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Agile Manufacturing Triumphs: A Lean Approach To Seasonal Demand Challenges In Mobile Charger Production - A Case Study Of India's Leading Manufacturer

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Abstract:

Managing uncertainty and demand volatility poses significant challenges for large manufacturers in resource planning. Traditionally, manufacturers respond to demand fluctuations through three main strategies: building upfront inventory, increasing production line capacity through overtime, and outsourcing capacity temporarily. However, these strategies come with considerable costs, impacting key business metrics such as profitability and cash flow. This article focuses on the challenges faced by one of India's leading mobile phone charger manufacturers due to demand volatility and how they addressed the capacity problem to meet customer demand effectively.

Keywords: *Demand volatility, Resource planning, Inventory management, Production capacity Optimization, Manufacturing challenges, Agile manufacturing, Supply chain management, Adaptive production system*

Introduction:

According to data s[1]hared by the India Cellular and Electronics Association (ICEA), India stands as the world's second-largest mobile phone manufacturer, with sales exhibiting a seasonal trend. The highest sales are observed in the second half of the calendar year during major festivals like Dussehra, Holi, Diwali, and Christmas. This trend extends to mobile phone charger sales, with demand lower in the first six months and peaking in the latter half. This case study focuses on enhancing the business performance of a renowned Indian charger manufacturing company by optimizing capacity and resources to meet peak demand without significant capital investment.

This company, supplying chargers to leading mobile phone brands globally, employs approximately 4500 individuals, predominantly women. Their competitiveness is sustained through Global R&D, a centralized supply chain, robust Quality Management Systems, and a commitment to Lean manufacturing principles. The company's organized approach to planning, designing, and manufacturing products, coupled with Lean concepts, aims to improve overall business performance, including profitability, customer satisfaction, and cash flow

Lean Manufacturing:

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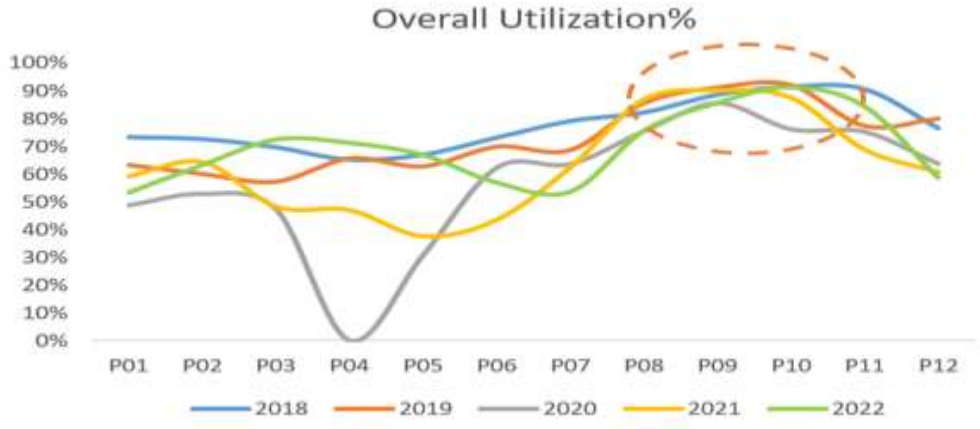
The Lean Manufacturing method is the best production technique that aims to find the waste and reduce waste in the production processes; this technique especially eliminates waste in workers' effort, production time and production space area, etc. The lean concept was first developed by Toyota (TPS) for their automobile industry. This method is applied in the process of manufacturing replacing mass production Womack and Jones (1990). According to Womack, the primary objective of Lean is to increase the value of the product with less work. Lean drives a self-directed workforce and is driven by output-based goals aligned with customer satisfaction criteria Elizabeth and Cassandra (2010). Waste is generally caused due to unnecessary delays, processes, costs and errors. The seven types of wastes associated with Lean are overproduction, transportation, processing, inventory (work-in-process and finished goods), waiting, motion and defects. These wastes are also associated with support functions involved in a production system. The main focus of Lean is to address the value-added and non-value added activities. A non-value added activity (NVA) is most commonly defined as any activity for which the customer is not willing to pay. Lean necessitates the reduction of these NVA"s by making the system perform better while consuming lesser resources Czarnecki and Loyd (2001). Some of the widely recognized benefits of Lean manufacturing include:

- ✓ To increase productivity.
- ✓ To balance the work force with available resources.
- ✓ To determine the production capacities.
- ✓ To determine standard costs of a product.
- ✓ Effective production planning and control.
- ✓ Efficient plant layout

Challenges faced by the company:

The charger manufacturing process begins with Surface Mount technology (SMT), Through Hole technology (THT), Soldering Technology, Final Assembly, Testing and Packing. There are two kinds of soldering processes followed in the charger manufacturing process, reflow soldering and wave soldering. This soldering process is the deciding factor for Production line layout.

Though the company manufactures a variety of products with different output Wattage ranging from 5W, 10W, 18W, 22W, 33W, 67W & 80W, it is broadly categorized as two types, Product-A (with Wave soldering process) and Product-B (with Reflow soldering process). This company has five manufacturing lines of which three lines are designed for the wave soldering



process to run Product – A type and two lines are designed for the reflow soldering process to run Product – B type.

The capacity utilization pattern for these lines is about 60% to 70% from Jan to Jul and it reaches its peak between Aug to Nov. During this peak demand time, both Product-A types and Product-B types have maximum customer orders. However, due to challenges arising out of unforeseen situations and constraints in the existing production capacity, these orders cannot be produced as per demand and are unable to deliver to customers on time. Therefore, the company faces huge revenue loss and unbalance in the net working capital which in turn results from the non-acceptance of any investment proposals for additional production lines to build capacity to satisfy peak demand.

The manufacturing facility currently faces several challenges that impact its operational efficiency and capacity to meet customer demand. At present, there are three production lines dedicated to Type-A products, utilizing wave soldering technology. In contrast, only two lines are allocated for Type-B products, employing reflow soldering technology. Compounding this issue is the seasonal surge in customer demand observed from August to December, attributed to festival seasons. During these months, capacity utilization reaches its maximum, intensifying the strain on resources. One of the critical problems arising from this scenario is the inability to fulfill the heightened demand for Type-B products, as the existing two lines operate at full capacity, posing a limitation on the company's ability to meet the excess demand during these peak periods. Addressing these challenges is imperative for enhancing overall production efficiency and meeting customer expectations.

Objective of case study:

The primary objective of this case study is to identify solutions for the production capacity constraints against demand fluctuations. Generally, manufacturing companies apply Lean techniques which is one of the best business strategies to eliminate waste in the manufacturing process and be competitive over the competitors; driving productivity improvement and enhancement of product quality. The challenges faced by this company is how to deliver their products on time at low cost and good quality during peak demand when their production capacity is almost full.

- To fulfill the excess customer demand in those peak periods without major capital investment when production capacity is full.
- To analyze the production line efficiency by lean approach methodologies

Strategic Approach to overcome the identified Challenges:

Task force Team:

A Special Task Force team comprising highly experienced personnel from various functions like Production, Process Engineering, Industrial Engineering, Supply Chain, Planning etc is formed to analyze the problem, identify the root cause and also to propose the best feasible solution to overcome the issue.

Review of Proposals:

This Special Task Force team is meeting constantly to discuss on this subject, reviewing the data of previous years, getting inputs from various teams on this issue, and listing out all feasible solutions for the issue to find out the best possible solution to propose to management. Listed are all the proposals that arrived to resolve the capacity issue on Product-B type during peak months.

1. Adding a new line
2. Build Inventory upfront
3. Do Overtime on Nonproduction days
4. Contract manufacturing the product temporarily
5. Increasing the Product-B type line capacity
6. Multi-model line concept

The pros and cons of each proposal to be reviewed in depth to find out the best out of it.

Adding a new Line:

This is the right decision if capital investment for a new production line is pretty low. A new production line cost here is about 7.5 Crores INR which is not a small amount, moreover the line utilization is less than 50% for the whole year since the peak demand is just 4 to 5 months only. In this case, the payback for investment takes more than 10 years of time. Hence this is not a good proposal to take it to management as a solution.

Build Inventory Upfront:

Building inventory is a very common practice in mass manufacturing to some extent, but it has an equal amount of risk as well in case of any quality issue found in the produced stock or any chance of Rev changes received from the customer. As per the Lean approach, keeping Inventory is a type of waste. Moreover, the company has various models under Product-A and Product-B categories, we are not sure exactly which particular model is needed during the peak period, so this is a huge risk and it also blocks the cash flow very much. Hence this is not advisable to take this approach as a solution.

Overtime on non-production days:

Again, this is also a common practice followed in the industry to manage sudden demand or close the supply backlog. This approach will solve the problem to some extent however this is not a permanent solution. This company operates continuously from Monday to Saturday (6 days) in a week with both Day and Night shifts and Sunday is compulsory OFF for Production. They are utilizing the non-production day to do preventive maintenance activities for machinery by a separate team. In this situation, utilizing the nonproduction days for Overtime production is a very limited option. This is already in practice to close the backlog quantity due to efficiency loss. So this proposal is not considered a feasible solution.

Contract manufacturing the product temporarily:

The charger is safety critical product since it has to connect your main AC supply to a valuable mobile phone. If any carelessness in the manufacturing process leads to safety failures like an electrical shock to the end users, hence this is not at all an advisable approach to propose. Moreover, contract manufacturers are not interested to support for a short span of demand. It also needs customer involvement to qualify the contract manufacturer, hence it is very much hectic.

Increasing the Product-B type line capacity:

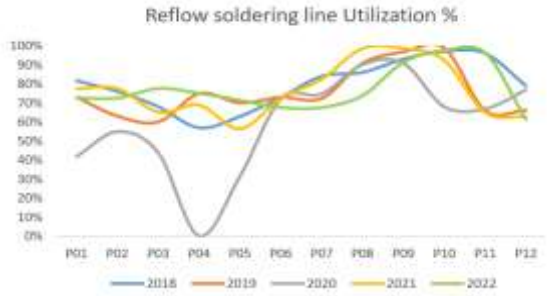
Though soldering technology (Wave or Reflow) is the deciding factor for the manufacturing process, it is not a bottleneck process in the production line as per the Cycle time of each individual process in the line. Generally, the production line layout is designed in such a way as to keep the costliest equipment used in the line as a bottleneck process in order to get the utmost utilization. Here the pick and place equipment used for the SMT process is costlier than

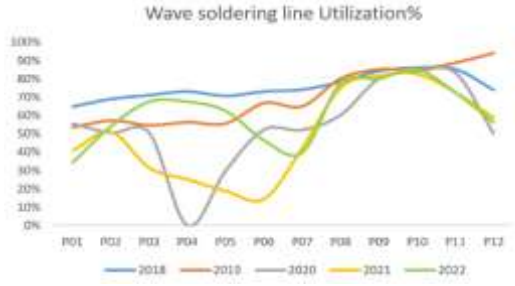
all other machines in the line, and the bottleneck process in the line is the SMT machine. The line balance rate for the Product-B type (Reflow) line is about 85% only so we still have a 15% chance to improve the line performance. There are 2 lines for Product-B type, so we have a chance to improve 30% (15X2) efficiency overall.

Team members in the task force team got hope now that they have identified a way to approach to solve an issue. In order to de-bottleneck the SMT process, they are working to increase the SMT capacity by adding an additional machine in the line. The cost of an SMT machine is about 3.5 Crores INR. They need 2 machines to improve the 30% efficiency overall, it cost about 7 Crores INR. The payback of this investment is about 60 months. But the team has confidence that it will solve the peak demand problem permanently, hence considered to take this proposal to management for approval.

Multi-model line concept:

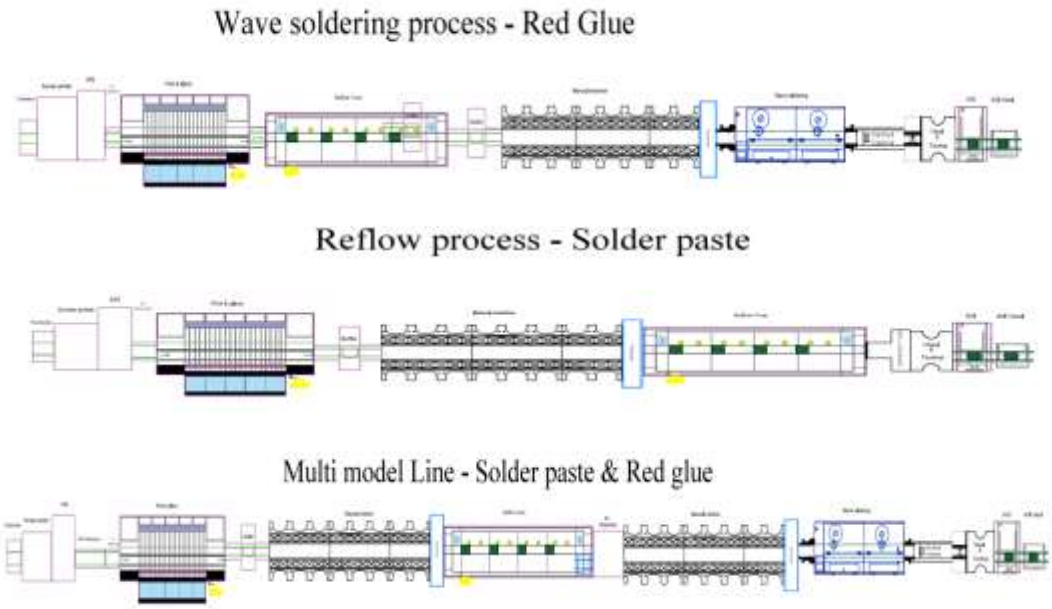
Based on the analysis of the past few year data, the Industrial Engineering person pointed out that the utilization of the Product-B type lines (2 lines) reached maximum utilization every year for 3 to 4 months in the peak season whereas the utilization of Product-A type lines (3 lines) are reached maximum 80% only in the peak months. This is another sparkling piece of information to think out of the box.





A process mapping study is arranged to compare the individual process in both types of lines. The conclusion of this study report is the breakthrough solution for the long-term problem. Adding a PTH table with a motorized conveyor after the SMT machine process is the solution, by doing so the line becomes compatible to manufacture both Product-A and Product-B.

The investment needed for PTH motorized conveyor is just 7 lakhs INR only per line. They have decided to convert the 2 lines of Type-A to a multi-model concept to accommodate the fluctuating demand for Type-B products in peak time.



The same has been proposed to top management for approval and it has been implemented successfully and managed the peak season of 2022 successfully for the both the product type without any delivery challenge.

Conclusion:

In conclusion, the case study highlights the critical challenges faced by India's leading mobile phone charger manufacturing company in navigating demand fluctuations and the innovative solutions implemented to overcome these obstacles. The integration of Lean Manufacturing principles proved instrumental in optimizing production processes and enhancing overall business performance.

The company's commitment to Lean methodologies, aimed at eliminating waste and improving efficiency, aligns with industry best practices. The adoption of a multi-model line concept, particularly the strategic addition of a PTH motorized conveyor after the SMT process, showcases a forward-thinking approach to address production capacity constraints during peak demand periods.

This case study serves as a testament to the company's ability to leverage Lean principles effectively, resulting in successful adaptation to the challenges posed by seasonal demand patterns. The proposed solutions underwent rigorous review, ensuring a comprehensive understanding of their implications, and the chosen approach demonstrated both cost-effectiveness and operational efficiency.

The management's approval and successful implementation of the proposed solution underline the strategic vision of the company. By converting Product-A lines to a multi-model concept, the company not only met the peak season demands for both Product-A and Product-B but also did so without compromising on delivery timelines or incurring excessive costs.

As the manufacturing landscape continues to evolve, this case study offers valuable insights into the practical application of Lean Manufacturing to resolve complex production challenges. The success achieved by the company underscores the importance of innovative thinking, cross-functional collaboration, and strategic decision-making in navigating the dynamic and competitive manufacturing environment. The lessons learned from this case study can serve as inspiration for other companies facing similar challenges, emphasizing the potential benefits of embracing Lean principles in optimizing production processes and meeting customer demand with agility and efficiency.

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