Eli Goldratt has said that TOC, JIT, TQM, and Lean are all pieces of the same puzzle. What exactly does he mean? I don't know for sure. So the following paragraphs contain my opinions on this subject as it pertains specifically to Lean and TOC. First I ask myself, "What is the 'puzzle' to which Eli refers?" The following is based on the premise that the 'puzzle' is how to achieve the goal of a for-profit company. Thus companies with different goals may benefit more from a different approach. I do not intend to question the chosen goals of any company; only the owners have the right to choose the goal. Allow me, then, to share with you what I define as the goal so that the following comments can be understood in that context. For the sake of this paper, the goal of a for-profit manufacturer is assumed to be:

To make money now as well as in the future, while guaranteeing simultaneously that the marketplace will be satisfied now as well as in the future, and that employees have a secure and satisfying environment now as well as in the future.

Compatible

Are the TOC and Lean compatible? Absolutely. To my knowledge they are not based on approaches that are contradictory at the foundational level. I do concede that the ways TOC and Lean are implemented by some practitioners clash resoundingly at times. However, the more I learn about the principles behind the "best practice" application of both, the more convinced I become of their compatibility!

For example, both TOC and Lean seek to reduce the time from receipt of order to conversion to cash. Both are based on a pull system that starts with the customer, and endeavor to provide a coherent approach to dealing with the entire supply chain. That is, TOC as an enterprise wide philosophy has extended the basic benefits of drum-buffer-rope, critical chain, the distribution solution – and more – across the entire supply chain. Likewise, Lean has extended the basic benefits of the JIT approach, 5S, – and more – across the entire supply chain.

Are they synonymous? No. There are distinct differences in some of the basic definitions as well as tactical approaches to achieving the goal.

Inventory and One Piece Flow

Lean is often said to have a goal of zero work in process (WIP) inventory. TOC teaches that this is too lean, threatening the continuous flow of product and, therefore, throughput. TOC uses strategically located stores of WIP to provide the necessary protection of throughput.

Lean is also often said to have a goal of one piece flow. TOC teaches that this is totally determined by the individual characteristics of the production process. There are times when one piece flow is entirely appropriate, and times where it is not
recommended. In TOC terms, the process batch and transfer batch sizes are determined by the circumstances, and should not be predetermined.

Waste

What constitutes waste? My understanding is that Lean defines waste as "any activity that does not add value from the customer’s perspective." Someone has said that if this were taken literally, top management would have to fire themselves! In most cases, that would not be good for the organization, so perhaps we need to take a closer look at this definition.

TOC defines waste as "anything that does not help the organization achieve its goal." Long range planning, for example, done by top management is absolutely necessary for achieving the goal even though it does not "add value from the customer’s perspective" as it is conventionally defined. This activity is not "waste."

It may be argued that "waste", from the Lean perspective, was not meant to include activities such as the planning function. It was focused on the transformation process. OK. Let’s look at the production floor for "waste." Lean typically strives for a balanced production line; all the steps will be balanced such that their respective cycle times are at worst slightly less than (and ideally equal to) the takt time. (Takt time is calculated by dividing the time that production resources are available each day by the number of units per day required by customers.) Any capacity that a resource has that is not required to perform to the desired takt time is considered to be excess capacity and is "waste." It is to be eliminated.

In sharp contrast, TOC believes that all non-bottleneck resources must have some protective capacity; if not, you will not be able to fully utilize the bottleneck resource — and throughput will be at risk. It appears to me that what lean considers to be "waste", TOC considers to be an absolute necessary condition of success. This is a very significant difference!

Different Focal Points

TOC focuses on maintaining and increasing "throughput." TOC practitioners utilize a powerful collection of tools that are expertly suited to this objective. Lean, as I understand it, focuses on reducing, and, ultimately eliminating "waste." The Lean practitioner is equipped with a powerful collection of tools that are expertly suited to this task.

The differences in what is considered to be waste has already been discussed above. The question here pertains to the effect of focusing on cost versus focusing on throughput. Just how significant is this difference? Aren’t they just two ways of increasing profit? I can sell $1 more, or spend $1 less. What difference does it make? In my opinion, a lot of difference!

Throughput, in the book "The Goal" by Goldratt (N. River Press, 1984), was defined as "the rate at which the system generates money through sales." For example, throughput might be $60,000/day. (Note that this is not revenue for the day. Suppose the material costs for this company is 40% of revenue; then the revenue for this day would be $100,000. That is, in TOC, throughput equals revenues minus "totally variable costs", which for many manufacturers is equal to their raw material costs.)

Let’s use the example above to examine whether reductions in cost do indeed have the same impact as increases in throughput. Which has a greater impact on the bottom line?

Suppose the company above has identified the fact that it has 25% excess capacity. One way to improve the bottom line would be to focus on reducing cost. In the short term a company cannot liquidate buildings or equipment, so the primary tactic is to reduce workforce by 25%. The following chart shows an impressive 30% improvement on the bottom line.
What would the bottom line impact be if the same company were able to increase sales and thereby make use of that 25% excess capacity? The table below shows the results.

<table>
<thead>
<tr>
<th>Original Performance</th>
<th>After 25% Increase in Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>100,000</td>
<td>Sales</td>
</tr>
<tr>
<td>40,000</td>
<td>Raw Material Costs</td>
</tr>
<tr>
<td>60,000</td>
<td>Throughput</td>
</tr>
<tr>
<td>12,000</td>
<td>Direct Labor</td>
</tr>
<tr>
<td>38,000</td>
<td>All other Operating Expenses</td>
</tr>
<tr>
<td>10,000</td>
<td>Net Profit</td>
</tr>
</tbody>
</table>

You can see that, if it can be done, an increase in throughput has a much greater impact on the bottom line! In this example the impact is 5 fold!!!! Put another way, for the company described above, a 5% increase in throughput will produce the same bottom line impact that is generated by a 25% reduction in labor costs!

Throughput, I conclude, is the more powerful focal point.

"Yes, but," some argue, "if we could increase sales we would have already done so. Your example just isn't reality."

My response: **Your focus determines your reality!**

Focus, is what TOC is all about. To focus everywhere is to truly focus nowhere. To focus on your true organizational constraint is to have real leverage on attainment of the goal! In the example above, those who say, "if we could increase sales we would have already done so", are really saying the constraint is visible as a market constraint. Focus your scarce resources there! (TOC provides a thorough process for developing an implementable, unrefusible offer to the marketplace. Goldratt’s book *It’s Not Luck*, North River Press, 1994, tells the story of three such successes.)

**Holistic, Predictive, and Proactive**

TOC is an overall management philosophy. Properly applied it considers the entire system: all "internal" functional areas as well as all "external" suppliers and customers in the supply chain.

Yes, TOC like Lean is prescriptive with its 5 step Process Of On Going Improvement: 1) Identify; 2) Exploit; etc. TOC is, at the same time, predictive. Dr. Deming said management is about prediction, and TOC fills that bill well. What do I mean?

The TOC practitioner knows that at the same time the current constraint is identified, it is absolutely necessary to predict what will emerge as the next constraint. Suppose the current constraint is in the production, and machine “A” is currently the greatest production bottleneck. Now suppose that when the 5 step process is complete, the organizational constraint will shift out of production to the distribution system. In other words, production can now produce fast enough to fill orders – in fact they are able to fill more orders than they could in the past. As a result, the sales department sells more. However, those new customers (and some of the old ones) still don’t get what they want when they want it because the distribution system cannot
keep up! The result is likely to be not only a flat spot in the process of continuous improvement, but, probably a loss of some of the improvements already made as dissatisfied customers cancel orders and/or demand financial adjustments. This is where the proactive element of TOC is important. When it appears that the constraint will shift out of production to distribution in this example (though it could just as easily shift to product engineering or out into the marketplace), this prediction becomes a major factor in determining the tactics and the timing of the 5 step process. The implementation plan will, of course, include the actions needed to exploit, subordinate, etc. to the current constraint. In addition, it will include the actions necessary to verify the emergence of the predicted constraint, and the proper timing to exploit it, subordinate, etc. In this way, the company is protected from the unexpected negative consequences of success. Too many examples exist where a company improved production flow only to find they have caused themselves to have excess labor capacity. The result is often to lay off the very people who improved the most…and thereby kill, or severely retard, future attempts at continuous improvement. Using TOC methodology properly to predict what the next constraint will be allows the organization to embark on a process of on going improvement!

**Strategic**

TOC is strategic. Holistically managed TOC companies choose strategically where they want their internal bottleneck to be. The company then aligns its entire structure and manages the entire operation in such a way to maintain that internal bottleneck. In times of market growth they are careful to maintain protective capacity at the non bottleneck resources as they elevate their bottleneck. This constancy of purpose allows these organizations to avoid the chaos that always accompanies the wandering bottleneck phenomenon.

When changes driven by customers, technology, or competitors necessitates a change in strategy, the 5th step in the five step process kicks in: “Do not let inertia become the system constraint.” A holistic analysis of the new situation allows the company to strategically choose their new internal bottleneck, and the rest of the tools are there to effectively change the system in support of this new reality.

**Convergence?**

Today some Lean practitioners are talking about buffer inventories and transfer batches in some circumstances. They are recognizing that many of the tactics of TOC are necessary for a robust process of continuous improvement. Similarly, more TOC practitioners are recognizing that many of the Lean tools are ideal for accomplishing the desired local impact. As a result, some say that the two philosophies of Lean and TOC are converging in practice—that they are becoming the same thing. In my opinion, and hopefully the readers remembers that I do not profess to be an expert on Lean, there is a growing recognition of the synergy between the two philosophies. Practitioners are beginning to offer companies the benefits of both. However, philosophically, Lean and TOC are still distinct on some key issues, as previously discussed. They cannot totally converge. (Let me note that I have a friend working in the automotive industry who has much expertise in both Lean and TOC. He makes the claim that when the variation in processes reaches zero, then Lean and TOC do converge. Dr. Deming taught us this day will never arrive, so I hold to my assertion that there will always be a need for protective capacity, time buffers, etc.)

**Conclusion**

The fact that continuous improvement practitioners are making more complete use of TOC and Lean is a very positive development. This trend should accelerate. TOC should be the overall philosophy that management uses to determine and
guide their strategy. Lean principles and lean tools should then be applied in the places in the system where TOC detects they will have the greatest impact on achieving the goal. For example, when TOC pinpoints the place where set-up reduction is needed (i.e. at the constraint or at feeding resources that sometimes become a bottleneck), Lean has the right tools to accomplish this. Etc.

In virtually all industries today, quality is a given. TQM and Six Sigma tools used to address quality assurance issues must proceed somewhat independently along side any Lean and/or TOC efforts. Regarding work flow however, TQM or Six Sigma tools should be applied according to the priorities established after TOC has been used to form the strategy and coherent tactics necessary to achieve the company’s goal! Where should variation in process time be reduced? First at the constraint, and then at the non-bottleneck process with the least protective capacity.

An industrial engineer in Turkey named Emin Yeysides (eyeysides@yahoo.com) summarized this topic quite well when he submitted the following via email:

“Every system has at least one bottleneck which limits the system’s ability to get more [of its goal]. So every system needs the TOC viewpoint to manage the constraints.

Every system has unnecessary steps which don’t add any value to the final products. So every system needs to use Lean tools to eliminate them.

And finally, every system has variations which prevent it from working steadily. So every system needs Six Sigma techniques to find and get rid of them.”

Source:  http://www.ciras.iastate.edu/library/toc/toclean.asp

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