OPTIMIZED PRODUCTION TECHNOLOGY (OPT)

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10.1 Introduction

Optimized Production Technology (OPT) is a computerized production planning and scheduling tool developed by *Creative Output of Milford, Connecticut*, USA. OPT realized that a detailed schedule and detailed shop floor feedback where only required for the *"bottleneck"* processes and that *"non-bottleneck"* processes can and should be slaved to these.

Furthermore, OPT follows a set of principles called the *"Theory of Constraints"* (TOC). This theory is focusing attention on the capacity constraints or bottleneck parts of the operation. By identifying the location of constraints, working to remove them, then looking for next constraints an operation always focusing on the part that critically determine the pace of output. A constraint is defined as anything that prevents a system from achieving high performance relative to its goal.

10.2 The Base Rules of OPT

OPT is based on a set of ten related rules, which principally focus on managing bottleneck and non-bottleneck resources. The ten rules are as follows:-

1. Utilization and activation of a resource are not synonymous. There is no gain from running a non-bottleneck machine if its output will only build up inventory in front of a bottleneck.
2. The level of utilization of a non-bottleneck is not determined by its own potential, but by some other constraint in the system. The

utilization of a non-bottleneck is limited by the rate of the bottleneck machine.

3. An hour lost at the bottleneck is an hour lost for the total system. This rule parallels and extends rule number 1, and helps managers focus on all activities at the bottleneck.
4. An hour saved at a non-bottleneck is a mirage. Throughput will not increase with savings at a non-bottleneck. Therefore, managers should focus improvement efforts elsewhere. The time spent by a job at a bottleneck is compared of set-up and processing time, while the time spent at a non-bottleneck includes set-up, processing, and idle time. Reducing the set-up time at a bottleneck saves time for the entire system. But, reducing set-up time at a non-bottleneck may increase idle time.
5. The bottleneck governs the throughput and inventory in the system. Inventory should be used carefully so that the bottleneck is never face a lack of parts to process.
6. The transfer batch size should not necessarily equal the production batch size. When a large batch being run on a non-bottleneck just prior to a bottleneck then it would be desirable to get it started on part of the batch (This part called *"transfer batch"*), even through the non-bottleneck is still processing the reminder. The use of different sized transfer batches is called *"lot streaming"*.
7. The production batch size should not be the same from stage to stage in the process. Lot sizes at bottlenecks should, in general, be larger than at non-bottleneck, so that less time is lost to set-ups. Of course, the small batches from the non-bottleneck need to arrive at the bottleneck in the time to be rejoined into a large batch.

8. Capacity and priority should be considered simultaneously. Because the lead time for a given batch depends on the priority given to it at a machine, and on the capacity of the machine, priority rules should be determined in conjunction with the capacity of the machine. In fact, the capacities at all constrained resources should be considered.
9. Balance flow, not capacity. The flow through the plant should equal market demand.
10. The sum of local optima is not equal to the optimum of the whole. Problems develop when supervisors at bottleneck, supervisors at non-bottlenecks, and marketing personnel all optimize for their own goals. Many supervisors try to run their equipment at full capacity, while many marketing personnel try to make bigger profits by selling more at the end of the quarter.

10.3 The Mechanism of OPT

No doubt, that the available information in the literature about the working mechanism of the OPT is very limited, but OPT produce production plans and detailed schedules using the following four basic modules:-

1. *Buildnet*: This module creates a model of the manufacturing facility using data on work center capabilities, routings, Bill of Materials, inventories, and sales forecasts. This model is in the form of network.

2. *Serve*: The model of the workshop is run through an iterative process to determine bottlenecks in the system. Serve is similar to MRP in its workings, and one of its outputs is a load profile for

each of the resources in the model. The most heavily utilized resource could produce a bottleneck in the system and must be examined carefully. Sometimes, rescheduling work from the heavily utilized machine to some other alternate to machine may produce satisfactory results.

3. *Split*: The network model of the shop floor is divided into two parts: critical resources and non-critical resources. The bottleneck operation and all other operations follow it in the order of manufacturing process up to the customer orders are included in the critical resources portion of the network. The remaining portion of the network includes non-critical resources.
4. *Brain*: The operations in the critical resource portion of the network are scheduled using module called the Brain of OPT. This module determines production and transfer lot sizes and the timing of production for each product for the bottleneck operations. Its output is fed to serve module, which then produces the entire production plan.

10.4 Weaknesses of OPT

Although, OPT attempts to overcome the weakness of the early MRP systems of taking no account of the finiteness of shop floor capacity, but practically OPT also have its own disadvantages. The main disadvantage of OPT is the concept of shifting bottlenecks. When the production volume and the mix of products are known, we can find out the bottlenecks in a system. But practically, the *"aggregate planning"* exercise is done at least over several months and the volume of the mix may change from one week to another. Different volumes or mixes can lead to different bottlenecks when that happen, this means that the bottleneck is shifting. It is not clear how OPT handle this dynamic situation because it relies on a clearly identified stationary bottleneck.

From other side, OPT focuses on bottleneck machines and ignores others during the planning horizon. Thus, OPT provides a plan for a production system that approximates the actual production system. In order for an OPT plan to work, it is necessary to have plenty of non-bottleneck resources. When the cost of non-bottleneck resources are not small, the OPT plan may have a high cost. This restricts the usefulness of OPT for cases when non-bottleneck resources are expensive.

10.5 <u>Comparison of MRP, JIT, and OPT</u>

	MRP	JIT	OPT
Loading of operations	**Checked by capacity requirements Planning afterward**	**Controlled by kanban system**	**Controlled by bottleneck operation**
Batch sizes	**One week or more**	**Small as possible**	**Variable to exploit constraint**
Importance of data accuracy	**Critical**	**Unnecessary**	**Critical for bottleneck and feeder operations**
Speed of scheduled development	**Slow**	**Very fast**	**Fast**
Flexibility	**Lowest**	**Highest**	**Moderate**
Cost	**Highest**	**Lowest**	**Moderate**
Goals	**Meet demand Have doable plan**	**Meet demand Eliminate waste**	**Meet demand Maximize profits**
Planning focus	**Master schedule**	**Final assembly schedule**	**Bottleneck**
Production basis	**Plan**	**Need**	**Need and plan**