CONSTRAINT ANALYSIS

AD PUNCTUM | Business Improvement

Assessing Priority For Improvement Actions Using Theory of Constraints

WHAT IS THE THEORY OF CONSTRAINTS?

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- **Theory of constraints can be applied to linked stages of work**
  - Could range from a production line to an accounting process
- **The theory is that output level works on a lowest common denominator basis**
  - Output will be dictated by whatever is your least-productive process
- **Stopwatches at the ready then? Not quite…**
  - Process output is a function of quality, uptime and speed
  - For industrial plant this is relatively easy to measure (with sufficient records)
  - In other environments the theory still holds but analysis is harder
- **After identifying the constraints, we focus improvement efforts on them**
  - Constraints are our overall least-productive process
  - Production lines sometimes have 2 or 3 machines “vying” to be the constraint

USING CONSTRAINT ANALYSIS

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WHEN

When we want to make performance improvements and we have a number of process steps that are involved

Can also be useful in process design if we are doing a new but similar task

WHY

Because we can't attack everything at once

Because we want to get the best value for our efforts

Because we want to ensure this improvement builds on the last

HOW

By understanding which processes are the least productive

By working out how we can improve them

By confirming the improvement led to higher output

Question:

What if we don't direct our efforts to the constraint and work on something else?

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Answer:

You may get some improvement, but the constraint will remain your worst process and constraint output

THE KEY FACTORS IN DENTIFYING CONSTRAINTS

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Raw Speed

- In a machine, this is the cycle time for a single component
- In an administrative process this is how fast we can do the activity if everything is there when we need it (and correct!)

Downtime

- This is all the time when we aren't able to do work – reasons include breakdowns, changeover time and planned maintenance
- In an administrative process this includes all the waiting time

Quality

- In a machine, this is the amount of parts that are produced without rework required
- In an administrative process this is the amount of work that doesn't cause errors, create customer complaints or have to be re-drafted

IDENTIFYING THE ROOT CAUSES

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Deming Cycle	5S	Six Sigma
• **Plan**	• **Sort** • **Set**	• **Define** • **Measure**
		• Analyse
• Do	• Shine	• Improve
• Check	• Standardise	
• Act	• Sustain	• Control

Whatever Your Preferred Problem Solving Methodology, We Have To Start With A Good Understanding Of The Process And Its Problems

This might mean having to measure things that we haven't measured before...

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It's normally at this stage that people become frustrated...

They are filling in log sheets and checklists but they want to improve!

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Pro Tip:

Gain acceptance by starting off simple. Choose a process you know well. Get some quick wins.

IDENTIFYING THE CONSTRAINT -- EXAMPLE

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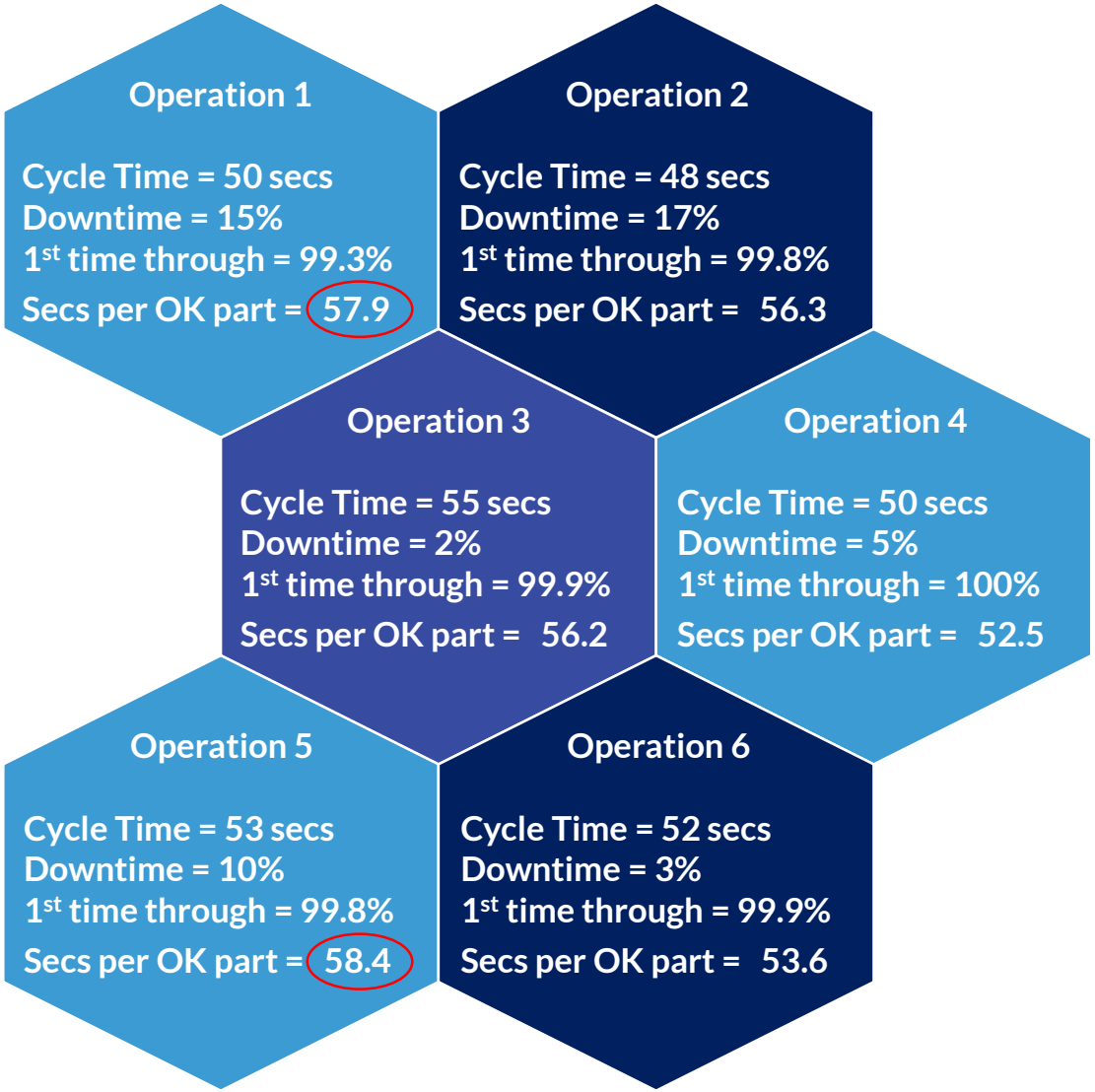

- In this example we can see that the constraints are not the slowest machines
- They are the constraints because of a combination of factors
- We should focus on operations 1 and 5 even though operation 2 has poor reliability and operation 3 is the slowest
- To be clear -- we need to take data over a long enough period of time to establish the pattern

IMPROVING THE DIFFERENT FACTORS

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SPEED

We identify elements as follows:

- Moving the work around
- Getting the work set-up correctly
- Doing the value-added work

DOWNTIME

We identify elements as follows:

- Time process is broken down
- Time spent in changeover
- Time spent in planned maintenance
- Time spent where process is unmanned (break time)

QUALITY

We identify elements as follows:

- Where we have to do rework before the job is finished
- Where a subsequent process sends it back or has to do rework
- Where the end customer is dissatisfied with the outcome

OPTIONS FOR DATA GATHERING

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"All In"	Log detailed data on all processes before confirming constraint Pro: Can move quickly through process steps Con: Upfront data logging may be over-the-top
"All In Good Time"	Gather detailed data only once constraint is identified Pro: We already know we are measuring the right things Con: We have to wait longer to know what to fix
"Do What We Can"	Gather a level of data we can capture without undue effort Pro: Sometimes there is a happy medium with easy to get data Con: Carefully set expectations -- we may need more data

SELECTED IMPROVEMENT EXAMPLES

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GETTING THE WORK SET-UP CORRECTLY

Plant example:
- Orienting the part correctly
- Solution -- create a jig where the part only sits in one position

Admin example:
- Transferring the data between a form and an analysis file
- Solution -- create a template which can pull the data in effortlessly

TIME SPENT IN CHANGEOVER

Plant example:
- Changing dies and height setting for the first good part
- Solution -- modify dies to have the same height setting

Admin example:
- Updating files at the beginning of a new year
- Solution -- put different settings in a table so that all the updates come through together

SUBSEQUENT PROCESS SENDS THE WORK BACK

Plant example:
- The next process can't align the part to the main assembly
- Solution -- create a go/no-go gauge to start, then fix the issue through process improvement

Admin example:
- The downstream department finds mistakes that we made
- Solution -- reconciliation sums within the file to find errors

NOT ALWAYS AS EASY AS IT LOOKS…

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- **Theory of constraints seems so simple and intuitive that it isn't clear why people wouldn't do it all the time…**
- **The difficulties are:**
  - The need to establish usable records of process performance
  - The nature of the problems you uncover and the time it takes to fix them
- **Constraints are often caused by chronic problems such as "build-up of swarf in station 3" or "missing data on the customer submission form"**
- **Often the team are so keen to show improvement that they go after something fixable instead on the assumption it will flow through to overall output**

WHAT DOES IT TAKE?

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Understanding Of The Affected Processes

Data Logging

Research Into Improvement Techniques

Data Analysis

Time

ABOUT AD PUNCTUM

- Consultancy and research firm founded by an ex-automotive OEM insider
- Proven experience in a range of environments from high volume, high precision manufacturing to finance, product development, sales and strategy
- Track record of developing and delivering sustainable improvements with minimal re-training
- Managed and delivered a number of process re-engineering and outsourcing exercises
- Please contact sales@adpunctum.co.uk or visit www.adpunctum.co.uk to learn more about us and discuss any specific queries you might have

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