

Level 5 – Continuous Improvement with Industry 4.0

Improve 7 – Process Flow



- Try to build Quality control into each step of the process
- Minimise defects
- Prevent adding value to products which are already non-conforming
- Balance workflow to avoid overloading bottleneck constraints
- Try to smooth customer demand
- Process by FIFO (first in first out)

- Reduce the size of batches
 - Operate 'finish job, move job'
 - Detect errors sooner, if possible immediately after that characteristic is changed
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- Design process to handle the routine not the exceptions
 - Use specialists to handle exceptions
 - Problem solve root causes of the exceptions to minimise and fix

We have previously learnt about the 'Voice of the Customer' (Kano model, House of Quality etc), now we need to understand how we relate this and adapt into our day to day activities to streamline manufacturing products and delivering more efficient services

Also, the VSM can identify the different elements of Value Added, Non-Value Added and the 8 wastes (TIM WOODS)

- Demand Smoothing - Heijunka
- Takt Time
- Work Place Layout – Standard Work Combination Tables
- Theory of Constraints

- Production smoothing - Heijunka

Process for levelling customer demand so waste is reduced:-

- Removes the peaks and troughs of customer demand
- Minimises waste
- More efficient to plan materials, manning machines etc.
- Reduce batch sizes to actual customer demand

- Production smoothing - Heijunka

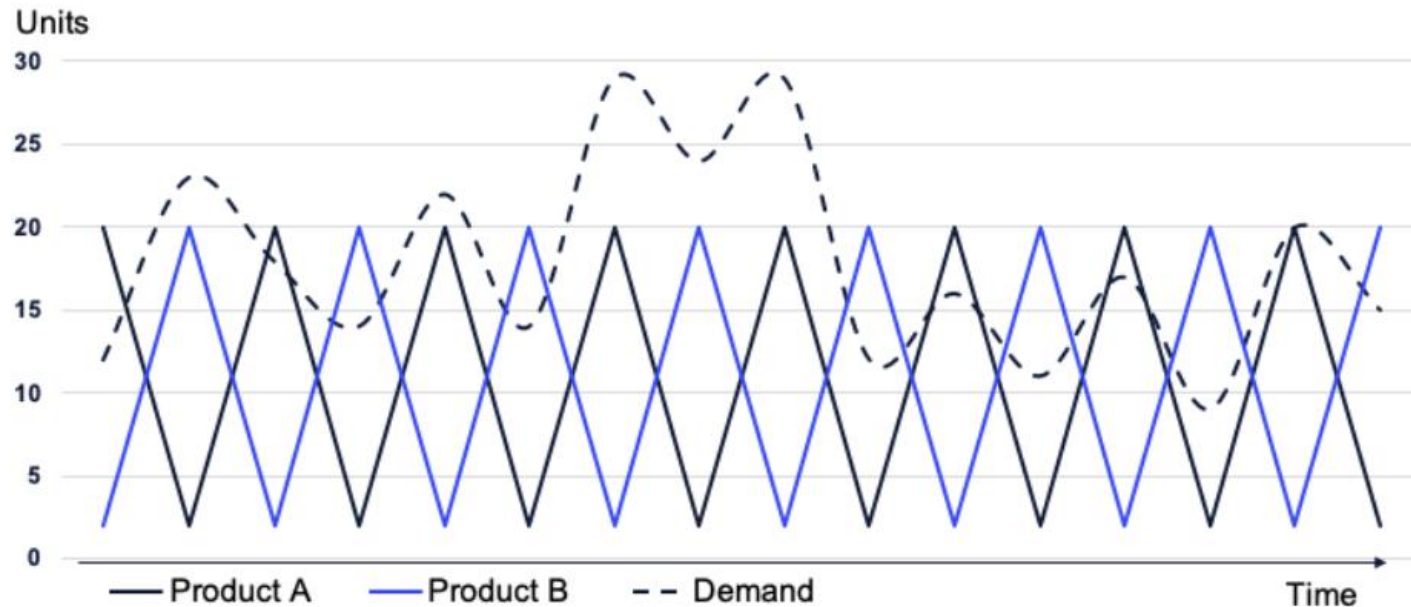


Figure 3: Shopfloor operations after applying production leveling

- Production smoothing - Heijunka
- Dialogue with customer to understand their specific needs
- Will need certain CI tools to help achieve this – SMED activity for faster changeovers, line balancing
- May not be able to achieve in certain scenarios i.e. jobbing shops

- Takt Time

Takt time is the drum beat of the flow of products. It is the metronome (from German origins of the word).

It is worked out by the available time (i.e. day – breaks, planned stoppages) divided by that days demand.

i.e

7.5 hr av./day (7.5 x 60) = 450 minutes / (600 units/day)

=

0.75 minute = 45s

- Takt Time = 45 seconds

If any of our individual processes are longer than 45 seconds within a production line we have a bottleneck within our process and cannot meet customer demands!

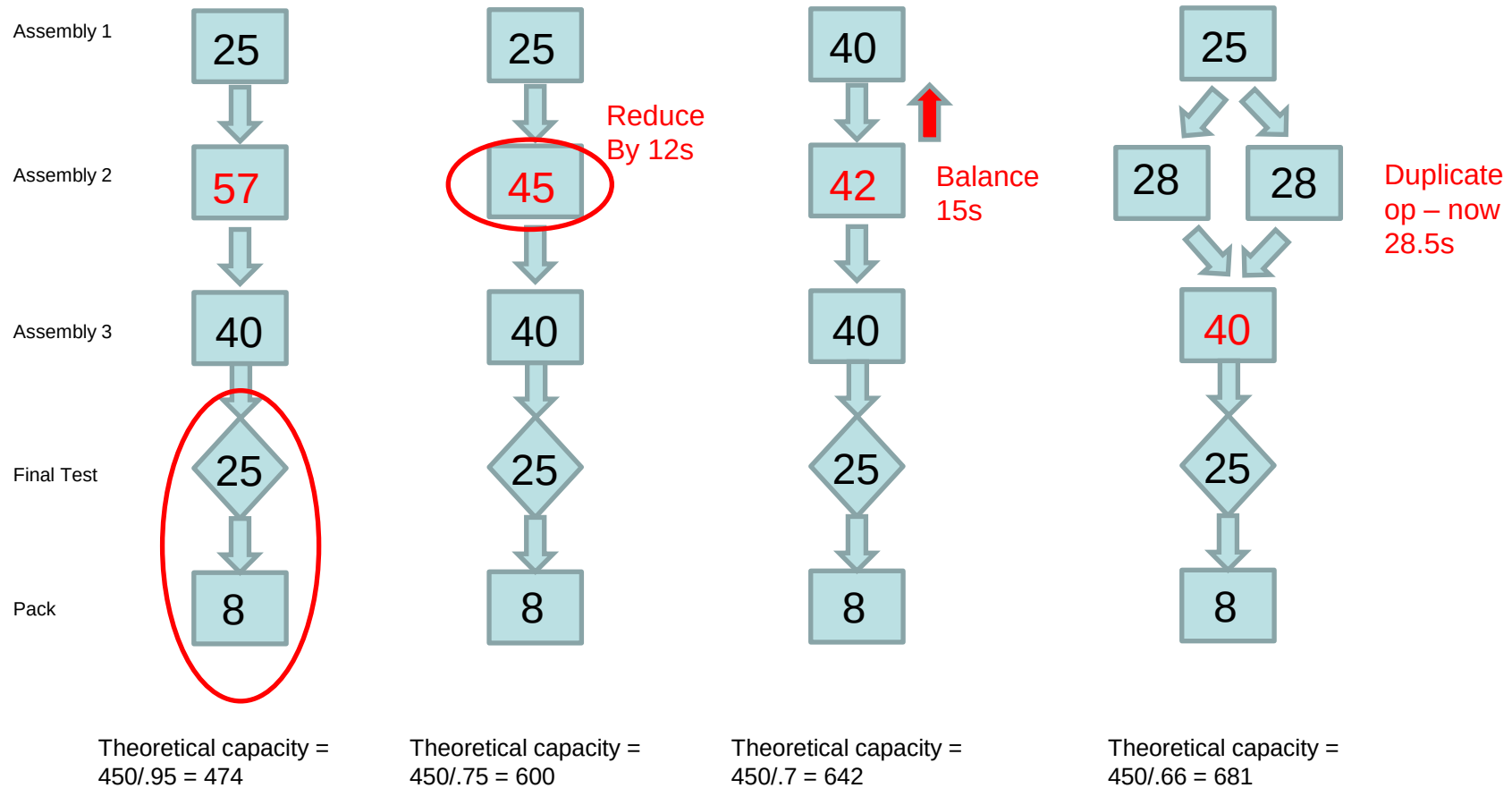
What can we do???



- Takt Time = 45 seconds
- Reduce our cycle time to equal or less than 45s
- Redistribute the work – balance the line
- Duplicate operation so we increase capacity
- Expand work time (overtime)
- Reduce demand

Improve - Process Flow

- Takt Time = 45 seconds



- Workplace Layout – traditional

Traditionally factories were laid out by process function:-

- Press shop
- Welding bay
- Assembly area
- Test area

- Workplace Layout - traditional

Some disadvantages of this type of layout:-

- Increased inventory
- Longer lead-time
- Quality issues not being identified until component being used
- Encouraged 'Silo' mentality within organisation.

- Workplace Layout – Cell

Most factories now laid out as cells:-

- One piece flow through process possible
- Optimum inventory levels
- Quality issues can be highlighted straight away and acted upon
- Job rotation of operators
- Can be manned according to demand

- Standard Work Combination Table/Sheet

Standard format for understanding the detailed work of a process, each element and their interactions:-

- Itemises each element of the work
- Shows if each element is a manual, automatic or walking operation – this can also be classed as VA/NVA or waste activity
- Shows time taken for each element and total cycle time
- Basis for on-going improvements

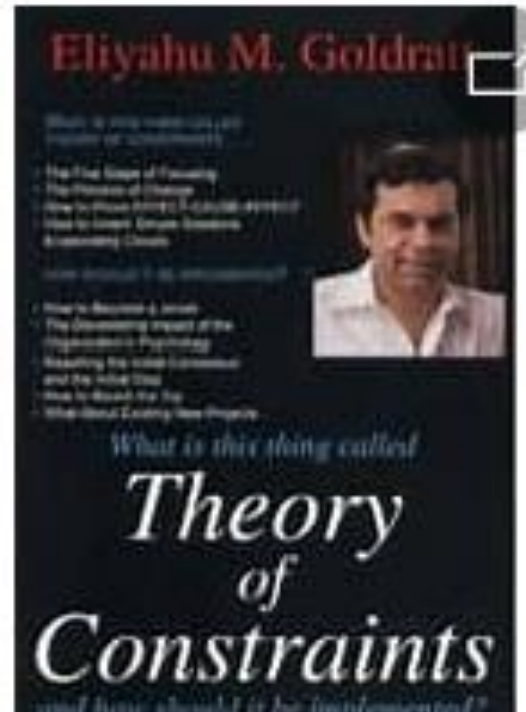
MADE

The Lean Toolbox 2016, John Bicheno/Matthias Holweg

Standardized Work 2: Standardized Work Combination Table

Standardized Work Combination Table		From:		Date:										Required Units per Shift:				Hand Walk Auto									
		To:		Area:										Takt Time:													
Work Elements		Time (sec.)			Seconds																						
		Hand	Auto	Walk	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100			
1																											
2																											
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Totals			Waiting		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100			
					Seconds																						

- Theory of Constraints



- Theory of Constraints

‘The Goal’ written by Eli Goldratt in 1984

- Every process has a limiting factor ‘the constraint’ – bottleneck – which constrains that process to improve
- Focuses on the limiting factor until it is no longer the constraint

- Theory of Constraints

5 distinctive steps

- Identify the constraint
- Decide how to exploit the constraint
- Subordinate all other resources to the constraint
- Elevate the constraint
- When constraint has been broken go back to step 1

- Theory of Constraints

Identify the constraint

- Company KPI's may identify this
- Largest maintenance issues
- Low OEE measure – if being used
- Often identified by large amount of inventory in front of constraint
- Down stream processes starved of material/inventory

- Theory of Constraints

Decide how to exploit the constraint

- Don't rework defects on it
- Ensure maintenance focus and attention
- Ensure products being manufactured meet quality requirements
- Make sure products being manufactured are actually required by customer

- Theory of Constraints

Subordinate all other resources to the constraint

- Encourage flow to the constraint
- Regular material and uninterrupted
- Make everyone aware of the constraints importance
- Minimise batch sizes

- Theory of Constraints

Elevate the constraint

- Break constraint by undertaking the previous two steps
- Additional machine
- Additional overtime
- When constraint is broken it will move

- Theory of Constraints

Back to identify constraint

- Note constraint will move around the process
- A constraint is precious – spend time understanding it
- Acts as a break within the process

Further reading ‘The Lean Toolbox’ p228