IMSI news & views

PROJECT PLANNERS & MANAGERS

Selected Articles Edition 2

# *The Critical Chain: A New Approach to Project Management?*

by Bill Skimin, IMSI

Israeli physicist and business consultant Eli Goldratt gained widespread popularity about 10 years ago with the publication of his first book, The Goal, which introduced his "Theory of Constraints" to eliminate bottlenecks, reduce costs and improve throughput in factory production. In his 1997 book Critical Chain, Goldratt applies the same concepts to project planning and management. While bearing a superficial similarity to the critical path method, the underlying planning process and concepts behind it are much different.

To understand the theory of constraints (TOC) it is useful to start with an analogy. Visualize a chain where each link represents a step in a process. The weight of each link represents the cost of that step in the process. The total cost of the process is therefore the sum of the weights of each link. Business being the way it is, we have to improve profits, so the directive goes out to the owner of each link (process manager) to "improve." Each manager then looks for ways to cut local costs (reduce the weight of that link in our analogy). The sum of these local improvements reduces the total weight of the chain, thus improving company profits. In Goldratt's view, most businesses live in this *cost world*, where the assumption is that any local improvement benefits the organization as a whole.

Continuing the chain analogy, he argues that a more effective approach is to focus on improving *throughput*, a concept represented by the strength of the chain. In his view, the only way to improve the overall performance of the organization is to strengthen the weakest link in the chain. That link, which he terms the constraint, limits the strength of the chain as a whole; improvements to other links only waste time and money. This simple idea forms the core of the theory of constraints. Goldratt offers a simple five-step approach to applying it:

- ***Identify*** the system's constraint (the physical process or policy that limits throughput of the system as a whole)
- Decide how to ***exploit*** (get the most from) the constraint
- ***Subordinate*** everything else to the constraint
- ***Elevate*** (improve the performance of) the constraint
- Once the constraint is fixed, start over again to ***avoid inertia***

So, how does this apply to project management? Simply put, Goldratt would say that every project has a weak link — a resource or process with limited capacity. This limited resource may or may not be on the critical path, which is simply based on the estimated duration of dependent activities. However, overloading or poor scheduling of work that requires this limited resource can ultimately delay the completion of the project. This problem is exacerbated where there are multiple projects, each of which requires some use of the limited resource.

Up until now this sounds a lot like good old resource leveling; shift tasks around until resource overloads are eliminated. There are, however, a number of critical differences:

- The focus is not on resource overloads in general, but to ***identify*** the one resource or process that is over capacity. This analysis can be done outside of a specific project schedule and, in fact, is most valuable when looking at demand across many projects.
- The response is to build buffers in the project plan to protect the constraint: ***exploit*** its limited capacity as much as possible and ***subordinate*** other tasks to it.
- A critical chain plan uses buffers to isolate the effect of delays on downstream tasks:
  - A *project buffer* provides a cushion at the end of the project
  - *Feeder buffers* are used where subprojects or paths converge
  - *Resource buffers* protect key resources, especially the constraint
- The constraint is analyzed to find ways to ***elevate*** it so that throughput can be improved
- All projects have a constraint, even if there are not any overloads, so there is always room for improvement.

There is much more to critical chain planning than I have been able to present here. Just as interesting are the problem analysis techniques that Goldratt introduces (with intriguing names, like "evaporating cloud"). The technique is getting a lot of attention, based largely on the general success of TOC in other areas. At the very least, it brings fresh thinking to a field that has not seen anything new since C/SCSC. Critical Chain is a must read for anyone with a professional interest in project management.

# *Inventing the Future*

Bouchon's use of perforated paper in 1725 to automate the Lyons silk looms had nothing to do with the development of calculation or data transmission, and yet it was an integral part of the development of the computer. The Venturi principle, basic to the structure and operation of the jet engine or the carburetor, was originally produced in an attempt to measure the flow of water through pumps. Gutenberg's movable typeface belonged as much to metallurgy or textiles as it did to the development of literacy. . .

Most people, if asked how the telephone is likely to develop during their lifetime, will consider merely the ways in which the instrument itself may change. But the major influence of the telephone on life might come from an interaction between communications technology and other factors which have nothing to do with technology. . . The triggering factor is more often than not operating in an area entirely unconnected with the situation which is about to undergo change.

***"The triggering factor is more often than not operating in an area entirely unconnected with the situation with the situation which is about to undergo change."***

Within this apparently haphazard structure of events we have seen that there are certain recurring factors at work in the process of change:

- **Innovation occurs as the result of deliberate attempts to develop it.** When Edison began work on the development of the incandescent light bulb, he did so in response to the inadequacy of the arc light. All the means were available: a vacuum pump to evacuate the bulb, electric current, the filament concept which the arc light itself used, and the use of carbon for the filament.

- **Find one thing that leads to the discovery of another.** Oersted's attempt to illustrate that a compass needle was not affected by electric current showed that in fact it was, and the electromagnet was the result of that surprise discovery.

- **Unrelated developments have a decisive effect on the main event.** The existence of a pegged cylinder as a control mechanism for automated organs gave Bouchon the idea of using perforated paper for use in the silk loom. The medieval textile revolution, which was based on the use of the spinning wheel in conjunction with the horizontal loom, lowered the price of linen to the point where enough of it became available in rag form to revolutionize the production of paper.

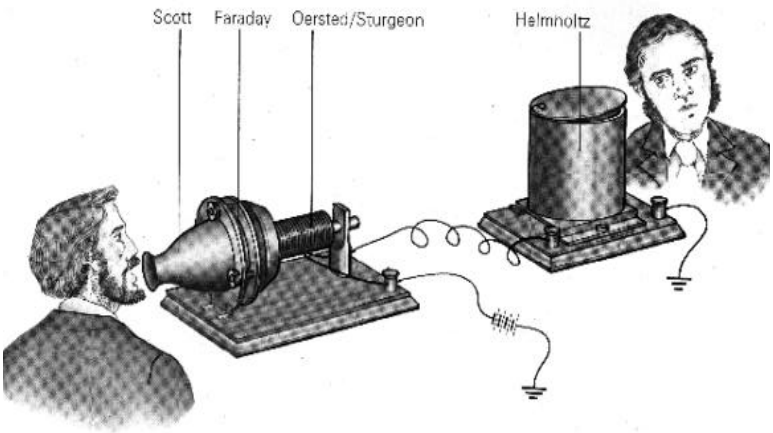
- **Accident and unforeseen circumstances.** The sudden arrival in Europe of the compass needle from China led to work on the phenomenon of magnetic attraction, and this in turn led to the discovery of electricity. A similarly unexpected Chinese invention, gunpowder, stimulated mining for metals to make the cannon, and the money to pay for them. The flooding of these mines and the subsequent failure of the pumps brought about the development of the barometer.

The automobile ... was assembled from parts which included Volta's electric pistol, using the electric spark to ignite gases. Its basic piston and cylinder drive was Newcomen's (steam engine circa 1700). The carburetor owed its operation to Venturi's jet principle and its scent spray derivative. Its gears were descendants of the waterwheel . . . The elevation of the lonely inventor to a position of ivory-tower isolation does more than deny such debts; it makes more difficult the bridging of the gap between the technologist and the man in the street.

Computer systems cause an avalanche of data to be released on the man in the street. But what use are data if they cannot be understood? . . . The fundamental task of technology is to find a means to end this vicious circle, and to bring us all to a fuller comprehension of the technological system which governs and supports our lives.

Without instruments, how could Copernicus have seen the heavens?

*Excerpts from Connections*
*by James Burke*




**Integrated Management Systems, Inc.**
P.O. Box 2777
Ann Arbor, Michigan 48106

Phone: 734.996.0500
Fax: 734.996.0266
www.imsi-pm.com

IMSI
Project Planners & Managers