

*"I say an hour lost at a bottleneck is an hour out of the entire system. I say an hour saved at a non-bottleneck is worthless. Bottlenecks govern both throughput and inventory."*

– From *The Goal*, authored by Eliyahu Goldratt

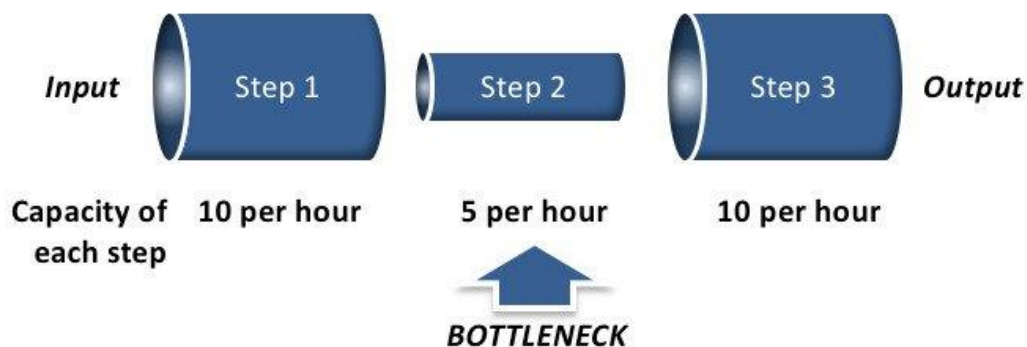
## WHAT IS THE THEORY OF CONSTRAINTS?

One of the most famous and must-read management books is "The Goal," by Dr. Eliyahu M. Goldratt. It's a fictional story of a manager who turns around an unproductive manufacturing plant utilizing Lean techniques. The book focuses on the theory of constraints, one of the essential process improvement concepts.

The theory of constraints is the idea that the output or quality of any system or process is often limited by a few constraints or "bottlenecks", which is a point of congestion in a system that is limiting the total output of the system. Look at the diagram below. The process consists of 3 steps. step 1 and step 3 can process at 10 per hour, but step 2 can only process 5 per hour. Step 2 is the bottleneck, which limits the entire process to only 5 per hour.

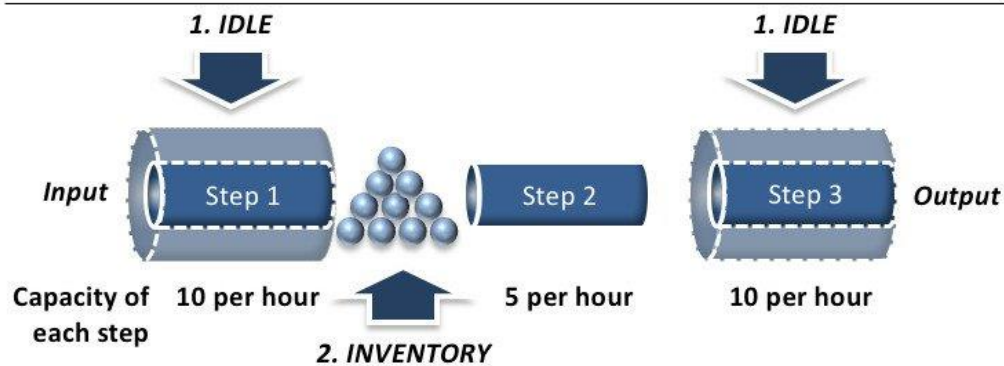
**Step 2 is a bottleneck limiting the capacity of the process to 5 per hour**

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Any efforts to improve the efficiency of Step 1 or Step 3 are simply a waste of time and resources since Step 2 is the bottleneck to the capacity of the process. Given the current capacities, Step 1 is either processing at more than 5 per hour and creating some significant inventory in front of step 2, or step 1 is idle for half of its time, to be balanced with the capacity of 5 per hour of step 2.

**With a bottleneck, either non-bottleneck steps are idle or inventory piles up**



In the real world, there are many signs of potential bottlenecks, including:

- Idle time of the resources in a process
- Long wait times or queues in parts of a process
- Inventory piles up in front of a step in a process
- A lot of complaints about or “fires” relating to a process

Idle time and inventory are the two outcomes of bottlenecks, which over time can become very expensive in terms of costs and capital. Either people or machines are processing things, and if they are idle then you are wasting costs and/or capital. And, if the inventory is physical inventory, then the cash is being tied up in work-in-progress inventory. If the inventory is information (e.g., documents, workflows, etc.), then the wait times go up and service levels go down for the end-customer of the process. I’m sure you can think of a few bottlenecks, idle people, or inventory piling up in your own organization.

## **GROWTH & THEORY OF CONSTRAINTS**

Beyond the realm of processes, you can apply the theory of constraints to the growth potential of a company. I’ve often witnessed the growth of a company severely limited by bottlenecks and constraints. In growth companies, the capacity of some functions can grow faster than others, and sometimes the inadequate capacity of one or two functions can impede the growth of the entire company. It is one of the many reasons why start-ups and high-growth companies often focus their efforts on their core competencies and outsource many of their non-strategic functions, so that capacity within those non-strategic functions won’t become a bottleneck.

## **WHY IS THE THEORY OF CONSTRAINTS IMPORTANT?**

When working with new companies, one of my favorite and productive things to do is observe and talk to people, with the goal of understanding where the bottlenecks are in an organization. You walk around an office, a manufacturing facility, a warehouse, and, with the right lens, you can figure out the bottlenecks quickly. The bottlenecks are hiding as 4-foot stacks of applications being worked by a clerk every night until 10 pm, piles of work-in-progress inventory scattered throughout a manufacturing

facility, the guy who spends his days surfing the net and chatting everyone up, and the sales team complaining and almost coming to blows with the warehouse shipping manager for not getting packages out in time.

Once you figure out the substantial bottlenecks in an organization, then you need to start attacking them, for those bottlenecks can be in the way of an organization achieving great things.

## HOW DO YOU RELEASE CONSTRAINTS AND BOTTLENECKS?

The name of the game with efficient processes is “balance”; ensuring the capacity of each step within a process is somewhat equal to each other. Balance enables a process to flow efficiently without inventory build-up and wasted idle resources. Ultimately, you want the flow of a process to be balanced with the downstream demand of a process. It is critical to understand how one process is interconnected with other processes, for the largest constraint in the entire system is the true bottleneck.

### 3 options to balance the flow

Ok, let’s go back to our 3 Step process example to go over the three fundamental options to “balancing” a process and flow. Beyond somehow eliminating Step 2 from the process, the next best option is to somehow increase capacity of step 2 to 10 per hour.

#### Best Option – Increase capacity of Step 2

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The next best option, if possible, is to reallocate resources from step 1 and/or step 3 to step 2. This can often be done in any process involving labor, where you can balance the amount of time spent or people working on any step.

#### Second Best Option – Balance resources across the 3 steps

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The last resort is to balance capacity to 5 per hour and try to repurpose the idle time from step 1 & 3. At least in this case, you won’t be building up inventory. The absolute worst thing you can do is simply try

and run step 1 and step 3 at their max capacity of 10 per hour, since this will create an ever-growing pile of inventory.

**Last Resort Option – Try to repurpose idle time of Step 1 & 3, or just go idle to eliminate inventory build-up**

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### **Be a bottleneck detective**

Often, in manufacturing, service operations, or around the office, you can often spot evidence of bottlenecks in the form of idle people, long processes, waiting or inventory piling up. For important processes, map out the process, figure out the critical statistics for steps (time, resources, inventory), and ways to improve the process.

### **Whack a mole**

Eliminating bottlenecks never really ends, since the minute you release one bottleneck, all your doing is letting a process flow, which will allow you to identify the next bottleneck. This is why Lean and Six Sigma are continuous improvement methodologies since you are never really done improving the efficiency and effectiveness of processes.

### **Use Lean or Six Sigma**

Lean and Six Sigma methodologies are ideal for identifying and releasing bottlenecks. We'll get into more detail on them in those sections.

### **Don't be a bottleneck**

Sometimes people become bottlenecks, and they don't even realize it. Maybe they need to get a part of a project done, approve something, make a decision, communicate something, and delay and delay, and all of a sudden a few days, weeks or even months go by, massively delaying a project or product. These are called false bottlenecks because they shouldn't exist if people would simply follow through on their responsibilities. We have all seen false bottlenecks, and they need to be managed through diligent follow-up and by holding people accountable.