7 COPY & PASTE Lean Processes

Instantly apply these Processes to your Shop Floor

LeanActivity.

Leveled Production Schedule

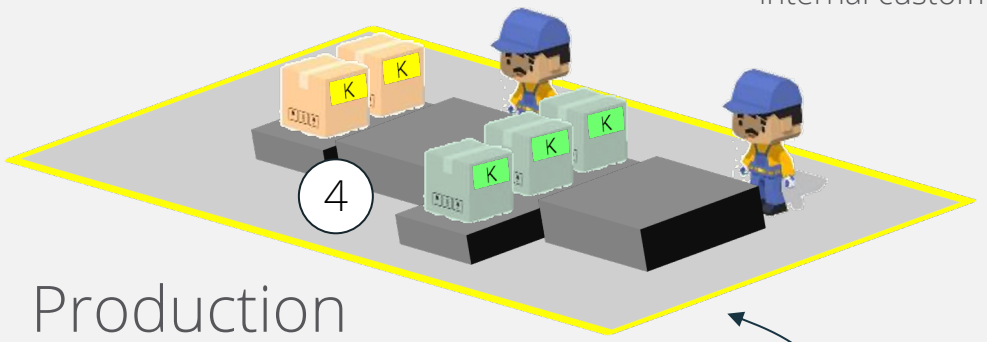
(5) De-coupling of Customer Demand
Use the same principle even within internal customers

5

Shipping

(2) Increase your Finished Goods Storage

- Simulate a stable production based on history demands
- Increase your safety stock level to be able to produce at a constant internal takt time even when the customer demand fluctuates



Production

(3) + (4) Leveled Production Schedule

- Calculate the average necessary production output per week based on the customer forecast of that week (or history data of past weeks)
- Stabilize that condition by involving production, planning and sales and indicating the benefits for the production

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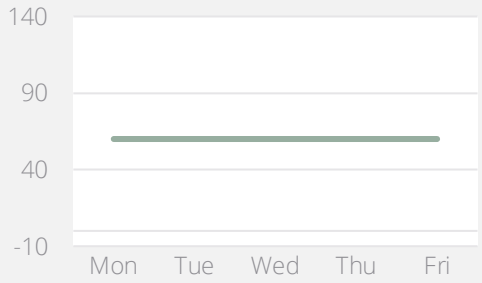
Leveled Production Schedule



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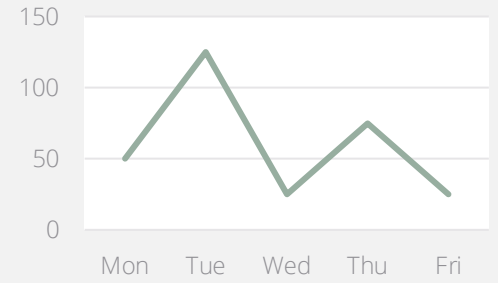
Fluctuating Customer Demand



(1) Fluctuating Customer Demand

- When customer orders fluctuate, your production will have to react 1:1 on these fluctuations
- Try to pass leveled production schedules towards your internal production

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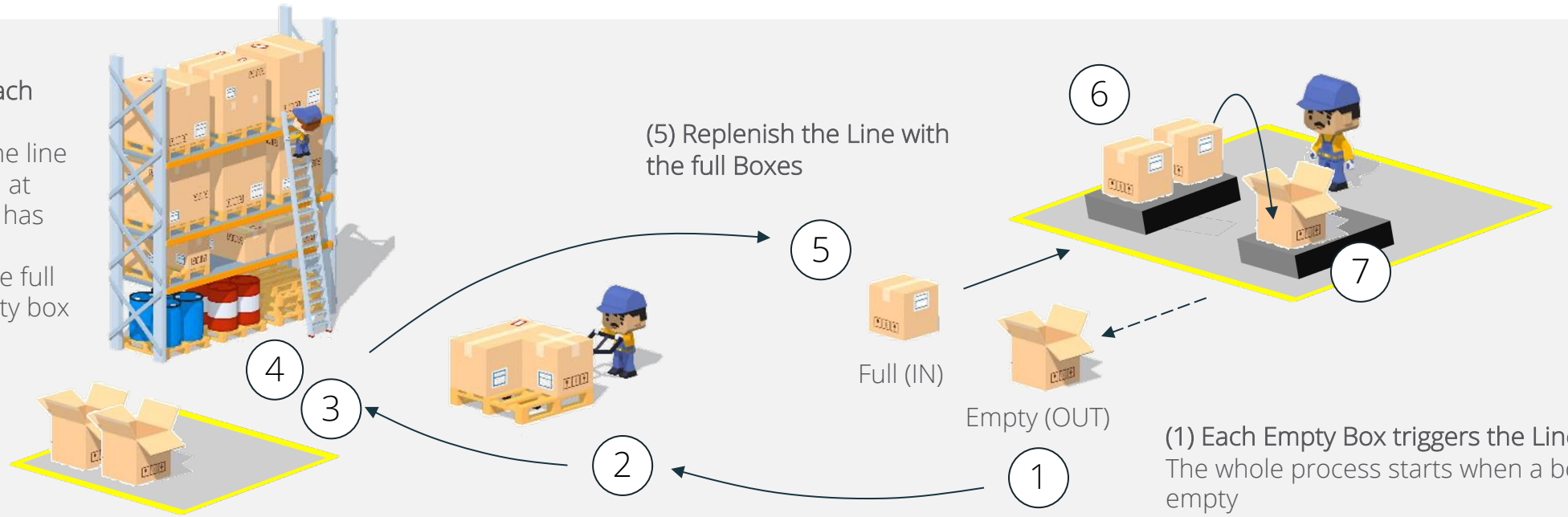
Checklist – Leveled Production Schedule

#	Topic	Description	Duration	Check
1	Collect shop floor and customer data	Gather history data: Past customer demands per day/week, past production output and production scheduling.	8 hours	-
2	Simulate 1 week with an constant production output	Calculate the **average daily demand** for 1 week. Assume you have produced with that average for 5 days, have you had run out of finished goods if the customer demand still fluctuated? Note the amount of missing parts.	2 hours	-
3	Increase safety stock based on simulation output	Increase the level of finished goods according to the missing stock of step #2. Once you figured out the amount of safety stock you need, simulate further weeks.	1 hours	-
4	Simulate several weeks with updated numbers	Try to stabilize the production output within each week: The output may change from week to week but should be stable within each week.	4 hours	-
5	Define rules for production scheduling	Once you defined a stable amount of safety stock and a leveled production output, standardize and define rules for that approach.	2 hours	-
6	Define emergency processes	In the seldom case of very high unexpected customer demand changes, define rules like extra shifts at the weekend or additional operators. Try to minimize the frequency of these cases.	2 hours	-

The 2-Box Pull Principle

(4) Pick a full Box for each Empty Box

- Each single box the line feeder just picked at the assembly line has to be replenished
- Therefore pick one full box for each empty box



(5) Replenish the Line with the full Boxes

(1) Each Empty Box triggers the Line Feeder
The whole process starts when a box is empty

(3) Unload Empty Boxes
Unload all empty boxes to a dedicated location for empty boxes or a hand-over location

(2) The Empty Box is picked by the Line Feeder / Water Spider / Forklift Driver
Each time the line feeder passes by the assembly line, he picks all empty boxes to his trolley / device

(6) The 2-Box Shelve at the Assembly Line
All part numbers at the assembly line are present with 2 fix locations of full boxes. Whenever 1 box is empty, the operator can continue with the remaining box. During that time the line feeder has time to refill that 1 box. If the time is too short, increase the line from a 2-box principle to a 3-box principle (or more).

(7) A dedicated Position for Empty Boxes
Make sure to have a dedicated position for empty boxes. As the box acts as a Kanban information for the line feeder, that position has to be accessible for the line operators and line feeder easily.

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Checklist – The 2-Box Pull Principle

#	Topic	Description	Duration	Check
1	Define the Frequency the Line Feeder passes by the Assembly Line	Use todays standard routine: How often does the line feeder passes by the assembly line? Define the required stock level at the assembly line based on that frequency. Maybe decrease the frequency if required.	2 hours	-
2	Calculate the Amount of Boxes per Part Number at the Assembly Line	If the line feeder will passes by each 30 minutes, he will take 30 minutes to pick the empty box (worst case) and further 30 minutes to finally replenish the box. You would need at least 1 hour of stock at the assembly line for each part number. Calculate the number of required boxes at the line carefully. Try to achieve a maximum number of 2 boxes per part.	8 hours	-
3	Create dedicated Position for two Boxes per Part Number	Modify the shelves or create new shelves for the 2-box principle. Make sure to force FIFO for each part number by positioning the boxes behind each other, not beside each other (!)	1 week	-
4	Simulate and Validation	Train your staff and simulate that condition as soon as possible.	2 days	-
5	Standardize the Process	Define standard work sheets to fix that process. Make sure to communicate and train your staff accordingly.	8 hours	-

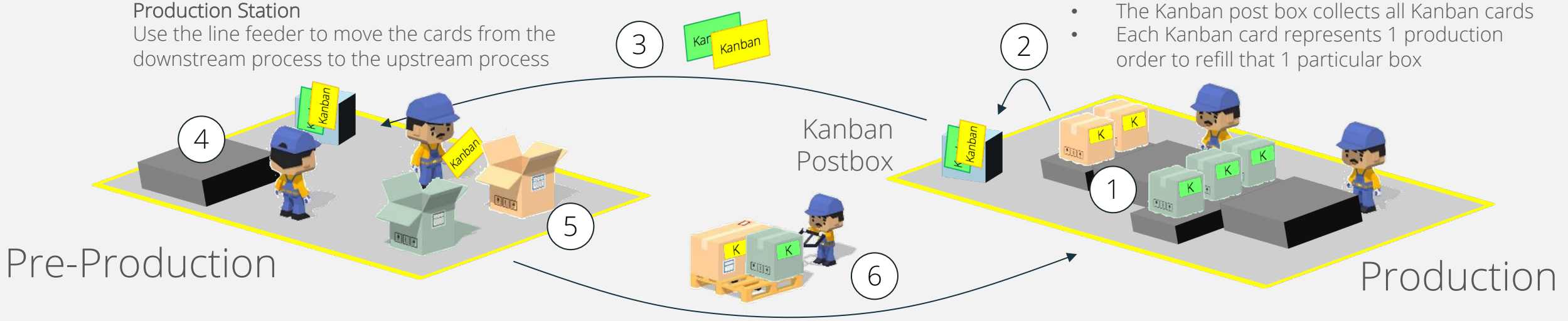
The Kanban-Loop between Two Stations

(3) Move the Kanban card upstream to the Pre-Production Station

Use the line feeder to move the cards from the downstream process to the upstream process

(1) Move each Kanban Card to the Post Box

- The Kanban post box collects all Kanban cards
- Each Kanban card represents 1 production order to refill that 1 particular box



(4) Each Kanban Card is an individual Production Order

- Just produce the amount of boxes according to the Kanban cards
- Each Kanban card is 1 box of a fixed number of parts
- If all Kanban cards are processed, stop the production until the next Kanban card arrives

(5) Place the Kanban card to the Box of prepared Parts

(6) Use the Line Feeder to move the Boxes to the Assembly Line

(1) Move each Kanban Card to the Post Box

- Whenever a box is empty, move the Kanban card from that box to the Kanban postbox
- The Kanban post box must be located close to the operator. If required use several post boxes at the assembly line

Additional Information

- The Kanban card is a physical piece of paper or plastic
- Make sure to clearly put all required information on that card, like the part number and the quantity of parts per box
- Use different colors of cards to clearly indicate the different part numbers (e. g. yellow for part (A), green for part (B))
- The physical card can be replaced by an e-Kanban card
- The e-Kanban card is a lable printed and taped to each box
- The box is scanned and the order forwarded to the upstream process

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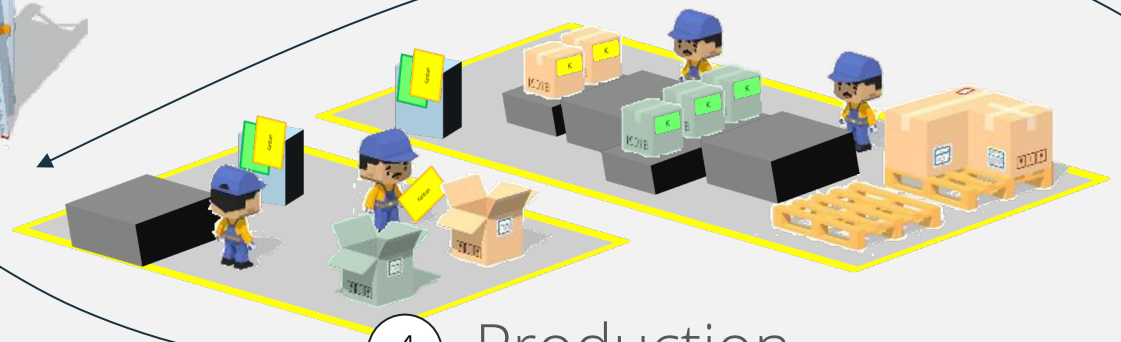
Checklist – The Kanban-Loop between Two Stations

#	Topic	Description	Duration	Check
1	Implement a 2-Box Principle	The foundation of a Kanban loop is a 2-box principle for **all materials**. Because: In the case 1 box is empty, the operator can continue to use the second box until the first box is replenished. Therefore, design shelves for all materials with the capability of 2 boxes per part number. In some cases even more than 2 boxes are necessary.	1 week	-
2	Define the Packaging and Quantity of Parts per Box	Define a fixed number of parts per box.	1 day	-
3	Define the Quantity of Boxes	To calculate the amount of boxes between the upstream and downstream process, measure how long it takes to replenish 1 full box. Divide this time by the time it takes to consume 1 full box of that part at the downstream process. The result is the number of boxes insider your Kanban loop (add a fixed number of safety boxes first).	2 days	-
4	Prepare the Kanban Cards	As 1 Kanban card matches 1 box, you have the same amount of cards inside the loops as boxes. Print information like the quantity and part number on each Kanban card.	8 hours	-
5	Simulate and Maintain	Support a full simulation before implementation.	2 days	-
6	Standardize and Sustain	Prepare standard work sheets to standardize that condition.	2 days	-

The Heijunka Box Planning

Warehouse



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4

Production

Line Feeder

1

2

Heijunka Box
(The customer)

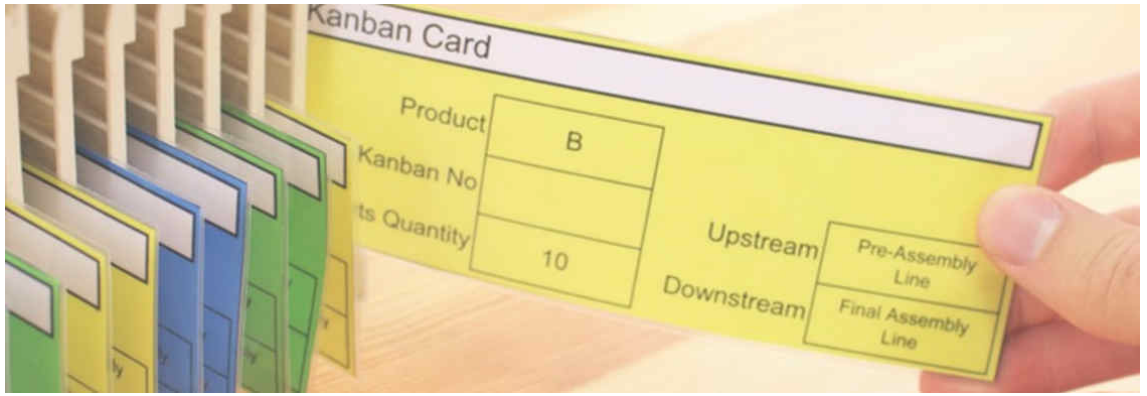
	Shift / Day Time											
	01	02	03	04	05	06	07	08	09	10	11	12
Mo												
Tu												
We												
Th												
Fr												
Sa												
Su												

(1) The Line-Feeder picks the next Card from the Heijunka Box
The next card is the yellow card on the top row (Monday, 09 o' clock)

(2) Each Card is 1 Production Order
The card tells you which parts to pick from the warehouse and to bring them to the line. The card will remain at the assembly line to let the operators know which product to produce next

(3) Pick the Raw Materials according to the Heijunka Box Card
Use color codes to separate between different products

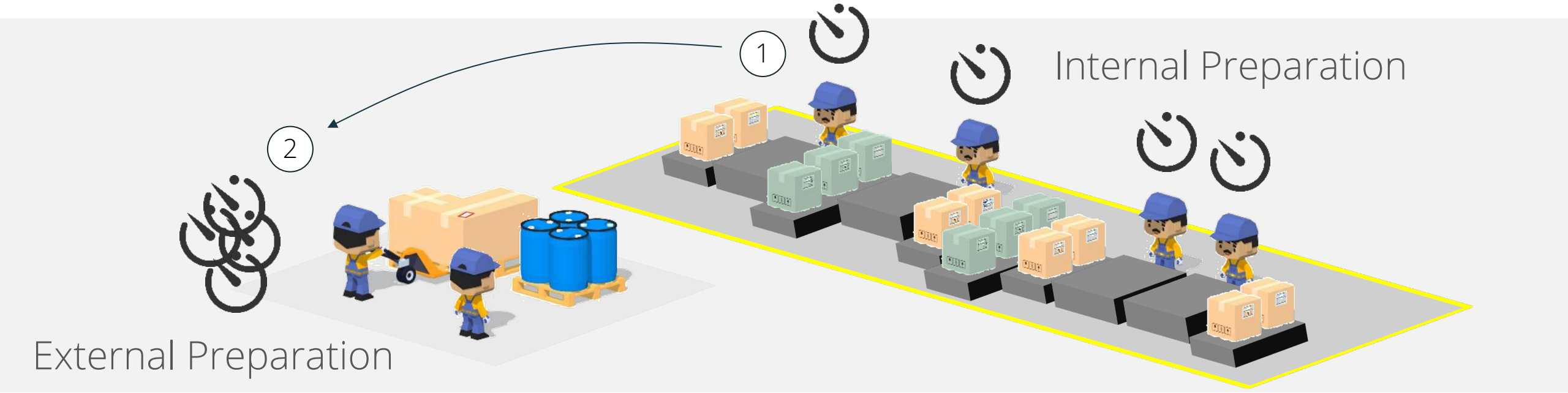
(4) Feed the Line and handover the Card to the Operators
Feed the line with all materials needed to produce the parts written on the Heijunka Box card. Align the written quantity to 1 full pallet of customer finished goods (1 card = 1 pallet). Hand-over the card to the production in the case they must prepare for a change-over



Checklist – The Heijunka Box Planning

#	Topic	Description	Duration	Check
1	Create a Heijunka Box and Cards	Implement the Heijunka box with 15 min timeslots on the horizontal line and the days on the vertical axis. Each slot is fed with 1 Kanban card. Each card contains the production order for 1 customer unit (e. g. 1 full pallet of customer goods). For instance: 1 Card contains the product information (e. g. Product B) and the quantity for 1 full customer packaging (e. g. 10 parts). Color-coding: Use different colors for different products.	2 days	-
2	Align all Packages	Best would be to align the quantity of all parts per box to the customer packaging (e. g. 10 parts per box): Each time a customer packaging is full, the supplier box becomes empty. The line feeder picks all the boxes necessary to produce the quantity mentioned on the Kanban card from the warehouse and delivers them to the line.	4 weeks	-
3	Prepare the Assembly Line	A 2-box principle with aligned shelves is mandatory for this process. Make sure to implement that principle for **all** materials.	1 week	-
4	Simulate and Validation	Train your staff and simulate that condition as soon as possible.	2 days	-
5	Standardize the Process	Define standard work sheets to fix that process. Make sure to communicate and train your staff accordingly.	8 hours	-

SMED Changeover Reduction



(1) Identify all Process Steps of your Change-Over Process

- Perform several change-overs to identify all required process steps
- Measure the time it takes to perform each process step
- Identify those process steps, which you could prepare before the change-over process starts

(2) Move Internal Process Steps to External Process Steps

- Identify those process steps, which can be prepared before the change-over starts
- Shorten the actual change-over time (the actual equipment/line downtime) by shifting internal processes to an external preparation
- Nominate a preparation team, which prepares these external process steps for your equipment

Note

- The external preparation can even be done by your shift or team leader
- The more lines you have and the more change-over you have to perform, the more a preparation team makes sense
- The term “SMED” simply is a marketing term indication a change-over process withing10 minutes. But, you should make sure to come to a range of a change-over taking the time of 1 takt or less
- Typical external preparation processes are the heating of molding tools, cleaning of equipment or to bring machines or stations already close tot your assembly line or equipment

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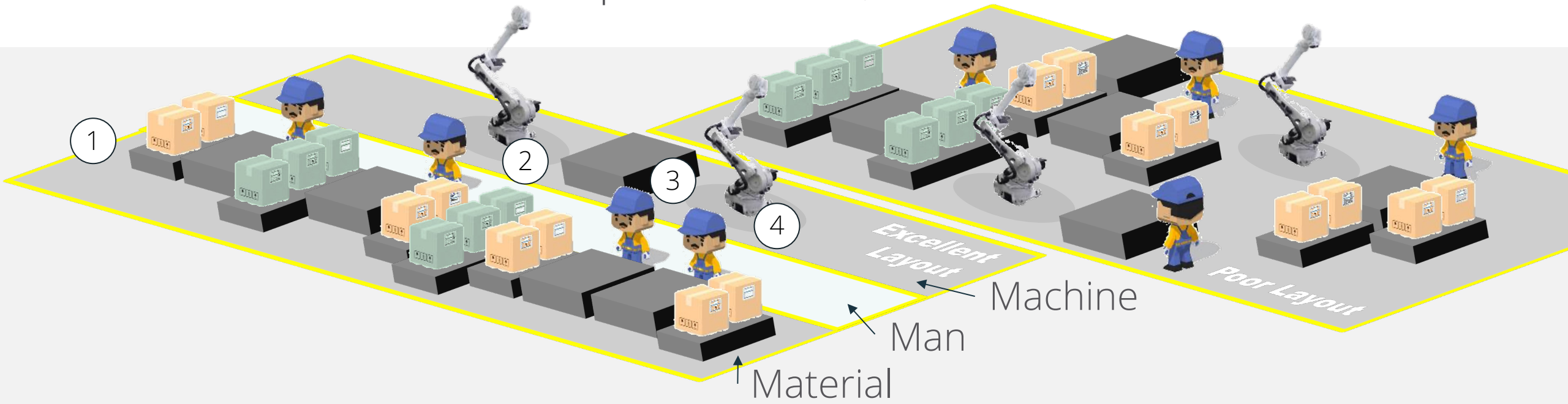
Checklist – SMED Changeover Reduction

#	Topic	Description	Duration	Check
1	Time measurement	Establish a workshop team with the target to reduce set-up time. Commit to perform several change-overs during that workshop with your managers. During the change-overs, do time measurements. Separate the change-over into smaller steps and measure the time per process step individually.	8 hours	-
2	Identify internal and external Processes	Identify whether each process step is an internal process step which causes the line downtime, or an external step which can be performed before the change-over starts or after it finishes. The target must be to transfer internal actions to external preparation.	2 days	-
3	Transfer internal to external Processes	Modify the change-over in a way, in which internal actions can be moved to external preparation. Try to cause the line to stop as short as possible.	1 week	-
4	Kaizen: Improve these Processes	Focus on the remaining internal processes first. Find smart kaizen solutions to eliminate or shorten these process times. Then focus on external processes.		
5	Simulate and Validation	Train your staff and simulate that condition as often as possible. The more often you will do the change-over the better you will get.	2 days	-
6	Standardize the Process	Define standard work sheets to fix that process. Make sure to communicate and train your staff accordingly.	8 hours	-

The 3M Principle – Material, Man and Machine



(1) Straight Material and Information Flow

- Watch the assembly layout on the right: It contains the same number of stations and operators as the straight layout on the left. But it looks far more chaotic and unstructured
- Align station by station in a one-piece flow. Make sure no boxes or working stations are located on the middle alley ("man")
- The straight layout makes it far easier for production managers to get all necessary process information

(2) Separation of Material, Man and Machine

- The key is to separate materials, man and machines on three separated rows

(3) All Operators close to each other

- The benefit of the 3M principle is to have all operators close to each other
- That allows us to balance the operators according to the customer demand
- In the case of a high customer demand, we can increase the number of operators on the "man" alley. In the case of a low customer demand, we can decrease the number of operators
- That would not be possible on the layout on the right-hand side

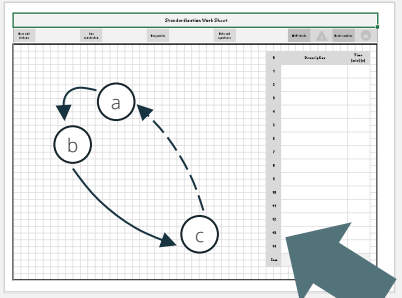
(4) Separate all Machines from the Operators

- Machine usually separate operators from others
- Design the interaction of operators and machines in a way, which allows operators to operate next to each other

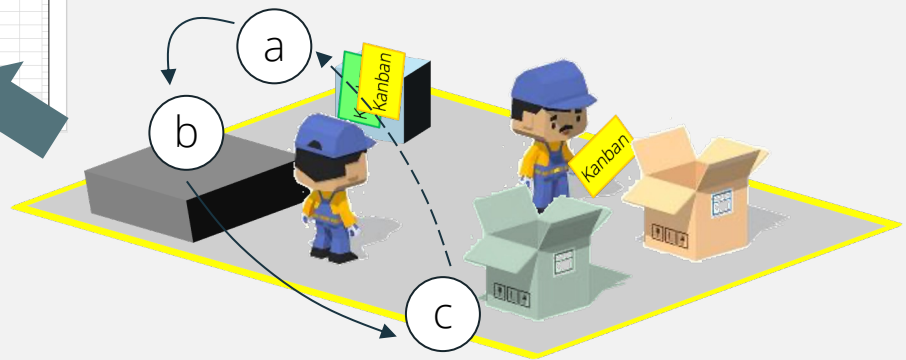
Checklist – The 3M Principle

#	Topic	Description	Duration	Check
1	Straight Assembly Line Layout	When designing a new layout, you must ensure to establish straight lines and straight structures. According to the image on the left, make sure to position all stations close to a straight floor marking. This allows your factory, to become highly transparent. Make sure to not place any material or table inside the area of your operators.	-	-
2	Separation of Material, Man and Machine	3M is about separating material, man and machine in three separate straight areas. Place your stations next to each other and try to supply the line with material just from one side. All complex and big-sized machines have to be located on the opposite side.	-	-
3	All Operators close to each other	The huge benefit of this approach is to have all your operators close to each other. By achieving this, we can balance the operators individually to the required output of that assembly line.	-	-
4	Separate all Machines from the Operators	Machines and robots usually require a lot of floor space. Often, that causes operators to work on separated areas, as machines separate them. The 3M principle forces you to store all machines outside the area of your operators. Like the image indicates, the target must be to create a lane for your machines and equipment to not separate your workers.	-	-

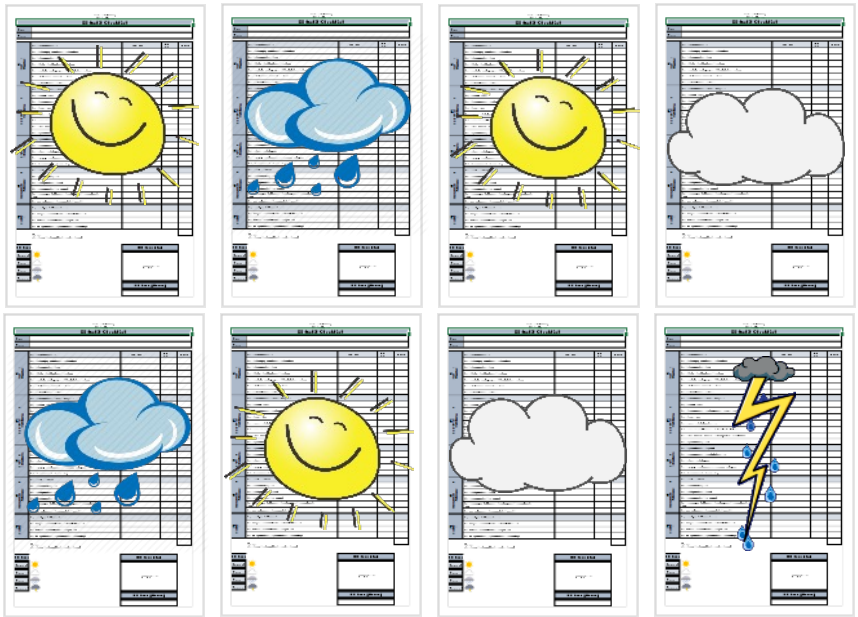
Standardize and Sustain the Implemented Processes



Standardization Work Sheet



5S Status Board



(1) Standardize Work Sequences

- Use the standard work sheet to standardize your process
- Once your processes become standardized, you can measure any deviation and react on them
- Use the standard work sheet (one pager) to train your staff. Place that sheet EASY to read and understand in front of each working station or operator
- Use 1 standard work sheet per 1 operator
- Use several work sheets to define standard routines for different line balancings
- Especially when implementing routines like Kanban or the one piece flow, the standard work sheet helps you to maintain that process within the critical days after implementation

(2) Sustain Processes by using 5S

- 5S will help you to keep everything set in order
- Apply regular internal 5S audits (e.g. every 4 weeks) and place the scoring of each line or team area to a 5S board
- Place the 5S board somewhere visible for everybody within that plant (e.g. at the entrance to your shop floor)
- Use simple cartoons or icons to visualize the status of each line or team area

Checklist – Standardize and Sustain

#	Topic	Description	Duration	Check
1	Define a Standard Routine	Observe the process and define the best repeating cycle for the operator. Keep the level of waste as small as possible.	-	-
2	Prepare the Standard Documents	Prepare a standard work sheet document. The standard work sheet is dedicated to 1 operator and includes all steps the operator has to perform within 1 cycle. Prepare the sheet as easy to understand as possible.	-	-
3	Communicate and Visualize Standards	Train the staff to follow that cycle. Print the standard work sheet and place it in front of the station to visualize the most important steps easy to read in front of the operator.	-	-
4	Schedule regular Audits	To sustain that condition, prepare regular audits (e. g. each month). You can use the 5S audit sheet to include that routine in a standard 5S audit routine. Make sure to include people from all kind of departments or functions in this audit team.	-	-
5	Visualize Audit Results	Visualize the audit result on a dedicated 5S audit board. Perform audits for all production areas in your factory to establish a kind of competition. Visualize good and bad results using transparent slides containing the sun or rainy weather like shown on the image.	-	-