Abstract

This chronicles implementing improvement in a privately owned shipyard in 1998 that is undergoing significant turmoil. On the one hand it is striving to maintain its reputation for delivering a high quality product on time while controlling costs. They are in the midst of implementing an ERP software solution in large part to comply with the specter of Y2K challenges. On the other hand they must increase their profitability to better leverage the owner's goal of selling the company.

The majority of their managers believed cost reduction the best way to improve profitability. There was a small but fervent group who believed the key lay in increasing the throughput. What they did agree; the two were incompatible. Any solution would have to address cost reduction and increased profitability.

The solution was implemented by using Theory of Constraints solutions. Managing building the ships with Critical Chain project management; Drum Buffer Rope to schedule the the manufacturing and the Replenishment solution to coordinate the material requirements. The breakthrough came from synchronizing the workflow.

Regrettably twelve years have gone by and I believe there has been some improvement, but much remains to be accomplished in switching from focusing on cost efficiency to workflow effectiveness.

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Shipyard Case Study
By Daniel P. Walsh

A shipyard we will call ABC, is privately held and profitable. The owner started the company twenty-five years ago and has revenues of $50M a year. They specialize in building small ships, which normally do not exceed 1500 tons. An ISO 9002 certification sign prominently displayed in the main office is testimonial to their commitment to process improvement. There is a high level of awareness within the workforce of the importance of producing a quality product. Although somewhat unusual in this industry, customers are starting to see this as a market discriminator.

A reputation for delivering high value and being very responsive allows ABC to be highly selective in which work they bid on. Coupled with a near perfect on time delivery, no wonder they only go after high margin work.

The owner is preparing to take ABC and three comparably sized shipyards he owns public within the next eighteen months. In preparation an ERP system is being installed. Since they have to be Y2K and GAAP compliant the CFO successfully argued, as did the ERP consulting company that they must commence with the financial module. To the dismay of the President of ABC and his senior managers, the MRP II module was delayed for at least twelve months.

Critical Chain was implemented and positive results were achieved quickly. The Assembly area is the Drum, the part of the operation that sets the cadence for the workflow that until now has never been a bottleneck. The first area in the process is the Engineering area where the drawings and the nesting tapes are developed. Next, the Fabrication area produces steel components that are rolled, cut and welded and sent to Assembly. In fact they take great pride in being able to outpace Assembly's ability to convert the individual components into larger sub-assemblies. The sub-assemblies are then passed on the Erection area where they are now added to the ship itself.

The head of procurement quickly confirms this to be the case, "In fact since the new Fabrication foreman, who previously was the production scheduler in Engineering took over, their efficiencies have never been higher." He went on to share how this was making him look good also since he now was saving a lot of money by getting better prices from his vendors by ordering the steel in larger order quantities.

Fig 1

Everyone was reducing costs and saving money, yet for some unknown reason their delivery dates were now in jeopardy. Something must be done with Assembly they are now a bottleneck. It was disheartening to see the many hundreds of components piling up in front of Assembly and watch their people just standing around. Yes, something must be done.

ANALYSIS

ABC does not have a physical bottleneck. Their inability to meet schedule is deeply imbedded in the cost mentality of the owner and his managers.

The Fabrication foreman is rewarded on how many components he produces. He is very much focused on the quantity of components produced over a given period of time. Since Fabrication is an efficient operation they successfully drown out the complaints from Assembly that they are not producing the right parts.

The production scheduler is rewarded on the steel scrap rate. Therefore, the scheduling software nesting algorithms attempt to maximize the amount of components cut from a sheet of steel. He fits as many components as possible on to a sheet of steel and schedules them for Fabrication. Since the new Fabrication foreman previously had responsibility for the production schedule, he knew how to maximize the number of components produced. In almost every case it is in conflict with what is needed at Assembly.

The head of procurement is rewarded on the lowest price he negotiates with their vendors. He is adamant that the problem is in Assembly. They just can't keep up. Since Fabrication is now processing steel quicker than before, the savings he is now seeing by buying in larger quantities go right to the bottom line.

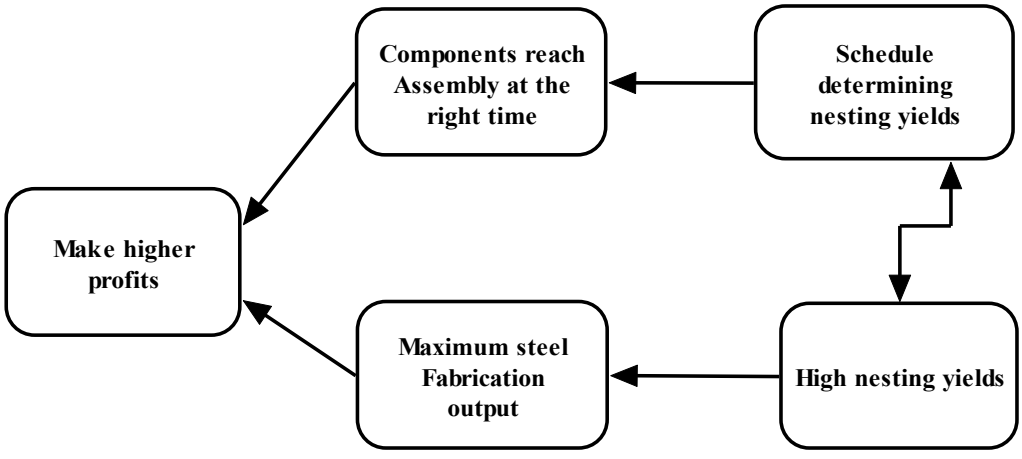

Figure 2

So, the dilemma became very clear when captured in Figure 2. Although everyone agreed that the company must realize higher profits, there were two necessary conditions that had to be achieved in order for this to be possible. One part of the organization, including the Assembly group focused on the need for the components produced by fabrication arriving in the proper sequence. The other part of the organization, although sympathetic to the complaints coming from Assembly were focusing on producing the greatest amount of steel components. In their eyes, they would fall behind if the did not have high production numbers. Besides, high production meant they were delivering more components and over time it would all work out.

They were quick to point out and had the reports to back them up showing they were not the bottleneck. If the project superintendent wanted to find out why the schedule was slipping, he needed to figure how to get rid of the pile of components sitting at Assembly. Although no one argued with the fact that Assembly needed to have the right parts delivered at the right time, it just was not happening. Increasingly, there was a growing consensus that the company had to give priority to getting back on schedule. Therefore, Fabrication had to produce what was required in order to meet the schedule. The Engineering and Fabrication people passionately pointed out that the key to maximizing steel output was having high nesting yields. In fact the scheduling software optimizes for high yield rates.

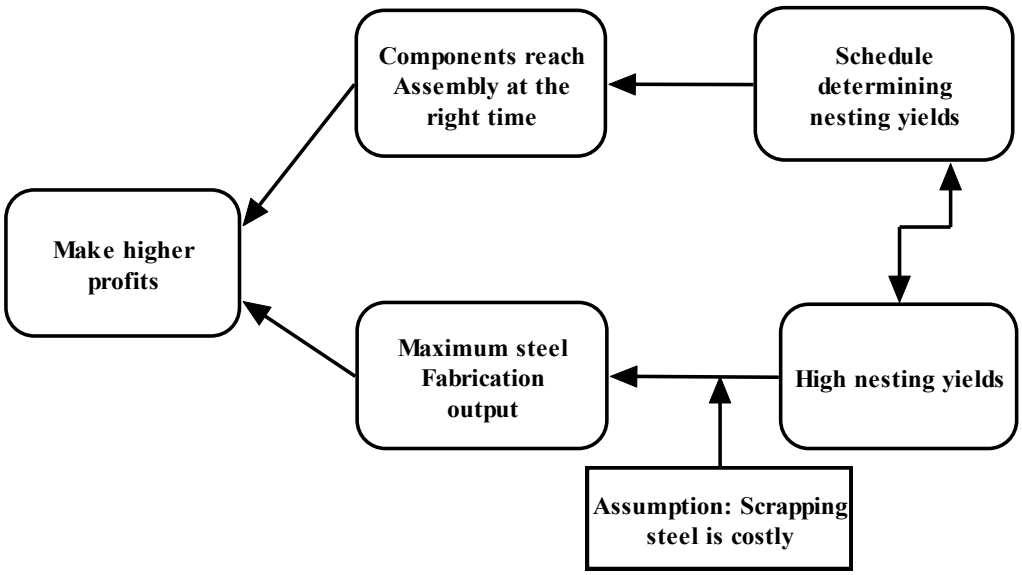

Figure 3

This is made clear in Figure 4, the ingrained held belief by Engineering and Fabrication that high nesting yields would lead to maximum steel output because scrapping steel was costly. And an additional assumption was this made them more efficient and productive. In fact this was precisely how they were evaluated and the bases for their personal bonuses. This is a common and standard approach used by many companies; measuring

individual areas in isolation with the mistaken belief this is the key to maximizing productivity. As we will soon see, nothing could be further from the truth. Their behavior was creating turmoil and conflict downstream within the shipyard. Assembly was drowning in a mountain of components reaching them out of sequence and impacting their ability to support Erection's requirements.

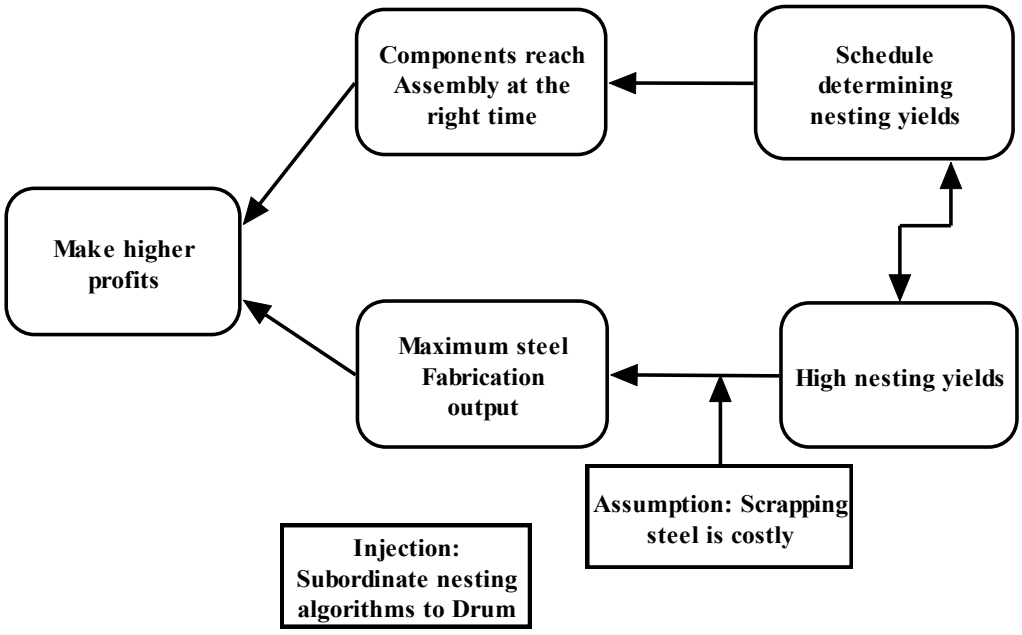

Figure 4

The Assembly area had become a bottleneck and was constraining the entire effort. An injection into the current operation that would remove the bottleneck was obvious to everyone. As seen in Figure 4, the focus now shifted to scheduling the components to arrive in the proper sequence to Assembly, the Drum was setting the cadence and sequence for the workflow.

Engineering changed the nesting priorities from focusing on high nesting yields to having the components arrive at Assembly in the proper sequence. This meant the schedule was built backwards from Erection to Assembly to Fabrication to Engineering; at first this did not seem intuitive to everyone. However the concept of starting with the end in mind and then in execution working toward the goal was understood and quickly adapted.

The other issue blocking some of the team that by not focusing on high nesting yields as the highest priority would significantly increase the cost of the project. Once it became obvious the yields would be still be very high and the very small increase in steel scrap rate was dwarfed by the 40% reduction in cycle time to build the ships. And Fabrication

increased by a commensurate 40% due to having a steady workflow once the previous bottleneck in Assembly was removed.

The actionable solution for achieving this injection was crystal clear and the buy in across the project team achieved quickly. Once the team saw the need for aligning the workflow everything fell in place. What transpired was a paradigm shift from trying to be *efficient* everywhere to focusing on being *effective* which is the key to improving productivity.

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