De-bottlenecking to Increase Throughput of Furniture Manufacturer

The Business Challenge

A Leading Furniture manufacturer established operations in 2004 with a mission to design, manufacture and sell metal-based furniture that set new standards for aesthetics, reliability and pricing meeting the needs of the diverse Indian market. Over the years the company has grown exponentially and currently operate of a 55,000 sq ft plant near Mumbai, India. Focusing on metal-based furniture,

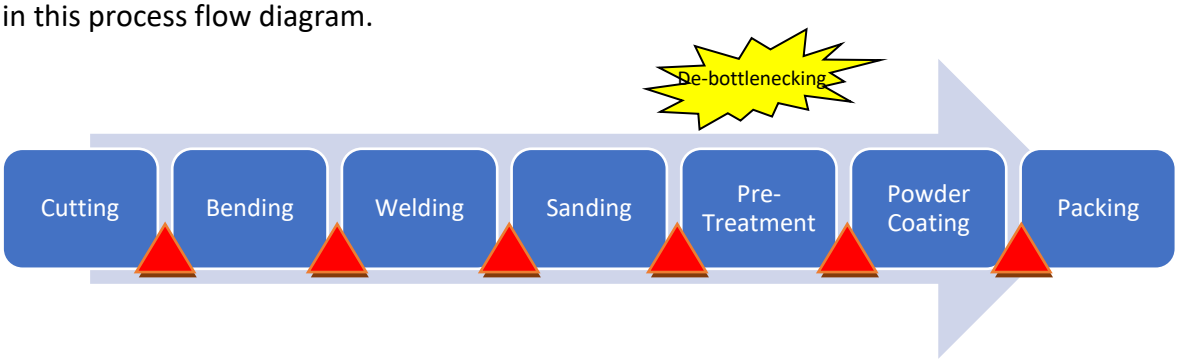
The company's fast pace of growth has brought in a number of challenges.

1. ***Margins under strain*** as customers especially the online business partners keep reducing prices
2. ***Delayed deliveries*** in spite of fire-fighting to meet the promised schedules
3. High ***working capital*** employed

With a strong order book for the coming year the company was looking at another 50% growth in turnover. However, the management felt that growing with the existing pains would be non-sustainable and could result in unwanted business issues. The owners got in touch with KIAP to help them streamline operations.

Our Approach

KIAP experts visited the factory to observe the current state of operations in terms of material flow, methods of work and organizational issues. The assisted self diagnosis exercise was conducted with the core team of the company and a four month improvement roadmap was finalized.The plant was working in a typical batch production set up explained in this process flow diagram.



The overall conversion process includes a mix of manual and machine operations. The data taken clearly showed that the chemical pre treatment process prior to color coating was the bottleneck. However, observations made at the *gemba* gave a further insight – the pre treatment capacity itself is underutilized due to inconsistent supply of material from the preceding welding operation. Hence the roadmap made prioritized these projects

1) Ensure feeding of the bottleneck process
2) Then improve the bottleneck to increase throughput

Focus Area1 : Ensure feeding to Pre Treatment

Improvement Project 1 – Cellular manufacturing for Welding &Sandering

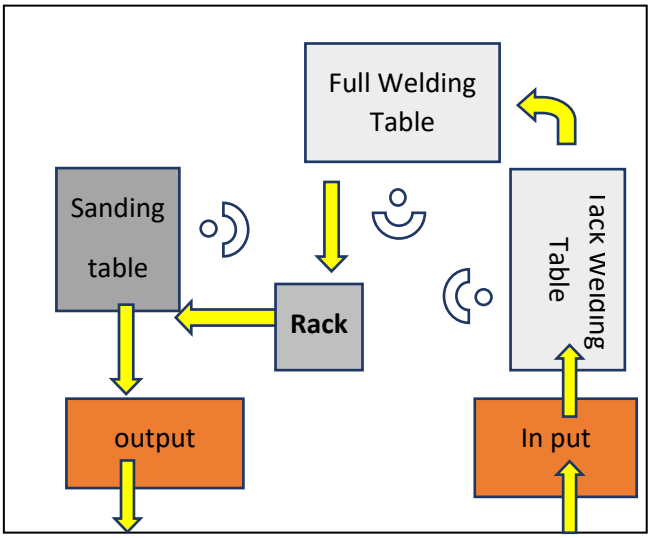
Existing Process

Welding is the heart of the furniture making process as this is where the sub assemblies actually get made as per the design. In the existing set up, welding tables were located in a cluster at one side of the shed while the sandering process which was actually smoothening out the extra weld splatters and sharp edges was being done in a separate part of the shed. Issues observed due to this set up

- Welding quality was inconsistent – sometimes an entire lot was found to be defective and additional time and resource had to be used for correcting the same
- More than 2 days of WIP in between these two processes as they were functioning as independent entities.
- Load on sandering appeared to be higher – also frequent absenteeism in this section meant fluctuations in the daily output

Improvements Done

The layout was modified – welding and sandering were connected in a cellular layout so as to facilitate online sandering thereby improving the flow of material



- Target to have **single piece flow** – rack provided to hold < 5 Nos
- Immediate feedback from sander to welder on quality – missing weld, spatter, wrong weld
- Special input trolleys fabricated to hold all the required components in easy to access positions.
- Modification of welding fixtures to reduce Muda and Muri

The runner products were taken up one by one and the complete cycle time for their sub assemblies studied to improve flow. In cases where welding time is higher, the above steps to reduce muda and muri helped in reducing the same. When sandering time was a constraint, extent of sandering was studied and non critical operations avoided. Also dynamic balancing was introduced where wither 1 or 2 sandering operators were allocated to a station depending on balance requirements.

Improvement Project 2: Establish Supermarket (to feed material to bottleneck)

Existing Process

While more than 3-4 days of sub assembly WIP was observed in the central area of the plant, the actual feeding to the pretreatment process was in a hand to mouth mode. Material handlers were actually carrying components from sandering tables one at a time and loading onto pretreatment fixtures. Several times there was a lull in loading as some of the parts were being manually transported from over 50 feet distance.

Key observations

- WIP lying all over the floor and in mixed up condition – different customer order items found together in some of the places
- Material needed as per plan not available in WIP
- Muri for material handlers in transporting material – distance, space crunch and unsafe conditions

Improvement Action

From the end customer perspective, it was important to pre-treat and powder coat the sub-assemblies in the same sequence as they would be packed. Hence, a supermarket of welded sub-assemblies in trolleys was planned up to a maximum of one shift inventory. The material handlers would move the trolleys as per sequence planned to the loading area.

A kitting supermarket for fabricated components was established before welding – where all parts required for welding a sub assembly are brought. If any part is missing, the material feeder immediately follows up with the fabrication in charge to get it completed.

This ensures there is no delay in welding process due to non-availability of parts.

Focus Area2: Improve Pre-Treatment Output (Bottle neck)

PT Pre-treatment plant is the bottleneck in the overall plant. So, the plant has to operate to the maximum capacity possible with the existing infrastructure. Since the plant is operator dependent, the output from the plant is inconsistent. The constraints identified in the existing process were taken up for improvement.

Improvement Action 1: Rust Elimination

Almost 10% of the components were found to still have rust post pretreatment – these were identified in some cases only after powder coating and they needed to have a complete rework cycle before they could be approved and packed.

Root Cause –A close study helped identify the root cause of rust - the points where components were in contact with each other during the process.

Action Taken – Spacers were designed and in such a way that there is just enough gap between the components so as to expose all surfaces to the treatment cycle.

Improvement Action 2: PT Load maximization

Observation showed that there was variation in loading pattern from cage to cage for the same or similar sub assemblies. There were no clearly defined standards on loading as there was a feeling that too many designs and custom orders are difficult to standardize.

Action Taken: The team brainstormed and tried out alternative loading patterns and verified the end product quality. Based on these trials the best possible loading pattern identified and standardized. Visual standards were then made in the form of a catalog / ready reckoner for the supervisor in charge.

Improvement Action 3: PT Cycle time reduction

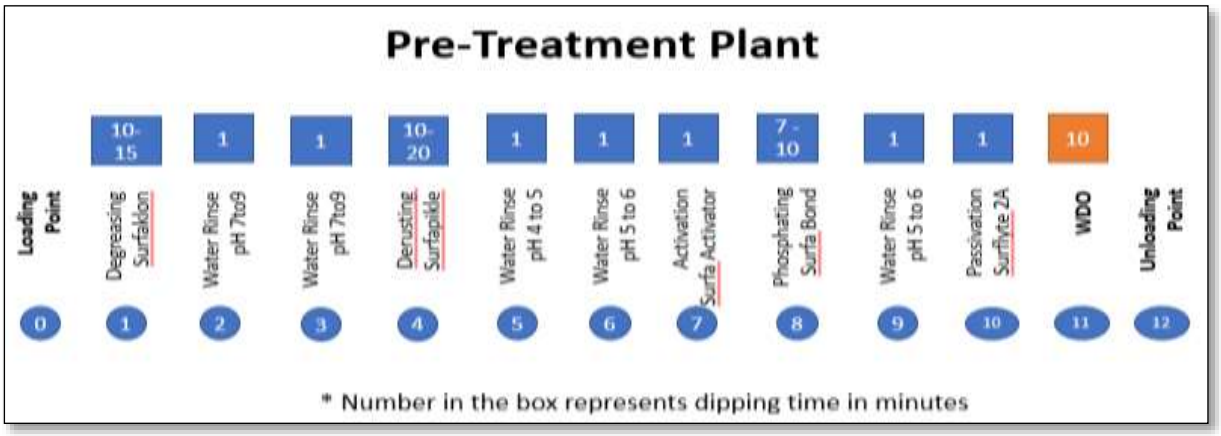
Existing Process:

Now that maximum possible load for each item was established and the quality of the output ensured, it was time for the team to work on the actual PT cycle time.

The pre treatment process consists of dipping the components in several tanks containing various chemicals and holding them inside for specified duration. In between two chemical

tanks, the components would be rinsed by dipping in water. **The bottleneck processes are the processes that have more than 10 mins.**

The defined sequence was not being adhered to due to delays in materials for cages. Also, there was no error proofing mechanism available to ensure sequence is maintained.



Action Taken

1. **PT** plant operational sequence was then studied along with the team.
2. The operational sequence was devised in such a way that the basket is dipped in all the tanks and the timing for dipping is as well followed.
3. By this the output from the plant is consistent and also the quality of the output is consistent.
4. The operator was trained with the new operational sequence and there were Andon lamps installed so that the operator follows the dipping time as per the standard.

Outcomes& Benefits of the Lean Implementation

1. Pretreatment (Bottleneck) throughput increased from by **almost 30%.**
2. **60% reduction in lead time** for manufacturing a product reduced from an average of 5 days to less than 2 days.
3. **Over 50%** Reduction in Raw material holding.
4. WIP Inventory reduced from 3.5 days to < 1 day thus helping reduce the **operating capital employed reduced**.
5. Plant operations streamlined and ready to match the next business target.