

# MBC & APS

An advanced planning system. A planning system that provides results.

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## **Preface: *Either you manage the constraints or they manage your corporate.***

Dr. E. Goldratt, the founder of the Theory of Constraints, has made a very important contribution to management thinking based on a very simple observation: ***A chain is as strong as its weakest link***

There can be no dispute on this observation. One can say it is trivial, but when Goldratt derives his conclusions they are simple, striking and far from trivial. This weakest link is the real limiting factor. When applied to a business organization, it is the factor that limits its ability to achieve more of its goal. According to Goldratt it is a constraint.

***"Because a constraint is a factor that limits the system from getting more of whatever it strives for, a business manager who wants more profits must manage the constraints. There is no choice in the matter. Either you manage the constraints or they manage you."***  
( Noreen, Smith and Mackey )

Hence we come to two major tasks for management:

1. Identify the constraints.
2. Focus on their improvement.

The identification of the constraint is sometimes simple. A bottleneck in a production process or in a service line, is an obvious constraint. But a business organization is not linear. It is more like a web and the real constraint is often far from the factor it actually limits. In these cases the "Thinking Process" must be refined and the critical measurements redefined.

Focusing on the constraints does not mean only their proper analysis. It means also that management should not waste time and energy on non-critical issues. Achieving 100% efficiency at non-critical resource is counter-productive. It takes a lot to enforce such decisions.

Finally, after the philosophy is accepted and digested, the implementation is not trivial and very sophisticated tools are needed, as it is the case in production planning and scheduling.

## **The case for Advanced Planning and Scheduling**

The learning process of the difference between efficiency at the operational level (especially at the floor level) and effectiveness at the corporate level has often been painful and expensive.

Effectiveness at the corporate level is achieved when maximum sales are reached (contribution to Profit) , while honoring promised delivery dates (contribution to Service Level factor) and at the

same time the inventory is kept under strict control (contribution to Return On Investment and Cash Flow factors).

On the other hand, maximum efficiency at the floor level is achieved when the number of setups is minimal (i.e. batches are very large), lowering production cost and thus increasing profit.

Efficiency could be managed separately without serious conflict with Effectiveness when the variety of the product mix was limited and the overhead costs were low (5-10%). This situation exists no longer. Today overhead costs typically exceed 50% and in some cases are as high as 80%. Moreover the product mix has increased more than ten folds in the last five years.

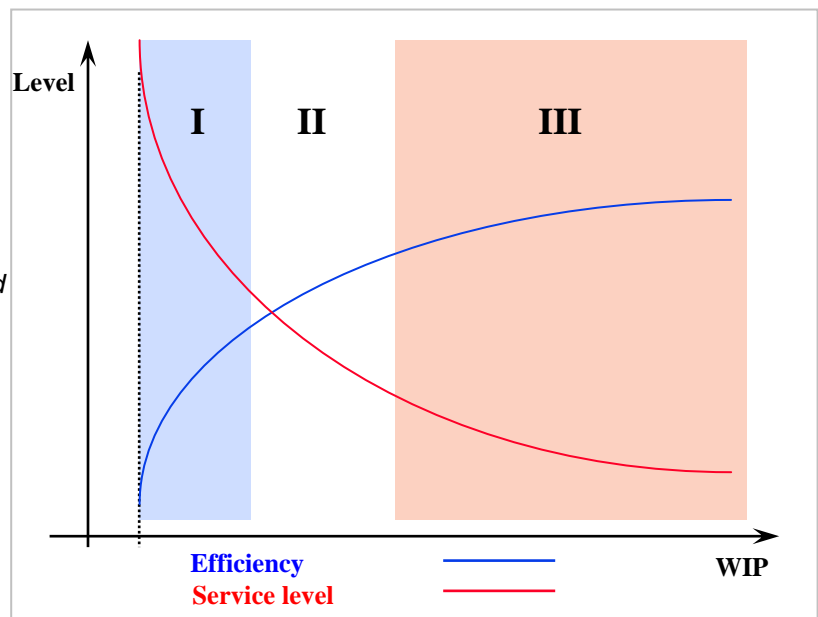
The result is an increase in the work in process together with an increase in the throughput time. The organization is unable to respond to rush orders. It is also unable to give reliable delivery dates. It is busy maintaining high production levels of products for which there is no immediate demand. At the same time customers and sales people may be striving for other products. Long production lead times cause also quality and engineering defects but we shall not relate to this aspect in this article.

Maximum sales for a given period will not be achieved by overall floor efficiency but by maximizing relevant throughput at the bottleneck - the constraint. The production plan will cater for maximum relevant throughput at the bottleneck, scheduling all other activities accordingly, including maintenance and delivery time.

Reliable promise dates will not be achieved if work in process level will be out of control. High priority customer order will not be focused in case of high level work in process.

***The following graph shows the relationship between work in process level (WIP) and Efficiency + Service level.***

- I      *Low level of WIP  
High service level  
Low efficiency, efficiency is  
Governed by any isolated event.  
**Dangerous zone***
- III    *High level of WIP  
Service level is suffers  
High efficiency, efficiency is governed  
By constraints.  
**Very common zone.***
- II    *Optimized zone. Balance between  
Throughput & Service level.*



## **Principles of MBC - based planning method**

The logic of the MBC based planning method follows the principles and the observations mentioned in the above paragraphs. The objective is to maximize the Effectiveness of the organization. Most of the time, but not always, it means to maximize its profit. The planning tool must incorporate 4 basic elements:

### **The planning scope**

The planning tool should not limit the planning scope. A limited scope will create local solutions, maximizing local parameters. The combination of local optimums will very seldom create a global one.

The planning scope must encompass the objectives of the organization as well as the constraints. Then it will be possible:

- To identify the constraints from an overall point of view. According to our definition a constraint is any element which limits the organization in achieving of its goals.
- To establish the reciprocal relationships between objectives and constraints. The objectives determine the priorities, which are the key factor for the planning at the constraint level, then the impact of the planning decisions is evaluated according to the objectives by means of feedback loops. As an example promised dates are derived from the planning of the constraints' activities and vice versa.

### **Constraints & non Constraints**

The planning tool must be able to differentiate between factors or resources which are constraints and those which are not. The planning of the activities at the non-constraint level will be subordinated to and synchronized with those at the constraints level. Thus we shall avoid the conflicts created by local efficiency parameters and the accumulation of excess work in process.

### **Hierarchical plan vs. concurrent**

In most cases of Supply Chain models, one can find internal bottlenecks. In such a case, according to the above principle, internal capacity constraint should become a key variable in the optimization solution, meaning that all planning functions should be geared by capacity constraint. With respect to this subject, we define two type of planning systems:

- Hierarchal where the full planning cycle is being split to two levels: Material Planning and then Detailed scheduling which its output is based upon the Material solution guidelines
- Concurrent where the material planning and the detailed scheduling concurrently output.

According to MBC, hierarchal solution cannot be valid in case there are internal bottleneck(s).

In our words: ***The most sophisticated and powerful optimizer cannot solve material planning guidelines.***

### **Batch size - E.O.Q.**

The batch size should be derived from market requirements. In order for the batch to move rapidly through the organization it should be minimized. On the other hand small batches at the constraints level will reduce the overall throughput of the organization.

This conflict reflects the different approaches of two planning methodologies:

- The western traditional approach based on the E.O.Q. formula
- The modern approaches based on the J.I.T., Lean-Manufacturing and Six Sigma theories, which champion batch size of one unit.

The traditional approach is more appropriate when the number of products is limited and the main constraint is the production capacity. The modern approach will give better results when there is ***protective capacity***. In any case life is not easy for the planner and the planning tool must provide flexible solutions.

### **Production Lead Time (L.T.)**

L.T. cannot be an input parameter in the planning process. A long lead-time is equivalent to a long throughput time, which is translated into high W.I.P. levels. The goal is to reduce L.T. to its optimum length. If L.T. is used as an input parameter its value will be the minimum value in the output and it will not be possible to achieve optimization. L.T. should be a target function and the planning tool must be able to provide the right answer.

### **The complexity of computerized planning**

The transition to computerized planning implies that the planner is to rely upon computerized data. Not all-planning data are computerized neither are the computerized ones reliable or reasonably maintained. Even if the data are good most of the time they represent averages while reality is stochastic. When the planner builds his database he must remember that accuracy is not critical for all data. The planning tool must be able to differentiate between accurate and inaccurate data. In these conditions the negative impact of inaccurate or irrelevant data will be minimal. But nature is of great help! In most organizations we find that data related to constraints are well maintained and reasonably accurate. There is a healthy and positive correlation between constraints and quality of data. This leads us to two important conclusions:

- Computerized planning must be based on MBC It is the only way to avoid the pitfall of inaccurate data.
- A model that contains the whole constraint's scope on one hand, and at the same time includes all information of the detailed constraints' variables is huge and explode by amount of data. A straightforward naïve calculation will need infinite time.
- The analysis and the identification of the constraints cannot be based on computerized data only.
- The Buffer concept must be broadened to **Protective Buffer**. The **Protective Buffer** role is to protect the throughput of the bottlenecks. It will make sure that a slow down or down time occurring at a non-constraint resource, or faster pace at the constraint itself, will not cause a loss of production at the constraint.

In a computerized planning environment it will reflect the latitude we give to non-constraint resources for which we cannot provide detailed planning, or in some cases we do not want to, due to the prohibitive cost of the information needed.

### **Traditional SCP/ERP planning model failed. Why?**

ERP or SCM (Supply Chain Management) systems were developed originally in order to support operations and control tasks in manufacturing organizations. A typical ERP system is a data processing project that includes three elements:

- The data processing hardware: computers, servers, terminals and a.s.o
- The databases and their management - transaction based system.
- The Decision Support Systems modules.

Historically the solution providers have been continuously busy adapting their database and database transaction solution to the new opportunities and capabilities offered by the hardware suppliers. A second focus of the ERP providers has been the adaptation of their databases to the changing needs of the organization.

On top of this the introduction of the system has always been time consuming and laborious and it has also very often suffered of management and personnel changes. The result has been that little attention has been paid to Decision Support Systems and more specifically to Planning and Scheduling systems.

As an example, comparing MRP modules of the 70ies with those of the late 2000ies one finds that the basic approach has not changed. The improvements have occurred in the technology

and the scope of databases, not in the planning engine-logic. After a long and expensive application period the planners still depend on their manual spreadsheets.

In this complex environment the conventional planning systems no longer give satisfactory answers. Computerized outputs need delicate human reviews and the updating of the plan becomes a nightmare. Advanced Planning and Scheduling is designed to solve this problem.

The traditional planning approach lacks the critical features that have been identified the paragraphs above:

- Scope of the solution. As mentioned above, model's scope should cover all corporate constraints. Related information for some of the constraints may not be maintained on the Supply Chain Management (SCM) but in external subsystems or on different ERP system.
- Planning logic: Hierarchical planning mode. All known planning solutions are hierarchical. As mentioned above, a key factor for succeed model is missing – Concurrent planning mode.
- Differentiated treatment of constraint and non-constraint resources.
- Flexible lead-time
- Flexible Batch Size policy.

After all there can be no surprise that a focused and untangled approach to Planning and Scheduling provides better solutions.