How to identify bottlenecks in production and projects

*Good news!*

*You are probably wrong about where your capacity constraints are*

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TOCICO 2015 International Conference  
Cape Town, South Africa

Wednesday 9th of September 2015
Abstract
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Good news!
You are probably wrong about where your capacity constraints are

We have observed a new situation that has emerged over the past 10 years. In today’s factories or R&D departments, 8 times out of 10, the capacity constraint is in the wrong place.

Furthermore, to make matters worse, management is wrong about where its constraint really is. So they over-utilize non-bottleneck resources thereby increasing WIP and lead times and they under exploit the bottleneck because they have not recognized its existence which results in limited throughput.

We will attempt to describe what has led to the development of this situation. This state of affairs can be viewed as regrettable...or as an extraordinary opportunity for 8 companies out of 10.

It means that the majority of organizations can transform their performance very easily, very quickly in both their production and their new product development. All they have to do is properly implement the Theory Of Constraints.

Several recent cases will be presented and an attempt will be made to identify the common root causes of this situation.
Content

- Introduction
- A few examples
- Lessons learned
- Conclusion
- Annexes
Introduction
Philip Marris
CEO – Marris Consulting, Paris, France

- Theory Of Constraints specialist. 29 years of TOC experience. Started working with the founder Eliyahu Goldratt in 1986.
- Consultant (warning!)
- >25 years of experience helping over 150 companies in all industrial sectors.
- Author of numerous articles on TOC. Gives over 10 conferences a year worldwide.
- Author of a very boring French textbook about TOC in manufacturing Le Management Par les Contraintes.
- >15 years of experience in major consulting firms.
Theory Of Constraints
marketing & awareness activities

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- 5 Permanent news websites (www.Scoopit.com)
  - Theory Of Constraints (English & French)
  - Critical Chain in (English & French)
  - TLS: TOC + Lean + Six Sigma
- >80 Free Videos (YouTube Channel)
- Discussion Groups (LinkedIn)
  - Critical Chain
  - TLS: TOC, Lean and Six Sigma
- 2 dedicated websites in French
  - TOC in Production
  - TOC in Projects
- Others:
  - Twitter, Facebook, Viadeo, Etc.
In this presentation we are only going to discuss capacity constraints in production or in projects. We will not cover other types of constraints: in Sales and Marketing, in Purchasing, in Distribution or the issue of "Management Attention".
80% of companies don't know where their capacity constraint is

- 10 years ago 50% of the companies we worked with knew where their bottlenecks were before starting to implement the Theory Of Constraints.

- Over the past 10 years (2005 to 2015) we have found that in 8 cases out of 10 the organization is initially mistaken as to where its capacity constraint is.
A few examples of mistakes in identifying bottlenecks
My impressive rolling mill

- A steel manufacturer world leader.
- A 2,900 person factory with a steel mill, a rolling mill, heat treatment and finishing operations.
- They thought it was their big impressive rare sophisticated rolling mill.
- In fact it was their 6 (boring) heat treatment furnaces.
My key research experts

- A 280 person R&D Department of a leading Animal Health Pharmaceutical firm.
- They thought that the constraint was their 19 key experts (research scientists).
- In fact it was their Industrialization Department because of an outsourcing decision 3 years previously. This had tripled the workload on these 9 people.
- So the new drugs developed were all waiting for this department to define how and where they were going to be produced.
What is not in SAP doesn't exist

- A 400 person factory making Flight Control Systems for airplanes.
- They thought that their 5 most expensive machines were the constraint.
- In fact it was their Quality Control.
- But their ERP/MRP system could not see this because these operations were "indirect" and did not have any kind of capacity management.
- This is a sad case because the huge pile of WIP before the constraint was hiding in plain sight.

35% of WIP was blocked before Q.C.
700 person factory. Aeronautical sophisticated bearings for plane engines, helicopter rotors, etc

2 mistaken identification of constraints:

- Firstly a set of machines that suffered spikes in demand for very urgent work due to internal quality problems but had a low monthly load.
- Secondly their expensive milling machines
- In fact it was another machine of secondary importance
A constraint hidden in 30 different places

- Another steel making factory of 2,200 people making thick metal sheets with a lot of WIP and many overdue orders.
- And yet, following a downturn the whole plant was only loaded to 50% of its capacity.
- In fact, due to simplistic cost cutting, the constraint was the 16 people who did manual testing of the metal sheets at various stages in production.
- Difficult to spot because the queue of work was spread out in over 30 locations.
How to create a huge constraint in 14 factories with one decision

- A leading Automotive Original Equipment Manufacturer producing alternators in 14 big factories around the world.
- Implemented a purchasing decision to replace very expensive rare earth metal magnets by cheaper normal ones.
- This means that one of the operations in each of the 70 production lines concerned suddenly had twice as much work (milling the slot in which these magnets were inserted).
- Impact: -50% Throughput in the entire division...
Lessons learned
The only difference between an adult and a child is the price of his toys

- We find that management often falls into the trap of wishful thinking. They convince themselves that their most expensive machines are the bottlenecks (since this is a sensible / good situation).
Beware of your ERPs blind spots

- Production systems have more and more operations that are considered as “indirect”.
- They are not managed in the ERP as an operation with a predefined time per part using an identified resources with a quantified capacity.
- For example: Quality control or quality documentation operations that are now significant in work load and widespread in contemporary industry (aeronautical, food, pharmacy, steel, etc.).
- Unfortunately when the constraint concerns indirect labor the overload on the resources and the accumulation of Work In Progress are likely to go unnoticed. The ERP system will not see them.
- The performance – the “productivity” – of these operations is rarely monitored correctly by management. So the constraint does not receive the appropriate management attention. This is good news because managerial attention (pressure) can probably increase performance by >50%.
Your analysis is probably out of date

Organizations tend to be 1 to 3 years late in their analysis. So to help find the real bottlenecks ask yourself what has changed over the past 5 years:

- New quality requirements
- Regrettable cost cutting initiatives
- New technology
- New machines
- New strategy
- New raw materials or new components
- New management with new rules
- New competitor
- New reglementation
Important note:

- Our experience is only in New Product Development, MRO (Maintenance Repair and Overall) or I.T. development projects. So our point of view might not be relevant to other types of projects such as in building and construction.

- We consider that there are 2 types of constraints in multi-project management:
  - The Critical Chain of each project (the constraint of each project)
  - The capacity constraint of the portfolio (a resource).
    It is this second kind of constraint that we are analyzing in this presentation.
Capacity constraints in projects (continued)

- In project environments the data regarding task durations and workloads are necessarily difficult to estimate.
- They are either very erroneous or simply non-existent; the organization does not even attempt to calculate workloads apart from a very approximate annual budget.

- This has always been the case but the increasingly significant changes in New Product Development portfolios are destroying the historical equilibrium (the "nearly balanced" system).
Companies are trying to develop today’s product portfolio with yesterday’s resource pool.

Typically in New Product Development we have very regularly found that the new competencies, or the areas in which the amount of work per product has increased very significantly, are understaffed.

Examples: electronics, regulatory, software development, quality management ...
Conclusion
Quick tips

- Forget the data and look for the big queues
- Beware if the bottleneck is too good to be true

- When you have a hypothesis for the location of a bottleneck TEST IT. Normally everything should make sense.
  - If the bottleneck produces 15% more then the organization should produce 15% more (often with a lag).
  - Late or overdue things waiting in front of the bottleneck.
  - Etc.
Good news!

- In our experience there is an 80% probability that you are wrong about where your bottleneck is...

- ...and that is very good news for you!
Any questions?
Annexes
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Philip Marris – TOCICO – 9th of September 2015 – Cape Town, South Africa
3 permanent news websites dedicated to the Theory Of Constraints, CCPM and TLS

- www.scoop.it/t/theory-of-constraints-by-philip-marris
- www.scoop.it/t/critical-chain-project-management
- www.scoop.it/t/tls-toe-lean-six-sigma
Philip Marris is CEO of Marris Consulting, a management consultancy focused on industrial operations based in Paris, France. Over 80% of the firm’s projects are based on the Theory Of Constraints.

He is the author of the French reference book *Le management par les contraintes en gestion industrielle*. He is involved in the “TOC + Lean” movement and founder of the LinkedIn “TLS - TOC Lean & Six Sigma” group and 5 Scoop It TOC related information websites.

He has designed, sold and executed over 150 transformation projects.

He is a member of the board of the TOCICO French regional group and is active in increasing the awareness of TOC worldwide.

He started his TOC journey in 1986 when he joined Creative Output France and had the honor and pleasure of working with Eli Goldratt and Issi Pazgal.

Philip Marris was for many years in charge of Manufacturing Operations in large consulting firms.

He has over 29 years of experience in industry and in consulting. Philip Marris started his career as a production engineer in the steel industry. He is English and is bilingual and bi-cultural. He lives in Paris, France.
Abstract
How to identify bottlenecks in production and projects
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Good news! You are probably wrong about where your capacity constraints are

In today’s factories and research and development departments, 8 times out of 10, the capacity bottleneck is in the wrong place. And, to make matters worse, the company, often surrendering to wishful thinking, mistakenly believes that it is elsewhere. This is our experience based on the last 10 years of our 30 years experience of TOC in production and projects.

Many years ago, let’s say prior to 2000, organizations that had accepted the precept of the Theory Of Constraints that their system contained a constraint, tended to have correctly identified them. In our experience this is no longer true of the majority of companies.

We argue that there are several reasons for this:

• The environment is changing faster and faster: new technology, new products … Companies will therefore have a tendency to have an obsolete view of the location of their constraints. Their analysis is out of date. The constraint that they believe they have was the constraint 2 or 3 years ago, but it has moved since then.

• Production systems have more and more operations that are considered as “indirect” and therefore are not managed (in the ERP’s routings) as an operation with a predefined time per part using an identified resources with a quantified capacity. This is for instance true of quality control or quality documentation operations that are now significant in work load and widespread in contemporary industry (aeronautical, food, pharmacy, steel, etc.). Unfortunately when the constraint concerns indirect labor the overload on the resources and the accumulation of Work In Progress are likely to go unnoticed. The ERP system will not see them. Unfortunately the performance – the “productivity” – of these operations is rarely monitored correctly by management. So the constraint does not receive the appropriate management attention.

• In project environments such as New Product Development (NDP) the data regarding task durations and workloads are necessarily difficult to estimate. In practice they are either very erroneous or simply non-existent; the organization does not even attempt to calculate workloads apart from a very approximate annual budget. This has always been the case but the increasingly significant changes in NDP portfolios are destroying the historical equilibrium. Companies are trying to develop today’s product portfolio with yesterday’s resource pool. Typically in New Product Development we have very regularly found that the new competencies, or the areas in which the amount of work per product has increased very significantly, are understaffed: electronics, regulatory, software development, quality management ...

So, in our experience of over 100 TOC implementations in production and projects these past 10 years, what we find is that management often no longer knows where their real constraints are, and therefore will focus on the wrong resources. So they over utilize their non-bottleneck resources thereby increasing WIP and lead times and they under exploit their bottlenecks which results in limited Throughput.

We will review several cases to support our point of view:

• A case in aeronautical production where quality control was the unrecognized bottleneck
• An animal health pharmaceutical company that had not realized the impact of their decision, 3 years previously, to subcontract 50% of their production. As a result all their new product development was blocked just before getting to the market.
• A leading steel manufacturer that had not realized that their manual quality control that was repeatedly used all over their plant was their invisible and elusive bottleneck.
• The case of a leading automotive equipment manufacturer that disrupted an entire division of its organization by implementing a purchasing decision regarding rare earth metals.

This situation can be viewed as regrettable. Some may think that these companies were badly managed, but we think that they are in fact the new normal. As we have said, we think this is the case of 8 companies out of 10 today.

But in our opinion, it means that it is an extraordinary opportunity for 8 companies out of 10. It implies that the majority of organizations can increase their performance very easily and very quickly in both their production and their new product development. All they have to do is correctly implement the first 3 steps of TOC’s 5 focusing steps: identify the constraint, exploit it and subordinate the system to its real constraints.
Marris Consulting has conducted over 150 engagements over the past 10 years, transforming industrial enterprises in France and around the world.

Clients: ArcelorMittal, GSK (Glaxo Smith Kline), Valeo, Embraer, Safran, SNCF / French Railways, Veolia, Salzgitter Mannesmann, EADS, Aubert & Duval / Eramet, Autoliv, SKF, ABB, Man, Michelin, Bobst, Banque de France, DSS / Kaysersberg Packaging, etc. and over 50 Small & Medium Enterprises.

The firm is recognized as an expert in TOC & Lean Manufacturing. Philip Marris is the author of the TOC reference book in French: *Le Management Par les Contraintes*. Philip is English and worked with Eli Goldratt in the formative years of TOC.

Marris Consulting conducts regular training courses in TOC, TLS, Critical Chain project Management, and other related areas of practice. The courses are delivered in Paris but can be arranged to be conducted at other sites.

TOC manufacturing & CCPM websites (in French):
- [www.management-par-les-contraintes.com](http://www.management-par-les-contraintes.com)
- [www.chaine-critique.com](http://www.chaine-critique.com)

Founded in 2005, 14 consultants + freelance network

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