THE MANUFACTURING DECK

Game 1: Pull-Takt-Flow

Objective

In this game, up to 5 participants will learn the benefits of implementing pull-principle, one-piece-flow and takt. By playing with the deck of cards, the effects of each one of these Lean Principles becomes visible. Additionally, the participants are able to improve the production by defining new standards.

Number of Participants

Minimum 3 participants for one assembly line. It is more fun however to have at least 2 teams in 2 assembly lines (total of 6 participants) competing against each other.

1 Time keeper,

1 Manager

1 Customer

There is no maximum number of participants. The number of participants is given by the number of assembly lines.

Needed Material

Each assembly line needs:

- 1 deck of playing cards (2 decks of cards will extend the running time of the assembly line)
- 20 Rubber Bands
- 20 Paper Clips
- 1 Desk with 3 chairs for the assembly workers for each assembly line
- 1 Flipchart with board markers to record the results (See template at the end of this document)
- 1 Formulary to record the assembled components Station 3 (see template at the end of this document)
- Clock

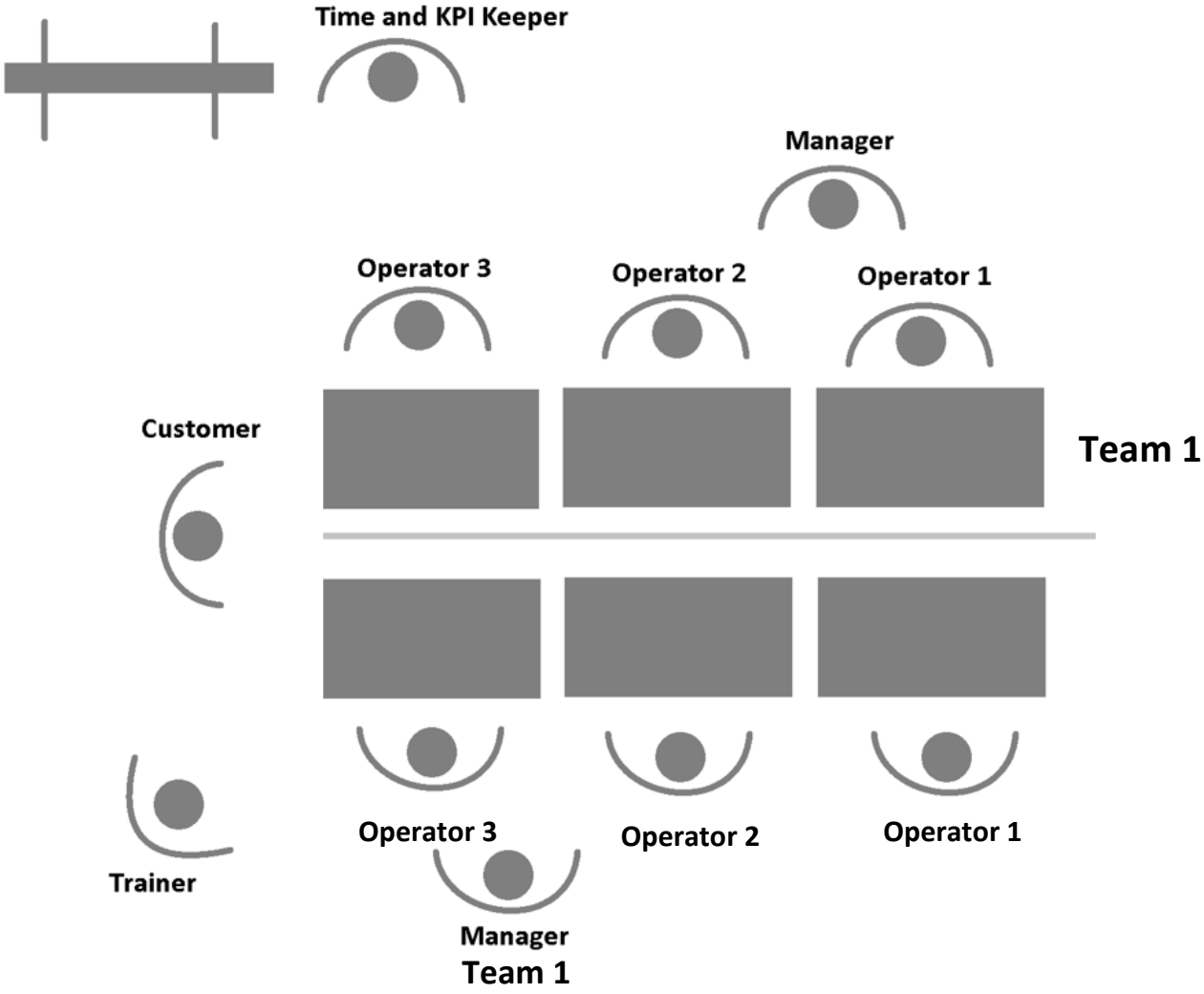

Figure 1 - Layout example playing with 2 groups

Procedure

1. **Explain the content of the game:**

   - We will create an assembly line for card houses in this room. Our production materials are the playing cards, rubber bands and paper clips. The finished products are card-houses which are top of the class in a robust and innovative design. We are a lean company; therefore, each assembly line will have only 3 assembly workers and one boss. There is a common customer who will analyze the quality of the built houses, accept or reject them. The target is to verify the performance of our company utilizing different production methods.

   fun fact: One of Toyota's Companies Misawa Homes in Japan also manufactures full-size houses in a assembly line

2. **Choose the participants**

   - 3 assembly workers for each of the assembly line.
   - 1 manager for each assembly line

- 1 common customer
- 1 person to record the KPI's and keep the time

3. Explain the job of each participant

- Station 1
    i. The worker at station 1 has the task to sort all the raw material (playing cards) into the correct assembly groups. This will be done by taking all the 4 cards of the same number and clip them together using a paper clip.
    ii. Once 2 groups of 4 matching numbered cards have been formed, these can be passed on to station 2

- Station 2
    i. The worker at station 2 will have to assemble the house. He will take 3 of the cards provided by station 1 and form a triangle pillar by using the rubber band (see Figure 2). A little of hand skill and training is needed to find the most efficient way to create these pillars (triangle). The 2 remaining cards will be used to create the roof using the paper clips (see Figure 3). Once 2 pillars and one roof is finished, the components can be forwarded to Station 3.

Figure 2 - Card House Pillar

Figure 3 - Roof

- Station 3
    i. Station 3 will then place the pillars and plate together to form a house (Figure 4).
    ii. Station 3 is also responsible to record all the assembled parts on the record list (see template below in this document).

Figure 4 - Finished House

- Manager
    i. The Manager has the function to do what managers do best: Manage
- Customer
    i. The customer will check his houses to see if it corresponds to his/her requirements.

First round (Batch & Push)

Once the teams have been formed and everyone understood his tasks, you can start the first production run.

With the assembly line completely empty you will have the possibility to produce 7 Houses with one deck of cards.

Set the time chronometer to begin. Start the production.

After the 7 Houses have been produced, all the KPIs are calculated and written down.

After finishing the round, the moderator asked the customer “how satisfied are you?”. The moderator then askes the participants. “How did it feel to work in this company?”. How did it feel? Was it easy? How about the level of stress? Is there any parallel to our factory? Have a short discussion to discover how the participants felt to work in this kind of environment.

“How about the factory manager?”.

Second Round (One-Piece-Flow & Pull)

Now its time to try the one-piece-flow and pull principles.

Ask the participants to find ways to implement a one-piece-flow in the line. How can there be a signal between the stations to trigger the material movements.

Basic rules are:

1st: Material should only be forwarded when the next station needs it

2nd: Material is transported in single pieces.

Once each group has defined on how to implement the pull and one-piece-flow, you can have a short discussion about how each team implemented the ideas.

Run the simulation again and check the result after assembling 7 houses.

Third round (Takt)

In the third round, the concept of takt time is explained and introduced.

What is the takt time of the assembly area? How can you define it? What is the cycle time of each station? How can you balance it? The concept of takt time is a fundamental element in creating flow within a factory.

Let the team discuss again and define their best-fit takt time and how they did to balance the workload. After finished, each group can present their result and the simulation run again.

After the run of the production check the KPI’s and have a discussion what changed, how it felt. How is the situation of the bottleneck now and how the performance has changed?

Fourth Round (Continuous Improvement)

This time, each factory is completely free to think about their improvement ideas for the assembly area. The target is to further improve the KPIs by at least 15% and creative ideas are needed to do so.

Give them space to try new ideas and explore the possibilities. Make critical questions but don't give suggestions on how to do the tasks.

Once each team came-up with ideas to improve the assembly, let them present the results and then run another round of the game.

Write down the results.

Closing Discussions

Have a discussion to draw the conclusions of the small simulation. Review what has been done, what has been achieved, how about the feelings and draw parallels to the work in a factory. Let every participant give their impressions and thoughts about this simulation and have a talk about which would be the next steps in the manufacturing area related to the learned concepts.

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Recording table

	Round 1 (optional): Batch & Push		Round 2 One piece flow & Pull		Round 3 Free to improve		Round 4 Further improvements	
	Team 1	Team 2	Team 1	Team 2	Team 1	Team 2	Team 1	Team 2
Playing Time								
Number of finished houses								
Number of houses with quality defects								
Number of good houses								
WIP								
Productivity								
Area								
Lead time								
Observations								

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Assembly Record for Station 3

House 1		House 2		House 3	
Pillar (3 Cards)		Pillar (3 Cards)		Pillar (3 Cards)	
Roof (2 Cards)		Roof (2 Cards)		Roof (2 Cards)	
House 4		**House 5**		**House 6**	
Pillar (3 Cards)		Pillar (3 Cards)		Pillar (3 Cards)	
Roof (2 Cards)		Roof (2 Cards)		Roof (2 Cards)	
House 7		**House 8**		**House 9**	
Pillar (3 Cards)		Pillar (3 Cards)		Pillar (3 Cards)	
Roof (2 Cards)		Roof (2 Cards)		Roof (2 Cards)	
House 10		**House 11**		**House 12**	
Pillar (3 Cards)		Pillar (3 Cards)		Pillar (3 Cards)	
Roof (2 Cards)		Roof (2 Cards)		Roof (2 Cards)	
House 13		**House 14**		**House 15**	
Pillar (3 Cards)		Pillar (3 Cards)		Pillar (3 Cards)	
Roof (2 Cards)		Roof (2 Cards)		Roof (2 Cards)	

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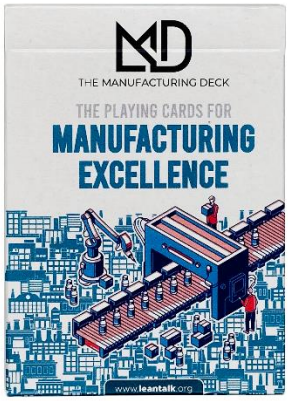

For more information on other **lean games** using **playing cards** visit:

www.leantalk.org