NHS Improvement

ACT Academy

Online library of Quality, Service Improvement and Redesign tools

Theory of constraints

collaboration trust respect innovation courage compassion

Theory of constraints

What is it?

Theory of constraints is an approach to identifying the most important limiting factor (ie constraint) that prevents any system or process from meeting its goal and then systematically improving that constraint until it is no longer the limiting factor. Within healthcare systems these constraints may show up as bottlenecks within the process.

While the bottleneck is evidence of a constraint, the constraint is usually related to equipment, staff or a policy which is stopping the process from functioning effectively. The link between constraints and bottlenecks is particularly important as a bottleneck determines the pace at which the whole process can work.

Just as the strength of a chain is determined by its weakest link, the limiting step and its constraint determine the work rate (throughput) of a team, process or hospital. Knowing where the constraints are enables you to focus your improvement efforts and employ specific techniques to increase and maintain throughput.

When to use it

In complex systems such as healthcare, there will always be bottlenecks or rate limiting steps along pathways. Typically these hot spots have been found to be services that are shared between multiple other services such as diagnostics, theatres, etc.

How to use it

The theory of constraints uses a five-step process in an attempt to improve throughput and achieve continuous flow.

1. Identify the system's constraint

Map out the processes or patient pathways at a high level (see **process mapping** or **value stream mapping**). Identify the steps or parts of the process where there are the longest delays for patients.

Next, map this part of the process in more detail (see **process templates** so that you really understand what is going on). Do this to the level of what one person does, in one place, with one piece of equipment, at one time. Look at the process templates tool at this stage, in conjunction with **demand and capacity management**.

Look carefully for the true constraint: it is often a lack of availability of a specific skill or piece of equipment. Waiting lists or backlogs of work tend to occur before the bottleneck in the patient journey and clear after the patient has gone past the stage with the constraint.

Keep asking 'why?' to try to discover the real reason for the delay (see **root cause analysis using five whys**). For example, the clinic always overruns and patients have to wait for a long time. Why? Because the consultant does not have time to see all her patients in clinic. Why? Because she has to see everyone who attends, including first visit assessments and follow up patients. Why? It is what she has always done.

2. Get the most out of the constraint – exploit it

The constraint must always be managed as it determines the rate at which patients go through the system. It is therefore important to ensure there is no idle or wasted time at this point in the process.

For example, if a radiologist is found to be the constraint in a given process, any time the radiologist is waiting for patients or equipment would be considered wasted time – this in turn affects the overall throughput.

To help ensure maximum utilisation at this point in the process, you could consider things such as multi-skilling staff or removing administrative work to enable trained staff to concentrate on their particular skill.

Where the constraint is equipment, it is important to ensure that it is always in use. Routine servicing of radiotherapy machines (a frequent constraint in the radiotherapy process) during the working week will impact on throughput.

At the same time, see if processes can be improved. For example, if theatres are the constraint, try prepping patients outside of theatre to release theatre time.

Detailed **process templates** will help identify potential opportunities and generate ideas on how constraints could be better managed. This information will help to develop careful schedules around the constraint to reduce any wasted time.

Be aware that once you get the most out of a constraint, the bottleneck may move to another step in the process.

3. Support the system's constraint

It is here that the organisation needs to ensure that its policies, resources, behaviours, measurements, etc support the constraint to ensure that it is always working. This may require behaviour change in the organisation.

The theory of constraints recommends putting a buffer (a small queue) in front of the constraint to ensure it is always fed and there is no down time. An example might be that patients are scheduled to arrive so there is an average of two or three patients in the waiting room at all times.

4. Elevate the system's constraint

If the constraint still exists after exploiting and subordinating everything else to it, then you can now elevate it and break it by investing resources in it.

This may require capital expenditure, overtime or increased bed or theatre capacity. This step is only necessary if the constraint is a true bottleneck.

5. Go back to step one

This ensures that you don't allow inertia to become the system's constraint. When the constraint is broken, go back to step one. This step highlights the need to focus on continuous improvement.

Examples

1. Staff at the Oxford Radcliffe Infirmary carried out a theory of constraints workshop, prompted by 64 elective neurosurgical cancellations in a three month period, combined with increased staff sickness levels.

The neurosurgeon and anaesthetists all believed that they were the constraint in the process, although on examination the problem was found to be bed capacity.

Changes introduced included one member of staff being given the role of bed manager, while the maximum daily number of elective patients was reduced from eleven to six.

Although initially these changes seemed counterproductive, the overall impact included reductions inpatient cancellations, a drastic cut in out of hours operations and an increase in throughput of 16 percent. (A Story of Success, Hitting the Bottom – *Health Management*).

2. A study conducted in 2005 (The Impact of Theory of Constraints in an NHS Trust, *Journal of Management Development*, Vol. 24 No.2) investigated the impact of the theory of constraints on three NHS trust departments – neurosurgery, ophthalmology and ear, nose and throat (ENT) – in relation to reducing waiting lists and improving throughput of patients.

Significant improvements were made in ENT and ophthalmology, but not in neurology due to the size of the system, its complexity and its heavy reliance on support services. The authors of this study recommend that an organisation's social environment is taken into account in order to maximise the benefits of the theory of constraints.

What next?

The theory of constraints has an overlap with **lean thinking**. Whichever approach is the main driving philosophy of your organisation, understanding where the rate limiting step is in the patient pathway can help you to understand how to improve throughput. This understanding will complement other improvement strategies.

Leadership, **stakeholder analysis** and using **project management** will support your improvement efforts. A structured approach applying small tests of change (**PDSA**) with measurement will help you to make sure that any change results in an improvement.

Additional resources

Bicheno, J (2000) *The Lean Toolbox: The Essential Guide to Lean Transformation*, PICSIE Books: 4th edition

Goldratt, EM (1990) *The Theory of Constraints*, North River Press: New York

Goldratt, EM and Cox, J (1993) *The Goal: A Process of Ongoing Improvement*, Gower

Hopp, W and Spearman, M (2000), *Factory Physics*, McGraw Hill, Boston

Young, T, Brailsford, S, Connell, C, Davis, R, Harper, P and Klein, J (2004) Using Industrial Processes to Improve Patient Care, *BMJ*, Vol.328

Background

The theory of constraints began with a simple concept about production lines, similar to the idea that a chain is only as strong as its weakest link (in Goldratt's 1990 book). It can also be used to describe a business philosophy and an improvement methodology.

The theory of constraints has been developed over the last 20 or so years, predominately in the manufacturing industry. It has most recently been applied to healthcare with regard to reducing waiting times and increasing throughput. Its application alongside Lean thinking is now well recognised in the NHS.