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ENIGMA OF TOC & WIP

ABSTRACT

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TOC, Theory of Constraints, is very clear on guidance with respect to WIP: *Excess WIP* is bad. Little's Law demonstrates the correlation between the amount of WIP and the lead time to produce a product or a deliverable. WIP should not exceed the capacity of the available resources. So, what is WIP? Well it depends, it is generally defined as Work in Process and is also defined as Work in Progress. There may be financial and accounting implications between the different definitions, however, we will use the terms interchangeably. Our focus will be on how do we best plan, schedule and execute a work order or a project in the shortest possible time within the limitations of available resources, with a high probability of delivering on time.

Two different and distinct types of Planning, Scheduling and Execution approaches for Production and Project management evolved in the modern era. Perhaps the time has come for closer scrutinizing.

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There are two popular methods for planning and scheduling work. The first uses an ERP to generate a master schedule for all of the Work Orders (WO). typically in production such as manufacturing, re-manufacturing, and MRO environments. The other is using Project Management, conventional wisdom suggests this should be used for longer efforts, for unique, one of a kind effort such as Capital projects, New Product Development and Research and Development, Construction, etc. Both approaches have been significantly influenced and improved by Lean, TOC, TPS thinking to name just a few. And many companies require both.

For many years the chosen approach has been shaped by the type of deliverable and the length of the cycle time. So, short durations equate to production of products, that are visible and can be seen on the shop floor. And the WO's physical presence can be visually observed and is referred to as WIP. Which means the WIP is easily observed, this has led to WIP being closely monitored. Longer durations equate to project management where WIP may or not be

physically observed. Therefore the emphasis of managing WIP does not exist and de facto not even measured.

Both methods have their strengths. A strong case can be made that technology combined with new knowledge can now be leveraged to improve planning, scheduling and managing while in execution.

During the Industrial Revolution, Henry Ford recognized the importance of managing WIP. He understood the negative impact excess WIP had on the cost and cycle time of a product. As the Ford corporation diversified their products, offering the option for different colors of the cars and eventually separate divisions with different brands of cars, exacerbating the planning and scheduling dilemma. The original concept proved to be scalable and indeed became the global standard for mass production and assembly line companies.

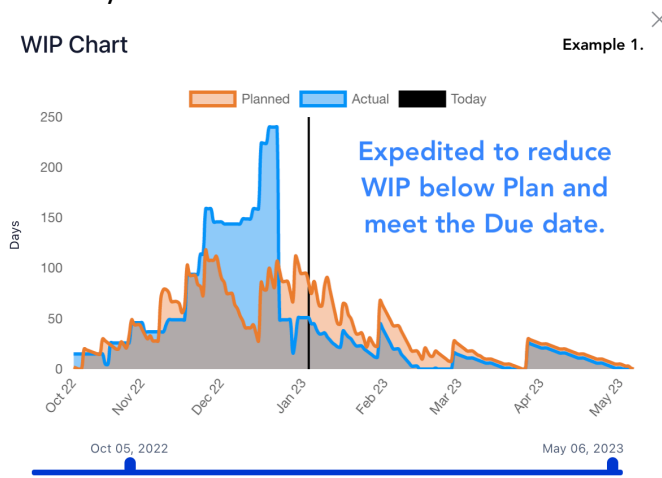
The concept was eventually improved upon by many people, Dr. Taiichi Ohno and Dr. Eliyahu Goldratt in particular. Just in Time, Toyota Production System, Lean and TOC's Drum Buffer Rope were incorporated. The focus on these advances, as with Ford, was increasing throughput; *and common to all was managing WIP.*

Changes to project management thinking and solutions, however, developed much slower. The breakthrough approach pioneered by Henry Gantt in the 1920's was a major advancement. Then in the late 1960's the concept of Critical Path and PERT became popular. By leveraging technology this was then codified and became the standard for planning, scheduling and executing work. The next major breakthrough came in 1997 when Goldratt published the *Critical Chain*.

The production solutions continued to emphasize the importance of WIP in planning and in execution. The critical path and especially the critical chain methodology project management solutions focused on WIP in planning, however largely ignores in execution. So, we see a major divergence between the two types of solutions. This a significant development and opens a window of opportunity for improvement. While the project management approach has many strengths and advantages, the negative impact of excess WIP in execution is not clearly understood. And many times it is realized too late and the disruptive damage to the schedule and inevitable increase in cost jeopardizes successful completion of the project on time.

Having real time visibility for monitoring the Planned WIP versus Actual WIP is a leading indicator metric. It is a very powerful Predictive Risk Management tool. If the WIP level is unacceptably high this will manifest itself with resources not being available to work on scheduled tasks, pushing task start dates later in time than originally planned while driving up cost. This requires developing a new Risk Management tool. In addition to the current, existing tools. It must, in real time, quantify the impact of the unacceptable level of WIP during execution while predicting the future degradation. The concept of managing WIP in project management may not currently be considered an element of the existing paradigm, this thinking must change; and recognized as an important leading indicator metric.

Managers will be able to see the current and predict the future disruptions in real time; comparing to the originally planned resource utilization, budget impact and jeopardization to finishing the project on time. Example 1 shows the planned WIP vs. the actual WIP up to today's date. Right of today's date shows the planned WIP vs. the predicted WIP if the necessary actions are taken. This will provide an additional risk management tool to the project manager. The solution will require the software intelligence be able to precisely identify what steps in the production routing or tasks in the Critical Chain schedule are causing the disruption, eventually jeopardizing the committed due date. This is essential in order to focus on the few and not the many.



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So, we now have a new and significant risk management and predictive tool. The project manager will have visibility on the stability of the project. Example 1. clearly shows a chaotic project becoming a project in control when corrective action is taken. When used with the other available risk management tools, provides an additional dynamic perspective for managing projects.

Perhaps the time has come for closer examination of the divergence of the production and project management solutions. There may be a hybrid solution that already exists. Critical Chain Project Management, CCPM in particular makes this possible. CCPM considers both the available resources and the predecessor/successor task relationships when planning the *Critical Chain Schedules*. And by using API's the schedule can become the planning and scheduling source for the ERP that can be updated real time in execution. Now the production scheduling will benefit from the many advanced features and capabilities of Critical Chain planning and scheduling.

There are numerous manufacturing companies, especially in the MTO, ETO, ATO; R&D, Capital Project and Construction environments already benefiting from this new thinking. In many environments there is a need for both project management and traditional production solutions. This hybrid approach will seamlessly accommodate both.