Dec. 1993), well-known American professor, statistician, and consultant, author of many books advocating the statistical quality control, substantially improved productivity in the USA during World War Two, but he obtained his best results in Japan, where he is considered a hero.

Method 3: Constraints anticipation from the top management. The third method by which safety time is currently added to projects is based on the idea that a company's top management usually prefers aggressive planning of projects. Most of the times, they will say that the project plan is too long, upon analyzing the project team's estimates, and will ask for a dramatic shortage of the planned time. There were some cases when the top management insisted on the planned duration reduction by as much as 20% **every time** an estimation was presented to them. In the end, the project teams started tracking this process and simply started adding 20% safety time to their initial estimations in order to protect their plan.

When combined, the three practices can lead to „inflated" times of completion for the project, but more importantly, they underline a lack of trust within companies. When a company doesn't encourage an authentic behavior of its members, it transmits a signal that what is really rewarded are self-defense acts and fraud, rather than the good-ending of the project.

With all these precaution measures, very often the projects still go over the planned duration.

Some ways of safety time wasting are related to institutions. They come out of organizational culture and are promoted by the company's policy. Other reasons for delay relate to human nature, from individual work habits to the lack of self discipline.

The first method, already discussed, involves the *Student Syndrome* and the *Parkinson law*.

The second method is about *failure to perpetuate positive variation*. When some activities are linked finish-to-start, as it happens in the most standard activity networks, every successor task's start date depends on the finishing date of the activity before. Delay of project's tasks (negative variation) leads to more delay downstream, because successor tasks have to start later than planned, the time reserves are exhausted and so on. When a predecessor task ends earlier than scheduled though, it would be expected that this early completion (positive variation) to be perpetuated and create time reserves for the tasks downstream. Alas, one of the basic arguments of behavioral consequences in project management suggests that most of the times the opposite happens, meaning, positive variation is not perpetuated throughout project network. Why? There is a number of reasons:

- Early completion of a task gives project team members the opportunity to work on other projects or tasks they remained behind on. Early completion of a task lets these members postpone the project in order to attend more pressing activities.
- Staff members might fear that the next time they'll make a duration estimation it won't be take seriously by the top management. When they ask workers to estimate duration for the tasks they're involved in, top management gives them trust, relying on their technical judgement. If they estimate that a task will take 3 weeks and they finish it in 2, next

time when they'll be asked to estimate, top management might try reducing the estimated duration based on previous performance.

- Some people feel a constant need to tinker on their part of the project, and they'll use the earned time to modify and optimize the result. Positive variation is treated by these project team members as an opportunity to improve the result of their work.

The third method through which project teams are wasting earned safety time refers to the unwanted consequences of *multitasking*. Usually, we use this term to define involvement in more than one task at a given time. Generally, people working in projects are supposed to do different tasks at the same time, and they have to use time management terms and prioritization skills to accomplish managing their work successfully. When the project team members are expected to divide their time among 3-5 projects instead focusing on one, time management can be a serious challenge. Multitasking also lengthens the time needed to finish an individual task within the project. We have to take into account a transition time between tasks, in which the employee rearranges his tools, tries to remember where he left off the task he will start working on and so on. It's a mistake to assume that these transition times do not exist. So, in reality, multitasking can double or triple the estimated duration of a task.

Goldratt's solution to the variables involved in project development is aggregation, or collectivization of all project risks under the form of uncertain duration estimations and deadlines. In the insurance industry aggregating risks is a well-known practice, and it can be successfully used in other industries as well.

We used the term *buffer* to refer to the safety time the managers maintain for certain tasks. When we aggregate risks, this buffer is dramatically shortened because instead of giving activities durations that will guarantee their completion on time in 90% of the cases, we will estimate their durations based on a 50% rate of completion on time. We take out individual task buffers and apply them to the end of the project. Because of all the above, the end buffer of the project is smaller than the sum of individual task buffers. Therefore, project duration shortens. By how much? How much buffer is enough? Goldratt advises against total annihilation of safety time.

To see how this technique works, let's take an example. Let's say that a project has as initial estimates for its activities those in Table 1.

Table 1

Activity	Estimated duration with a 50% chance of success
A	10
B	14
C	6
D	8
E	2
Total	40

We notice the total project duration of 40 days, in this case.

Computing duration estimations for a 50% chance that the activities will end on time, we get the results in Table 2.

Total project length would be in this case 18 days. That means 22 days were safety times added to the project. By using critical chain project management technique, we would create a buffer of 11 days at the end of the project, that being 50% of the initial safety time. Taking this into consideration, it means that the new estimated project duration would be 18+11=29 days, which is 11 days shorter than the initial forecast.

Table 2

Activity	Estimated duration with a 50% chance of success
A	5
B	7
C	2
D	3
E	1
Total	18

Which are the consequences of relocating time reserves at project level? First of all, we eliminate all deadlines for individual tasks. We don't use milestones, like we do in project networks based on critical path. The only deadline we have is the project completion deadline. Thus, team members are encouraged to make realistic estimations. It's vital that we have a company policy that doesn't blame the employee, otherwise CCPM will be hard to implement. We have to remember that a 50% chance of the team members finishing a task on time means they can as well be late, therefore the company has to enact a policy of not blaming employees for eventual tardiness of tasks, otherwise they'll just come back to the old habits of inflating estimations and wasting safety time.

In the present conditions, I strongly believe that this method can be a „breath of fresh air" for the Romanian construction companies.

If a year ago the real estate market was booming, which led to higher, many times for no reason, prices of buildings and land, and also, a great opportunity of development for all companies in the field, today a lot of players on the Romanian constructions market are freezing their projects, they lay-off staff or declare bankruptcy.

We estimate that, since October 2008 until the first months of 2009, more than 100.000 construction employees have been laid-off.

Since it is clear that something must change in the way Romanian constructors manage their projects, I think that a method like CCPM, that helps end projects sooner and even save some of their budgets, can only be something to look up to.

At this point the Romanian training market doesn't offer a program based on Critical Chain Project Management, dedicated to the construction industry projects. Along my doctoral research, I have created such a program, which will make the subject of a future review.

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