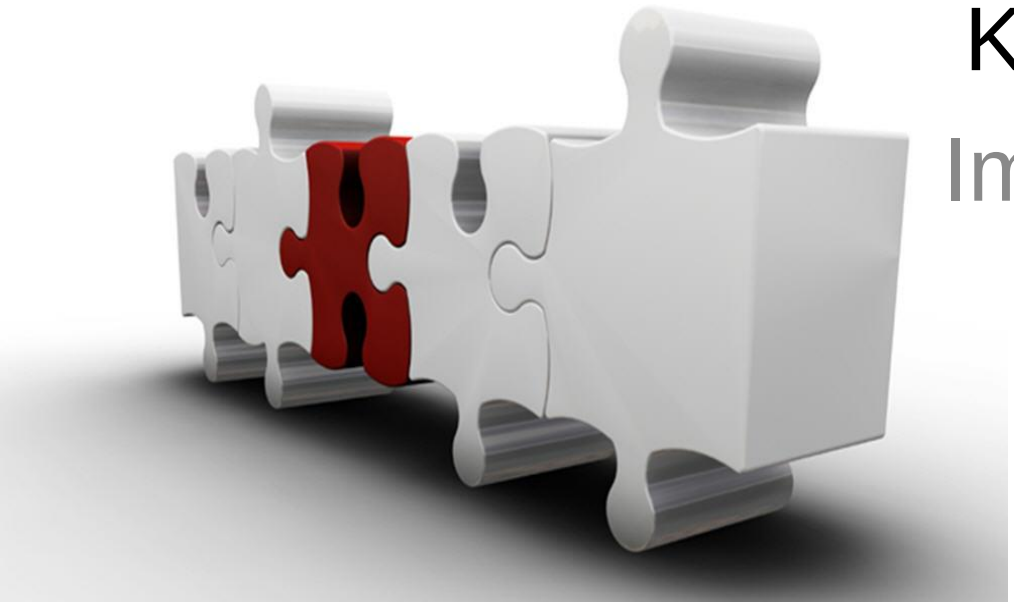
The LeanMan

Lean Principles

Facilitator Presentation



Kaizen eno Yon Dankai

Improvement in 4 Steps

Kaizen

- History of Kaizen
  - After World War II, to help restore Japan, American occupation forces brought in American experts to help with the rebuilding of Japanese industry. The Civil Communications Section (CCS) developed a Management Training Program that taught statistical control methods as part of the overall material. This course was developed and taught by Homer Sarasohn and Charles Protzman in 1949 and 1950. Sarasohn recommended William Deming for further training in Statistical Methods.
  - The Economic and Scientific Section (ESS) group was also tasked with improving Japanese management skills and Edgar McVoy is instrumental in bringing Lowell Mellen to Japan to properly install the TWI programs in 1951. Prior to the arrival of Mellen in 1951, the ESS group had a training film done to introduce the three TWI "J" programs (Job Instruction, Job Methods and Job Relations)- the film was titled "Improvement in 4 Steps" (Kaizen eno Yon Dankai). This is the original introduction of "Kaizen" to Japan.
- Kaizen is a daily activity
  - The purpose of which goes beyond simple productivity improvement. It is also a process that, when done correctly, humanizes the workplace, eliminates overly hard work ("muri"), and teaches people how to perform experiments on their work using the scientific method and how to learn to spot and eliminate waste in business processes.
  - In all, the process suggests a humanized approach to workers and to increasing productivity: "The idea is to nurture the company's human resources as much as it is to praise and encourage participation in kaizen activities.“ Successful implementation requires "the participation of workers in the improvement."

Kaizen

- Kaizen at Toyota
  - All line personnel are expected to stop their moving production line in case of any abnormality and, along with their supervisor, suggest an improvement to resolve the abnormality which may initiate a kaizen.
    - The cycle of kaizen activity can be defined as:
    - Standardize an operation
    - Measure the standardized operation (find cycle time and amount of in-process inventory)
    - Gauge measurements against requirements
    - Innovate to meet requirements and increase productivity
    - Standardize the new, improved operations
    - Continue cycle ad infinitum
    - This is also known as the Shewhart cycle, Deming cycle, or PDCA.
  - In their book The Toyota Way Fieldbook, Jeffrey Liker, and David Meier discuss the kaizen blitz and kaizen burst (or kaizen event) approaches to continuous improvement. A kaizen blitz, or rapid improvement, is a focused activity on a particular process or activity. The basic concept is to identify and quickly remove waste. Another approach is that of the kaizen burst, a specific kaizen activity on a particular process in the value stream.
  - Key elements of kaizen are quality, effort, involvement of all employees, willingness to change, and communication.

Customer Pull

- Toyota Way
  - The underlying principles, called the Toyota Way, have been outlined by Toyota as follows:
    - Continuous Improvement
      - Challenge (We form a long-term vision, meeting challenges with courage and creativity to realize our dreams.)
      - Kaizen (We improve our business operations continuously, always driving for innovation and evolution.)
      - Genchi Genbutsu (Go to the source to find the facts to make correct decisions.)
    - The right process will produce the right results
      - Create continuous process flow to bring problems to the surface
      - Use the "pull" system to avoid overproduction
      - Level out the workload (heijunka). (Work like the tortoise, not the hare.)
      - Build a culture of stopping to fix problems, to get quality right from the first
      - Standardized tasks are the foundation for continuous improvement and employee empowerment
      - Use visual control so no problems are hidden
      - Use only reliable, thoroughly tested technology that serves your people and processes.

Kanban

- Kanban
  - An important determinant of the success of production scheduling based on "pushing" the demand is the quality of the demand forecast that can receive such "push."
  - Kanban, by contrast, is part of an approach of receiving the "pull" from the demand. Therefore, the supply or production is determined according to the actual demand of the customers. In contexts where supply time is lengthy and demand is difficult to forecast, the best one can do is to respond quickly to observed demand. This is exactly what a kanban system can help: It is used as a demand signal that immediately propagates through the supply chain. This can be used to ensure that intermediate stocks held in the supply chain are better managed, usually smaller.
  - Where the supply response cannot be quick enough to meet actual demand fluctuations, causing significant lost sales, then stock building may be deemed as appropriate which can be achieved by issuing more kanban. Taiichi Ohno states that to be effective kanban must follow strict rules of use (Toyota, for example, has six simple rules, below) and that close monitoring of these rules is a never-ending task to ensure that the kanban does what is required.
    - Toyota's six rules
      - Do not send defective products to the subsequent process
      - The subsequent process comes to withdraw only what is needed
      - Produce only the exact quantity withdrawn by the subsequent process
      - Equalize production
      - Kanban is a means to fine tuning
      - Stabilize and rationalize the process

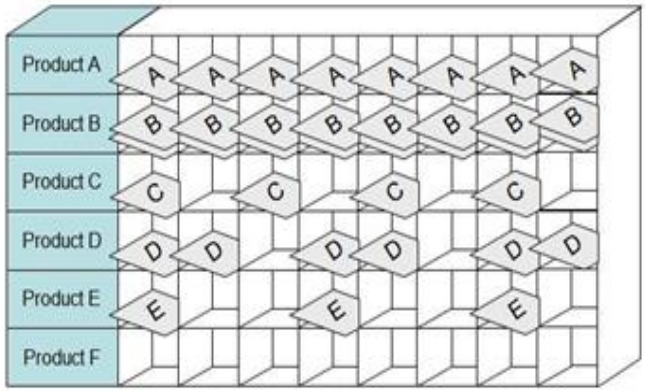
Kanban

- Kanban
  - A simple example of the kanban system implementation might be a "three-bin system" for the supplied parts (where there is no in-house manufacturing) — one bin on the factory floor (demand point), one bin in the factory store, and one bin at the suppliers' store. The bins usually have a removable card that contains the product details and other relevant information — the kanban card.
  - When the bin on the factory floor becomes empty, i.e, there is demand for parts, the empty bin and kanban cards are returned to the factory store. The factory store then replaces the bin on the factory floor with a full bin, which also contains a kanban card. The factory store then contacts the supplier’s store and returns the now-empty bin with its kanban card. The supplier's inbound product bin with its kanban card is then delivered into the factory store completing the final step to the system.
  - Thus the process will never run out of product and could be described as a loop, providing the exact amount required, with only one spare so there will never be an oversupply. This 'spare' bin allows for the uncertainty in supply, use and transport that are inherent in the system. The secret to a good kanban system is to calculate how many kanban cards are required for each product.

Heijunka Box

- Kanban Control
  - Most factories using kanban use the colored board system (Heijunka Box). This consists of a board created especially for holding the kanban cards.
  - A heijunka box is a visual scheduling tool used in heijunka, a concept for achieving a smoother production flow. While heijunka refers to the concept, the heijunka box is the name of a specific tool used in achieving the aims of heijunka.
  - The heijunka box is generally a wall schedule which is divided into a grid of boxes or a set of 'pigeon-holes'/rectangular receptacles. Each column of boxes representing a specific period of time, lines are drawn down the schedule/grid to visually break the schedule into columns of individual shifts or days or weeks. Colored cards representing individual jobs (referred to as kanban cards) are placed on the heijunka box to provide a visual representation of the upcoming production runs.
  - The heijunka box makes it easy to see what type of jobs are queued for production and for when they are scheduled. Workers on the process remove the kanban cards for the current period from the box in order to know what to do. These cards will be passed to another section when they process the related job. 60

Heijunka Box



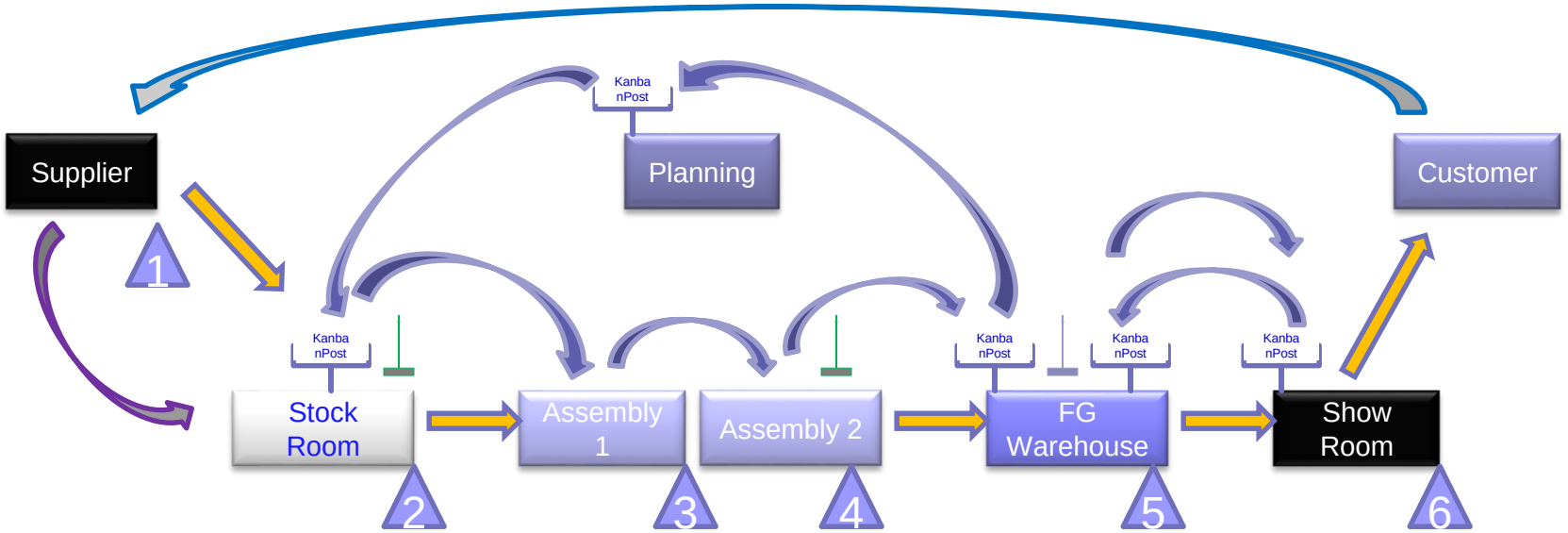
- The Heijunka box allows easy and visual control of a smoothed production schedule.
- A typical heijunka box has horizontal rows for each product. It has vertical columns for identical time intervals of production. In the illustration on the right, the time interval is thirty minutes. Production control kanban are placed in the pigeon-holes provided by the box in proportion to the number of items to be built of a given product type during a time interval.
- In this illustration, each time period builds an A and two Bs along with a mix of Cs, Ds and Es. What is clear from the box, from the simple repeating patterns of kanbans in each row, is that the production is smooth of each of these products.
- This ensures that production capacity is kept under a constant pressure thereby eliminating many issues.

Kanban Simulation

Facilitator Notes

Kanban Single Card Method

with Kanban Signal Communications



Customer demand-pull initiates replenishment using a single move kanban card (job order card) request from showroom to finished goods.

Kanban Single Card Method

with Kanban Signal Communications

The Supplier takes in completed cars and disassembles them into piles of components which are delivered to the stockroom as they become available. A kanban signal flag may be used to alert Conveyance to deliver the materials to the Stock Room.

The Stock Room receives inventory from the supplier as it is available Conveyance will see the raised flag at the supplier and deliver the materials to the stockroom, and return any empty totes from the stockroom back to the supplier. The Stock Room receives Job Kanban Cards with car models checked from the Planner. Upon receiving a card, picks the necessary component materials and places them into a kit bag along with the Job Kanban Card, and places the bag at the output area and raises the Kanban Signal Flag for the Conveyance person to pick up the kit bag and deliver it to the Assembly 1 input., and returns any empty kit bags to the Stock Room.

The Assembly 1 and Assembly 2 operators build the subassemblies and complete the car, placing it at the output along with the Job Kanban Card, and raises the Kanban Signal Flag for Conveyance to deliver the product to the Finished Goods Warehouse.

The Warehouse receives replenishment orders from the Show Room as a Job Kanban Card. If a matching car is in stock, the FG Administrator sends the car and its Job Kanban Card to the Showroom, and returns the Show Room Job Kanban Card to the Planner for replenishment. If no match yet exists, the FG Admin holds the Show Room card until a matching car arrives. A kanban signal flag may be used to initiate a Conveyance move.

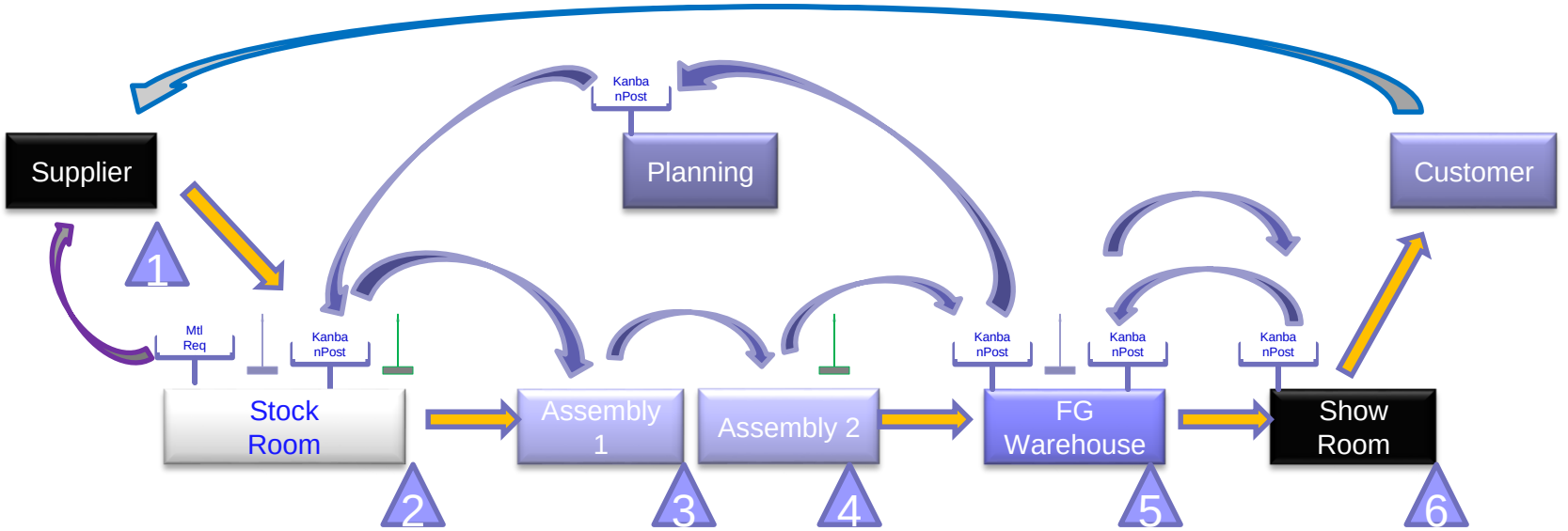
The Show Room sells cars either from on-hand stock or by photo. As a car is delivered, the Show Room removed the Job Kanban Card and sends it to the FG Warehouse for replenishment. Delivery for all cars is on-time if done in under two minutes.

The Customer orders one car every two minutes at random. Upon delivery sends the Car to the Supplier for disassembly back into components.

Facilitator: after the initial run and the simulation is stable, attempt to reduce the cycle time to the minimal and still achieve

Kanban Single Card Method

with Kanban Signal Communications



Customer demand-pull initiates replenishment

Planner pushes stockroom to push product to finished goods

Flow of materials and tools:

The Customer and Supplier functions are background activities and not part of the flow dynamic that is the simulation event.

The Stock Room requires raw components, kit bags and Kanban Cards to perform its function. The raw components are supplied as part of the material loop used to sustain the simulation event without regard to the finite number of items in the Car Factory Kit. The kit bags are intentionally limited to 5 bags. The backward flow of empty bags are necessary for the Stock Room to function, and is dependant upon a downstream process to “remember” to perform this side task.

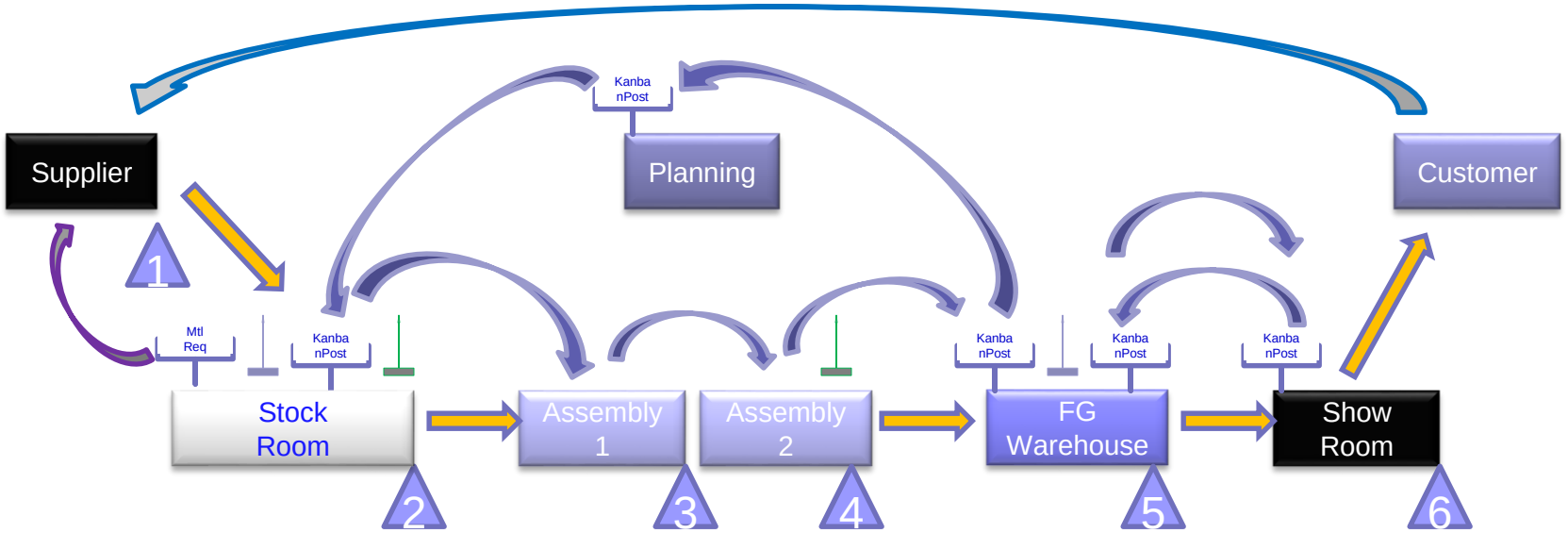
The Assembly 1 person loads subassembly fixtures with the 4 subassemblies necessary to complete the car by the Assembly 2 person. The number of fixtures is 5 and therefore must be returned backward upstream in order for the Assembly 1 person to continue. Both build the car according to the Job Card.

The Warehouse person maintains a stock of completed cars which is used to replenish the Show Room stock upon demand. This person acts as the gate keeper flowing cars in one direction and replenishment Kanban Cards in the other. The single Kanban Card can be a bit confusing so the GF Admin person must take extra steps to keep track of requests where on-hand inventory does not have the needed model.

The Show Room person sells cars for on-hand stock, or takes an order for the model that is missing. Since it’s already on the replenishment loop, the sales person must take extra steps to record the model and time ordered, and track on-time delivery performance. On-Time is <= two minutes.

Kanban Single Card Method

with Kanban Signal Communications



Use of multiple types of kanbans:

The Stock Room uses a kanban signal flag , monitored by Conveyance, to move materials in or out of its area. It also flows the Kanban Job Card from planning through to assembly, using it to also control what kit materials are needed. It also uses a Material Requisition kanban card to request specific materials from the supplier.

The Assembly 1 and assembly 2 people build the car according to the Job Kanban Card. Assembly 2 may also use a kanban signal flag for Conveyance to move materials if the distance to the Warehouse is great.

The Warehouse person uses a kanban post to receive replenishment kanban cards from the Show Room, and may use one to deliver replenishment kanban cards to the planning. The Warehouse may also use a kanban signal flag to Conveyance to move materials or cards.

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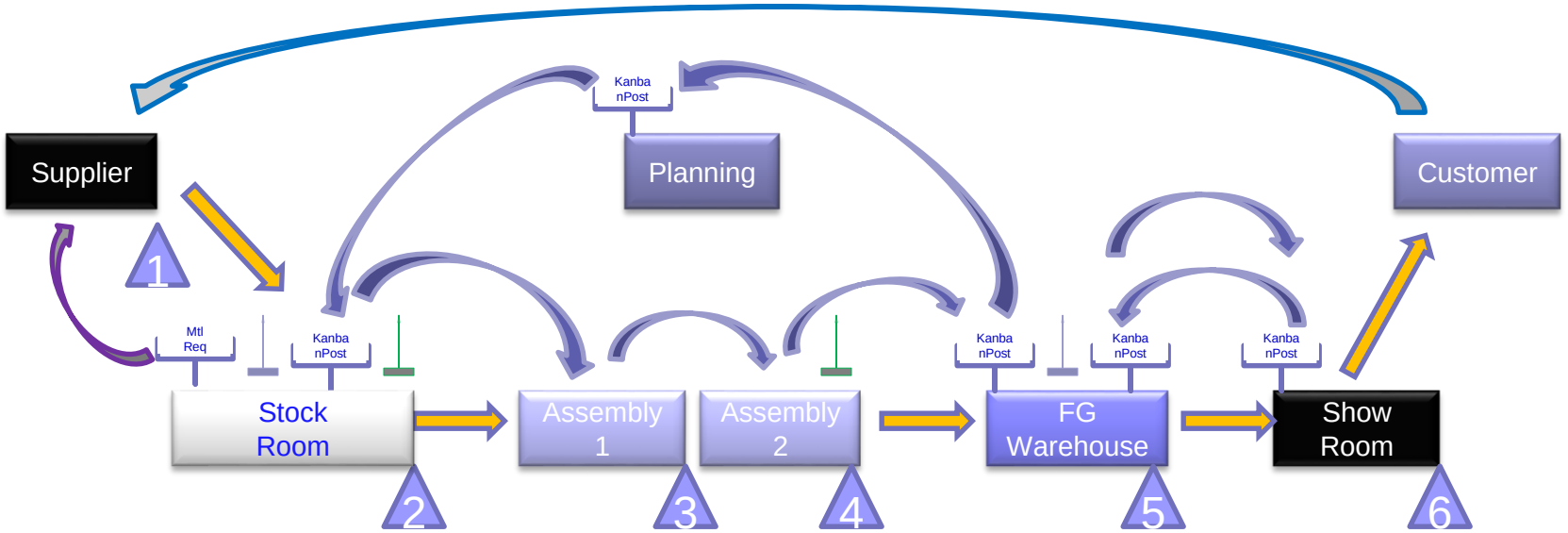


Use of inventory buffers and Earned Value metrics:

EV = Sales – COGS – Capital; there capital is the number of tables, chairs, fixtures, bags, totes, etc. See Metrics Chart.

The Supplier inventory (1) is not part of the “company” inventory until transacted to Stock. Do not count it as part of EV

The Stock Room inventory buffer (2) is the sum of the components on hand. For EV calculations, consider picked kits as raw inventory.

The Assembly 1 (3) and Assembly 2 (4) inventory is the sum of the WIP kits at each station.

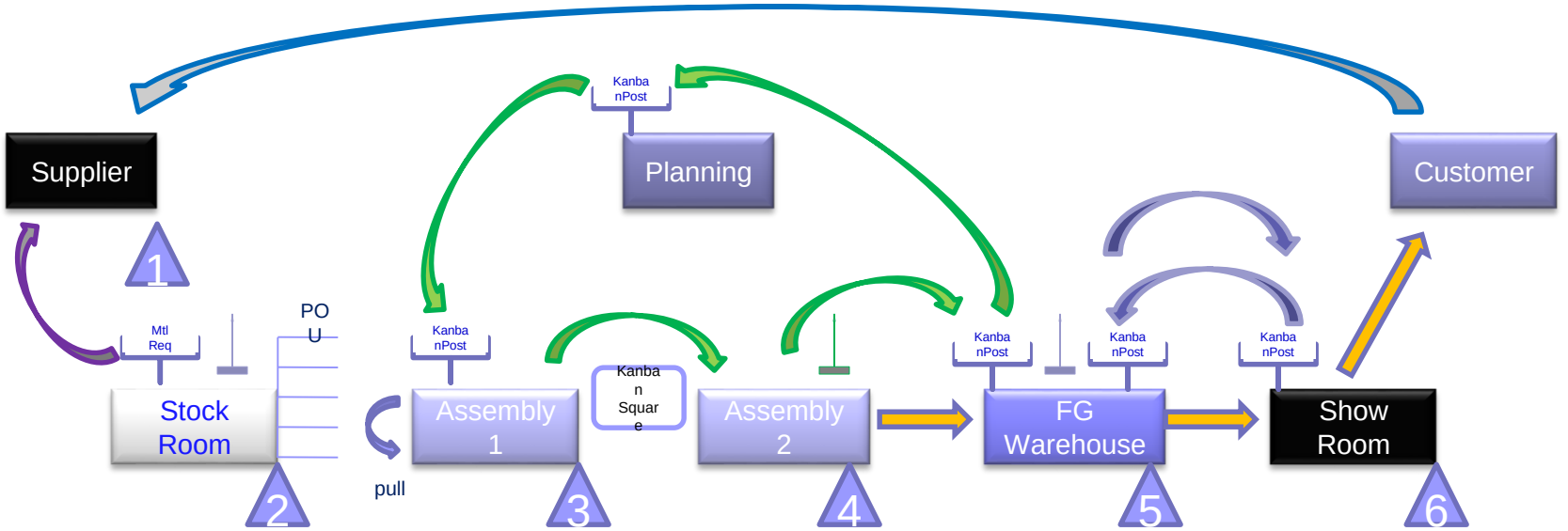
The Warehouse inventory (5) is the sum of the completed cars on hand in stock, and any undelivered cars waiting for Conveyance.

The Show Room inventory (6) is the sum of the completed cars on hand in stock. Any undelivered cars waiting for Customer pickup are assumed delivered.

Note: watch for piles of inventory between operation stages caused by the PUSH system and individual stage cycle time imbalance. Stop the simulation
(freeze action) and have the participants count the inventory items at each station and enter the numbers on the excel metrics chart. Compare the results as you make improvements to flow.

Kanban Dual Card Method

with Kanban Signal Communications and local Point-Of-Use Inventory



Kanban Dual Card Method

with Kanban Signal Communications and local Point-Of-Use Inventory

The Supplier takes in completed cars and disassembles them into piles of components. Upon receiving a Material Requisition Card from the Stock Room gathers the requested components into a tote bin and calls Conveyance to deliver the item to the Stock Room.

The Stock Room manages inventory, and when a component level is low, raised the kanban Signal Flag and places a Material Requisition Card with the needed items checked into the output area by the flag. The Stock Keeper monitors the Assy 1 area POU levels and fills as appropriate.

The Assembly 1 person receives Production Kanban Card with car model checked from the Planner. Upon receiving a card, picks the necessary component materials from the POU inventory and assembles the 4 subassembly items. He then places them into KanBan Square located between Assy 1 and Assy 2 positions along with the car body and Job Kanban Card. The Assembly 2 operator completes the car, placing it at the output along with the Production Kanban Card, and raises the Kanban Signal Flag for Conveyance to deliver the product to the Finished Goods Warehouse.

The Warehouse receives replenishment orders from the Show Room as a Move Kanban Card. If a matching car is in stock, the FG Administrator sends the car and the Move Kanban Card to the Showroom, and returns the Production Kanban Card to the Planner for replenishment. If no match yet exists, the FG Admin holds the Move card until a matching car arrives. A kanban signal flag may be used to initiate a Conveyance move.

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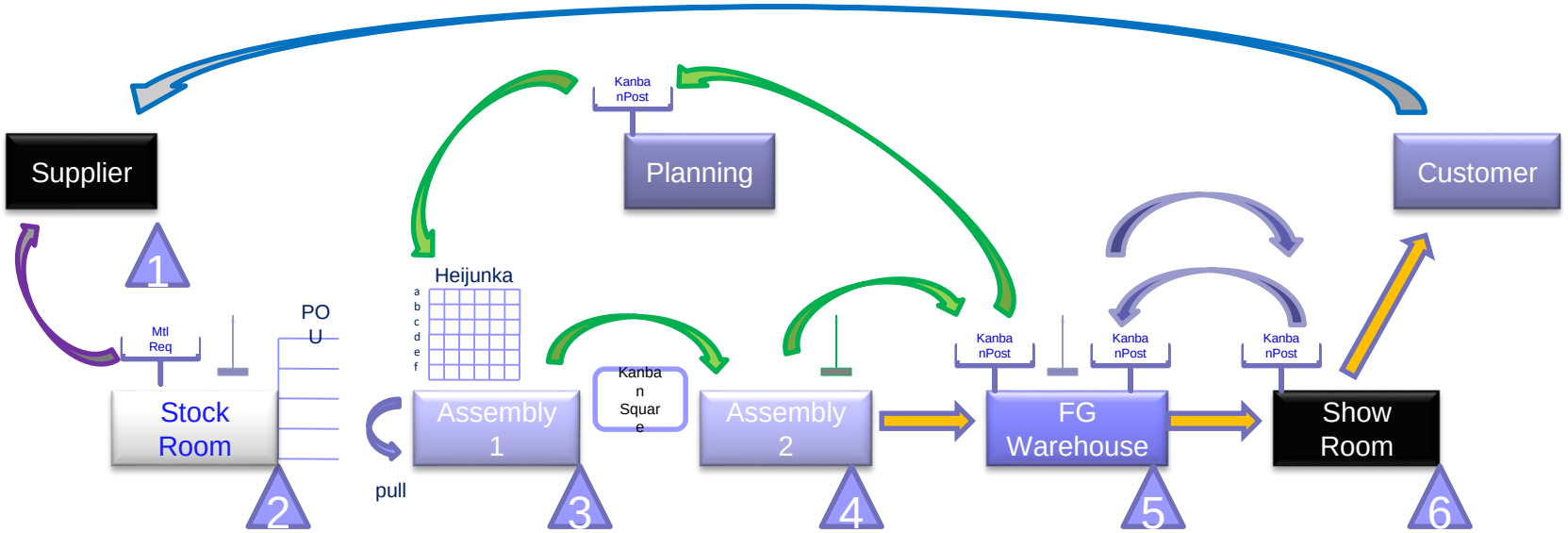
Kanban Dual Card Method w/Heijunka

with Kanban Signal Communications and local Point-Of-Use Inventory



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The Planner calculates the heijunka loading and places the heijunka kanban into the heijunka box at Assembly 1 area. The Assembly 1 person Pulls the Production Kanban Cards from the box in sequence, picks the necessary component materials from the POU inventory and assembles the 4 subassembly items. He then places them into KanBan Square located between Assy 1 and Assy 2 positions along with the car body and Production Kanban Card. The Assembly 2 operator completes the car, placing it at the output along with the Job Kanban Card, and raises the Kanban Signal Flag for Conveyance to deliver the product to the Finished Goods Warehouse.

The Warehouse receives replenishment orders from the Show Room as a Move Kanban Card. If a matching car is in FG stock, the FG Administrator swaps Move and Production Cards and sends the car and the Move Kanban Card to the Show Room, and returns the Production Kanban Card to the Planner for replenishment. If no match yet exists, the FG Admin holds the Move card until a matching car arrives. A kanban signal flag may be used to initiate a Conveyance move.

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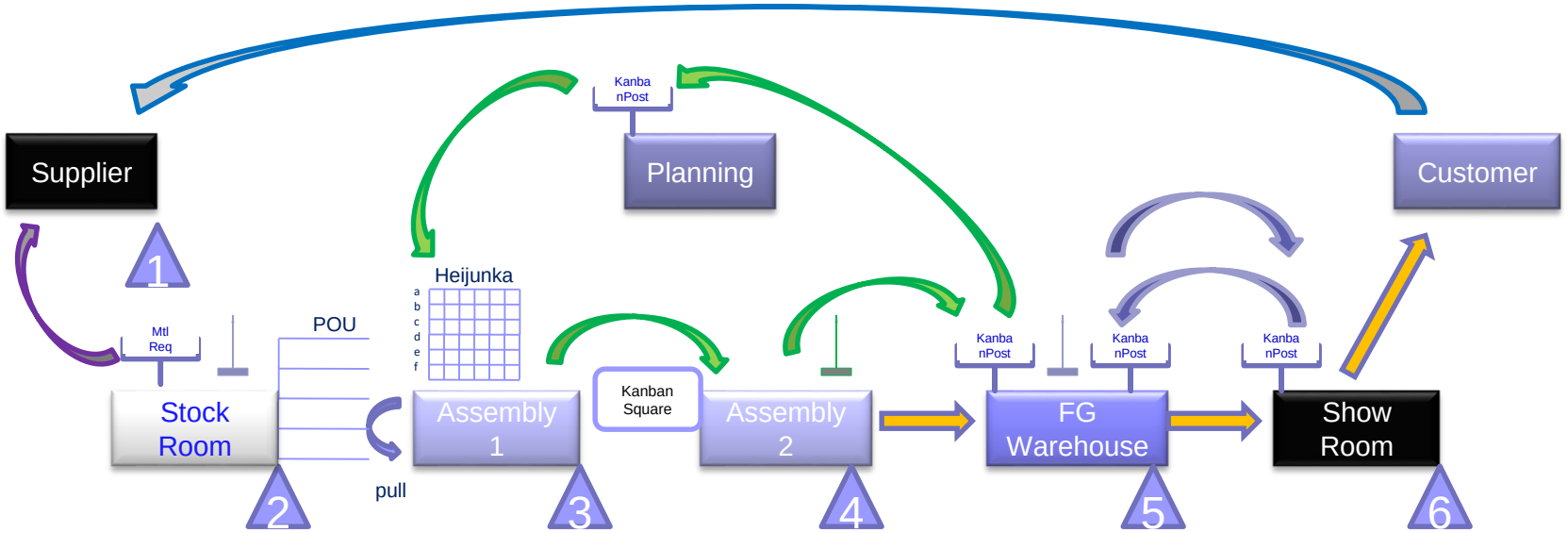
Kanban Dual Card Method w/Heijunka & Zero-FGI

with Kanban Signal Communications and local Point-Of-Use Inventory



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