

TOC – More output with less effort on the inputs

Let us take a step into the hypothetical world of a supply chain manager as he grapples with a challenge thrown at him from a higher authority to improve the area of business under his control. His underlying logic starts with the premise that idleness is waste, and that the best he can do for the organisation is to ensure that all the resources he has under his control are fully utilised.

The starting point of any good manager is to understand the processes that add value to the business. In our hypothetical case, let's say he is in charge of a large warehousing operation that has four basic functions – replenish, pick, pack and ship. Our manager notices that he has much more capacity in the workforce that does the replenishing than he has anywhere else. Picking has more capacity than packing, which appears as a real bottleneck most of the time and the capacity for shipping is more or less balanced with that of picking.

Immediately our young manager sees cost saving potential – what is required he decides is to balance the line. What he determines is that he will move various people around and make some changes to the processes and departmental responsibilities such that he has balanced capacity equal to that of the average demand on the bottleneck (packing) and he will immediately get some cost saving from employing fewer people and the utilisation rate will increase. Sadly he cannot work according to his exact calculations, as that would require him having only 2/3 of a person doing a particular piece of work, but all the same he is reasonably satisfied with his efforts. He is particularly pleased that he doesn't have to wear the cost of retrenchment, as the company has a policy that moves "excess" people to other departments that may have a need of them. His department is beginning to look good on paper even though the net effect on the cash flow of the company is nil.

Our intrepid manager trains all the staff in their new positions and comes in on Monday morning ready to prove his worth to all who might be interested. By Friday evening, when he eventually goes home at close to midnight, he cannot believe the firefights he has been dealing with all week. Expedites everywhere, his airfreight bill blown out completely, overtime at a record high, disgruntled customers screaming and shouting and an exhausted and confused workforce wondering what went wrong. It all looked so good on paper.

What our manager didn't appreciate when setting out his new process of a balanced line was that the law of averages is a cruel taskmaster when it comes to a set of dependent events such as replenish-pick-pack-ship. When he examined his data from the week from hell it showed that his calculations as to standard times for each of the activities was only right 90% of the time. Things went wrong – boxes broke, people didn't turn up to work, the warehouse ran out of packing materials, the union called a meeting. None of them were catastrophic in their own right, but they seemed to have a disproportionate effect on what he could get out at the end of the day.

Our manager evolves further – he has read many an article about Six Sigma and statistical process control. He remembers a course he did on total quality management and it slowly begins to dawn on him that if you have four activities in a dependent set of events, and each of them has only a 90% level of confidence in its output, the system's output can only be guaranteed to a level of $.9^4$ or 66%. The answer he decides must be to eliminate variability from his processes, or at least set the target at the six sigma level (3.2 defects per million operations) so that their effect has minimal effect on his system output.

As with most initiatives, our manager's begins well. He painstakingly explains his strategy to both management and staff and even secures some funding for everyone to go on a six-sigma course. Each group is tasked with looking for a six sigma project within their particular area and make sure that they action it – this is not an environment where lip service will do.

Some months later, things are worse than ever. IT had endless uncoordinated demands on their resources to do everything from pick by light to scan packing to electronically generating consignment notes and a whole swag of requests for different types of measurement data. IT were genuine in their desire to help everyone get their projects over the line, but in reality got none of them done. The IT department in fact began to resemble the chaos that so often now overtook the warehouse.

By this stage the chief executive starts to get overwhelmed with the demands for all manner of capital equipment and the large sums required to have them installed and working. He adds up all the savings and efficiencies each one promises it will deliver and discovers he would be able to run the business without any costs! Six sigma went the same way as ISO – nice theory, perhaps good in a factory environment, but no good for taming Murphy here. Even on those rare days when our manager managed to get his warehouse under control, and working according to the rules, some supplier would let them down and all hell would break loose again. If it wasn't the suppliers, all it needed was a customer to put through a request for an order larger than the average planned and the system would once again become unstable.

Fortunately for our manager, his bosses were sympathetic to his plight, as they knew from their mates that the struggle between cost cutting to drive efficiency and providing adequate levels of service for their customers was never ending. Within their professional groups and in their executive clubs they would all moan how one day they were pushing efficiency and cost savings and the next they were blowing whole piles of money just to keep the customer. It was received wisdom. Fact of life. One didn't have to be excellent, one simply had to be better than the competition!

There is of course another way, and it's called TOC or Theory of Constraints. However, to quote Albert Einstein "The problems that exist in the world today cannot be solved by the level of thinking that created them" – getting the benefits of TOC requires the slaughter of some sacred cows and a profound shift in thinking.

Let's begin at the beginning, with a definition of the theory – “Any system has a constraint. Were this not the case, the output of the system would be infinite, or would collapse to zero”.

What is the “system”? At a fundamental level, the system is wherever we determine the boundary is. It could be a work centre, it could be a production line, it could be the supply chain of the division or it could be the entire enterprise. For our purposes, let us define the system as the enterprise, and furthermore, let us assume for now that the enterprise we have in mind is a for profit organisation. (This does not have to be the case – TOC has been applied equally successfully in for cause and government environments).

Like all good for profit organisations, the goal is to make a decent return on investment now and do better and better in the future. As I have not yet found any company that is capable of making an infinite amount of return on its investment, we can say that our theory holds true for that part of the equation that talks to “infinite” output. What about the “collapse to zero” part? There is no shortage of companies that go into liquidation every year – indeed there is an entire industry that specialises in insolvency, so I guess our Theory of Constraints is holding up pretty well so far.

If we now think about our theory in a slightly different way now, we could argue that if there is a constraint in our system, something which prevents us from getting more of the system's goal units, then that which is not the constraint, is not fully utilised.

Think about this for a moment – in our hypothetical above, the hapless manager's underlying approach was to ensure that there was no waste in his system. All component parts had to be working at maximum efficiency in order for him to maximise the warehousing system under his control. To quote Deming, father of the quality movement; “The object of any component is to contribute its best to the system, not to maximise its own production...some components may operate at a loss themselves in order to optimise the whole system.”

What if the key performance indicator for the warehouse had been to ensure that packing, which had intuitively been identified as the bottleneck, improved its production by 10%? The gain would have been an overall gain of 10% for the whole warehouse. No matter what any other function did, the rate-determining step of the warehouse was the packers, so even one unit of output gained there would have been a unit gained for the whole warehouse. By the same token, if the focus of improvement was picking, the net improvement in warehouse performance would have been nil – in fact it would probably have got worse as there would be a bigger queue sitting in from of packing and a greater likelihood of expediting and chaos.

The TOC approach to management can be derived from the theory stated above and has been clearly articulated in the “Five Focusing Steps” by Dr Eli Goldratt, founder of TOC.

Step 1 - Identify the constraint.

If a constraint governs the output of a system, then before the system output can be improved, there must be a clear idea of where that constraint is!

Step 2 - Exploit the constraint.

If a system is only capable of producing at the rate of its constraint (a chain is only as strong as its weakest link), then that part of the system must be kept busy all of the time and squeezed for all it is worth! One unit lost at the constraint is a unit lost for the system as a whole.

Step 3 - Subordinate to the constraint.

If there is a weakest link in a chain, then it follows that the rest of the chain has the ability to produce more than the weakest link. The role of the rest of the chain is not to produce more than the weakest link. Instead, it should help support it or be subordinate to its needs, ensuring the constraint is able to focus on doing only what it is meant to.

Step 4 - Elevate the constraint.

Eventually the system will reach a point where its constraint has been exploited or squeezed to its maximum. At this point, investment in additional capacity is usually considered, and this is known as “elevation” of the constraint. The elevation step is usually, but not always, a strategic decision.

Step 5 - Do not let Inertia become the constraint.

Once the system constraint has been elevated, the constraint will move to a new point in the system! The system therefore cannot be managed the same way as before and Step 1 must be revisited. In this way, a process of continuous improvement begins.

When comparing this approach to that of our hypothetical manager (removing all variability) which one is easier to implement? Which one is easier to grasp intuitively?

The results speak for themselves - to place the benefits of the proposed intervention in its proper context, we quote below the results of a study conducted by two International Researchers. The results were recorded after looking at the implementation of TOC in over 100 large and small companies around the globe.

Operational Variables

- Reductions in **Lead-time** of a substantial magnitude, with a mean of **70%**.
- Reductions in **Cycle-time** of a substantial magnitude, with a mean of **65%**.
- Improvements in **Due-Date-Performance**, with a mean of **60%**.
- Reductions in **Inventory levels** of a large magnitude, with a mean of **49%**.
- Increases in Revenue or Throughput often of a substantial magnitude, with a mean of 68%.

TOC has been around since 1980. The logic is compelling and many people refer to it as common sense. The investment needed to implement in time,

money and effort is a fraction of the competitive methods and TOC consistently produces a higher success rate than them. The results surpass the highest conventional expectations and are evident within a surprisingly short period of time. The various TOC applications have been applied around the globe, across a comprehensive spectrum of industries from the very large to the very small and all in between.

TOCCA is Australia's premier implementer of TOC methods and has a diverse range of clients across numerous industries in the private and public sector. We exist to deliver enduring beneficial change and our goal is to have TOC adopted as the main operational method in Australia.