Developing An Entrepreneurial Mindset

Power of Industry Knowledge

PhD. Akmal Varisov

Work Balancing / TAKT Time

Work balancing maximizes operator efficiency by matching work content to TAKT time

TAKT time is the rate at which customers require your product

TAKT time is calculated as follows:

$$\frac{\text{Available work time per day}}{\text{Daily required customer demand in parts per day}}$$

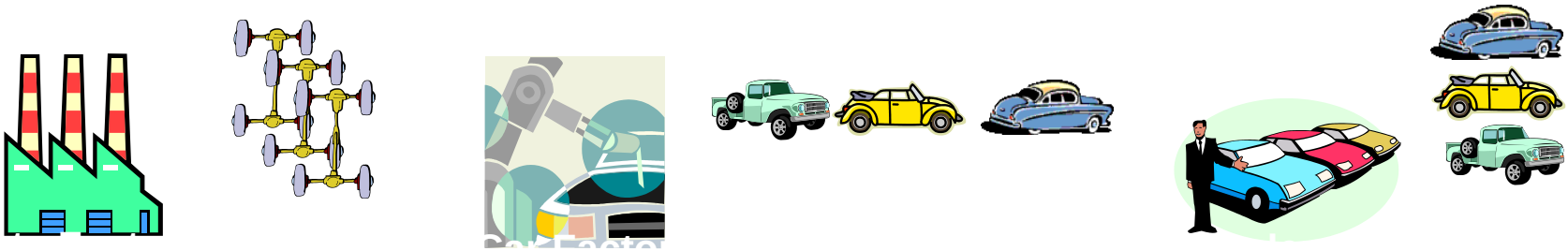
Production Smoothing / Leveling

Averaging both the volume and the production sequence of different model types on a mixed-model production line.

Example: Toyota Manufacturing

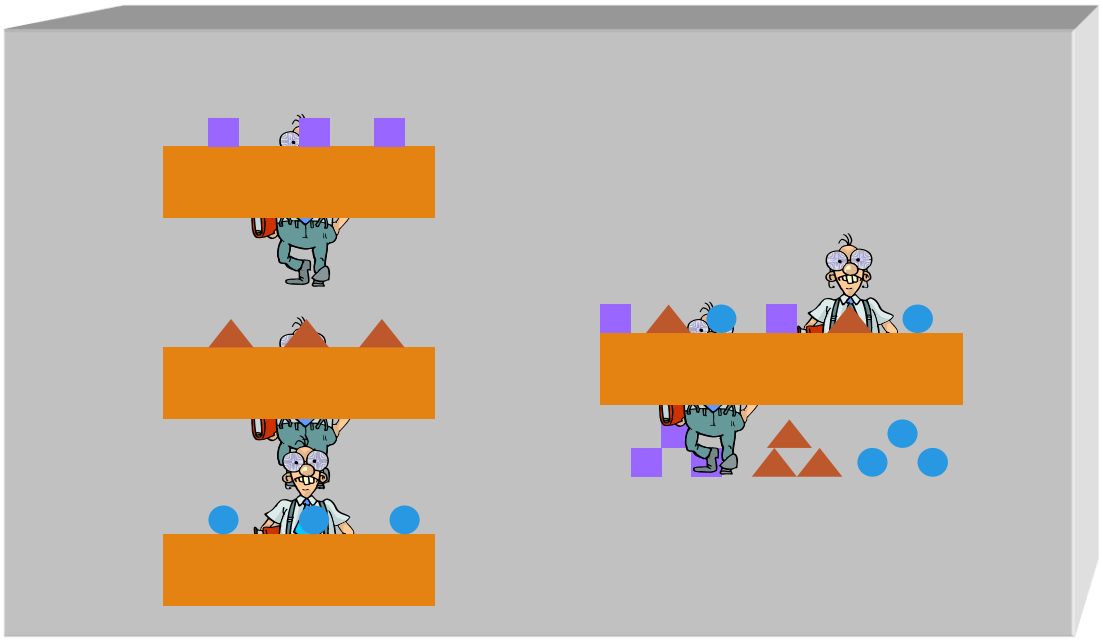
Toyota makes 3 car models - a convertible, hardtop, and an SUV. Assume that customers are buying nine convertibles, nine hardtops, and nine SUVs each day. What is the most-efficient way to make those cars?

Production Smoothing / Leveling



Production Smoothing / Leveling

production leveling



Wrap-up - Pull Manufacturing

Lean manufacturing is really about minimizing the need for overhead

which is about concentrating precisely on *only* what is necessary

which is about linking interdependent supply system decisions, and actions

which needs to be visual, responsive and simple to manage

What is Mistake Proofing?

- The use of process or design features to prevent errors or their negative impact.
- Also known as ***Poka yoke,*** Japanese slang for “avoiding inadvertent errors” which was formalized by Shigeo Shingo.
- Inexpensive.
- Very effective.
- Based on simplicity and ingenuity.

Everyday Examples

Evidence of the Effectiveness

AT&T Power Systems is first US manufacturer to win the Deming prize. Average outgoing defects reduced by 70%.

A washing machine drain pipe assembly line produced 180,000 units without a single defect (6 months).

TRW reduced customer PPM's from 288 to 2.

Federal Mogul: 99.6% less customer defects and 60% productivity increase

DE-STA-CO: reduced omitted parts 800 to 10 ppm with a 15-30% productivity increase.

Source: Productivity Inc. and Shingo prize profiles

Mistake Proofing ROI

Dana corporation has reported a $500,000 savings resulting from a $6 device.

Ortho-Clinical Diagnostics (Johnson & Johnson) saved $75000 annually by discovering a new use of Post-It® notes.

AT&T Power Systems (Lucent Technologies) reported net saving of $2545 per device (3300 devices).

Weber Aircraft reports saving $350,000 during their first year of implementation of approximately 300 devices.

GE Aircraft Engines spends a minimum of $500,000 on any in-flight shut-down (IFSD). Spending $10,000 to stop one IFSD yields 50:1 benefit.

The difficulties with human error

Why existing tools are not enough

Motorola findings:

...it became evident early in the project that achieving a C_p greater than 2 would go only part of the way. Mistake-proofing the design would also be required ... Mistake-proofing the design is an essential factor in achieving the [total number of defects per unit] goal.

Smith, B. IEEE Spectrum 30(9) 43-47

Error proofing & SPC

SPC is good at detecting shifts in the process mean or variance. Changes to the process must be ongoing to be readily detected.

Human errors tend to be rare, intermittent events. They are not readily detected by control charts.

Use error-proofing (not SPC) to reduce defects caused by human error

“Be more careful” not effective

“The old way of dealing with human error was to scold people, retrain them, and tell them to be more careful … My view is that you can’t do much to change human nature, and people are going to make mistakes. If you can’t tolerate them ... you should remove the opportunities for error.”

“Training and motivation work best when the physical part of the system is well-designed. If you train people to use poorly designed systems, they’ll be OK for awhile. Eventually, they’ll go back to what they’re used to or what’s easy, instead of what’s safe.”

“You’re not going to become world class through just training, you have to improve the system so that the easy way to do a job is also the safe, right way. The potential for human error can be dramatically reduced.”

Common Mistake proofing Devices

Guide Pins

Blinking lights and alarms

Limit switches

Proximity switches

Counters

Checklists

Quick Changeover Single Minute Exchange of Dies

Changeover Defined

Changeover is the total process of converting a machine or line from running one product to another

Changeover Time Defined

Traditional approach

Setup is given and fixed

Therefore,

- Use highly skilled setup personnel
- Minimize product variety
- Combine lots
- Make large batches

Another way

Setups CAN be improved!

Small lot production REQUIRES short setups

Setup time reduction of 90% and more is common

Benefits of setup reduction

Better quality

Lower cost

- Less inventory

Better flexibility

Better worker utilization

Shorter lead time and more capacity

Less process variability

Classification of setup activities

Type 1

- Gathering, preparing, and returning tools, fixtures, etc.

Type 2

- Removing previous setup, mounting next setup on machine

Type 3

- Measuring, calibrating, adjusting

Type 4

- Producing test pieces, further adjustment until parts are good

What is SMED?

Single Minute Exchange of Dies is changing process tooling in 9 minutes or less.

The process was developed by Shigeo Shingo at Mazda, Mitsubishi and Toyota in the 1950's and 1960's.

- Separate internal and external activities.
- Convert internal activities to external activities.
- Streamline all activities.

Single Minute Exchange of Dies

Internal set-up activities.

Elements in the changeover which can only be done when the machine is stopped.

External set-up activities.

Elements that can be performed when the machine is running.

Why SMED?

Reduced inventories.

Improved productivity.

Higher quality levels.

Increased safety.

Improved flexibility.

Reduction in throughput time.

Improve operator capabilities.

Lower manufacturing costs.

SMED Methodology

Identify internal and external steps

Convert internal steps to external

Improve all aspects of the setup operation

Abolish setup

The SMED Process

Preliminary Stage – Observe and record.

Stage 1 – Separate internal and external activities.

Stage 2 – Convert internal activities to external activities.

Stage 3 – Streamline all activities.

Stage 4 – Document internal and external procedures.

Preliminary Stage

Observe and record

Team-work

- Recorder
  - Overall duration (from last product to first good product).
  - Describe the change (from what to what?).
  - Record the equipment used.
- Timers
  - Time each step
- Fact collectors
  - Breakdown the steps into actions – as much detail as possible.

Stage 1

Separate internal and external activities.

Study each internal step and ask if it could be external.

Common issues:

- Dies in remote storage racks.
- Spanners not available.
- Raw material checks.
- Lifting equipment not available.

Stage 2

Convert internal to external.

Ask why the remaining internal steps can't be external.

Re-examine the true function of each step.

Common issues:

- Cold dies – using material to heat the dies.
- Imaginary center lines and reference planes.
- No record of settings.

Stage 3

Streamline all activities.

Analyze the elements (facts), and discuss all possible ways of improving the step.

Study the external activities as well as the internal activities.

Common issues:

- Fastenings – Are bolts needed? If so remember that only the last turn tightens a nut or bolt.
- Standardize bolt heads.
- Standardize die heights.

Stage 4

Document the procedures.

Write down the new internal and external procedures.

Fill in an action sheet to ensure that the new procedures can be achieved.

Review the whole activity to determine “What went well?”, “What went badly?” and three changes that the team would make before the next SMED activity.

The SMED System - Results

Company	Machine	Before improvement	After improvement	Red'n
T Manufacturing[1]	80t single shot press	4 hours 0 mins	4 mins 18 sec	98%
S Metals[1]	100t single shot press	40 mins	2 mins 26 sec	94%
H Press[1]	30t single shot press	50 mins	48 sec	98%
TT Industries[1]	50 oz injection moulding m/c	1 hour 10 mins	7 mins 36 sec	89%
Expanded Metal Co.	4'6" lath press	4 hours 30 mins	11 mins (note: NOT SMED)	96%
S Engineering	Machining Centre	139 minutes	59 mins 29 secs	57% *
AM Bottlers	Bottling plant	32 mins 43 secs	23 mins 33 secs	28% *
E Finishing	Paint Plant	56 mins 26 secs	23 mins 12 secs	59% *

Reference

DEVELOPING AN ENTREPRENEURIAL MINDSET (Ultradatum E-Illuminations Series Book 1) by Ron Lanning | Oct 26, 2011

1 Habit™ for Entrepreneurial Success: 300 Life-Changing Habits to Turbo-Charge Business Book 6 of 7: 1 Habit | by Steven Samblis, Forbes Riley, et al

The Kingdom Driven Entrepreneur's Guide: Doing Business God's Way by Shae Bynes and Kingdom Driven Publishing

New to Big: How Companies Can Create Like Entrepreneurs, Invest Like VCs, and Install a Permanent Operating System for Growth by David Kidder and Christina Wallace | Apr 2, 2019

Dream Toolbox: Building an Entrepreneurial Mind and Financial Abundance by Kenneth C. Aldrich | Apr 25, 2019

Capacity Building in Developing and Emerging Countries: From Mindset Transformation to Promoting Entrepreneurship and Diaspora Involvement (Contributions to Management Science) Part of: Contributions to Management Science (154 Books) | by Elie Chrysostome | Jul 16, 2019

Entrepreneurial Leadership: The Art of Launching New Ventures, Inspiring Others, and Running Stuff by Joel Peterson, Josh Childs, et al.