The Medical Devices Supply Chain Specialization

Hi, I'm Tejaswi. I'm a software engineer working in the supply chain domain for the past 2.5 years. During this time, I've worked on various projects, which have helped me become familiar with a few supply chain concepts and terminologies.
While my professional experience has been valuable, I've realized the importance of expanding my understanding beyond what I encounter on the job. That's what motivated me to enroll in this course. I'm especially interested in better understanding logistics and planning areas that have always intrigued me. Through this course, I hope to build a stronger foundation and gain insights that will allow me to contribute more effectively in my role.

The newly imposed 2.3% Medical Device Excise Tax under the Affordable Care Act has significantly impacted Medical Technologies Corporation (MTC), translating into a reduction of over 10% in profits. To offset this financial hit and protect annual bonuses and potential jobs, we need to identify major cost-saving opportunities. Given that most roles in the medical device industry demand a highly skilled workforce, lay-offs could have serious long-term consequences.

<u>Executive Summary</u>:
We propose to streamline the medical device supply chain by eliminating the distributor layer and instead utilizing an in-house third-party logistics (3PL) team to manage distribution directly to hospitals. Products will be cataloged through the GPO, enabling direct access for hospitals and reducing dependency on intermediaries. By introducing RFID tagging at the manufacturer level, we ensure end-to-end tracking of devices from assembly to point-of-use via smart kiosks. We also recommend transitioning sales representatives into on-demand consultant roles, optimizing resource utilization. Over time, additional innovations such as 3D printing for customized devices and bringing sterilization processes in-house can further reduce costs and increase responsiveness.

Key changes:
1. RFID tagging at the manufacturing stage
2. Inventory management system software
3. Change with the off-site sterilization process
4. Eliminate the distributor, and bring in 3PL
5. Sales representatives on contract roles
6. 3D printing
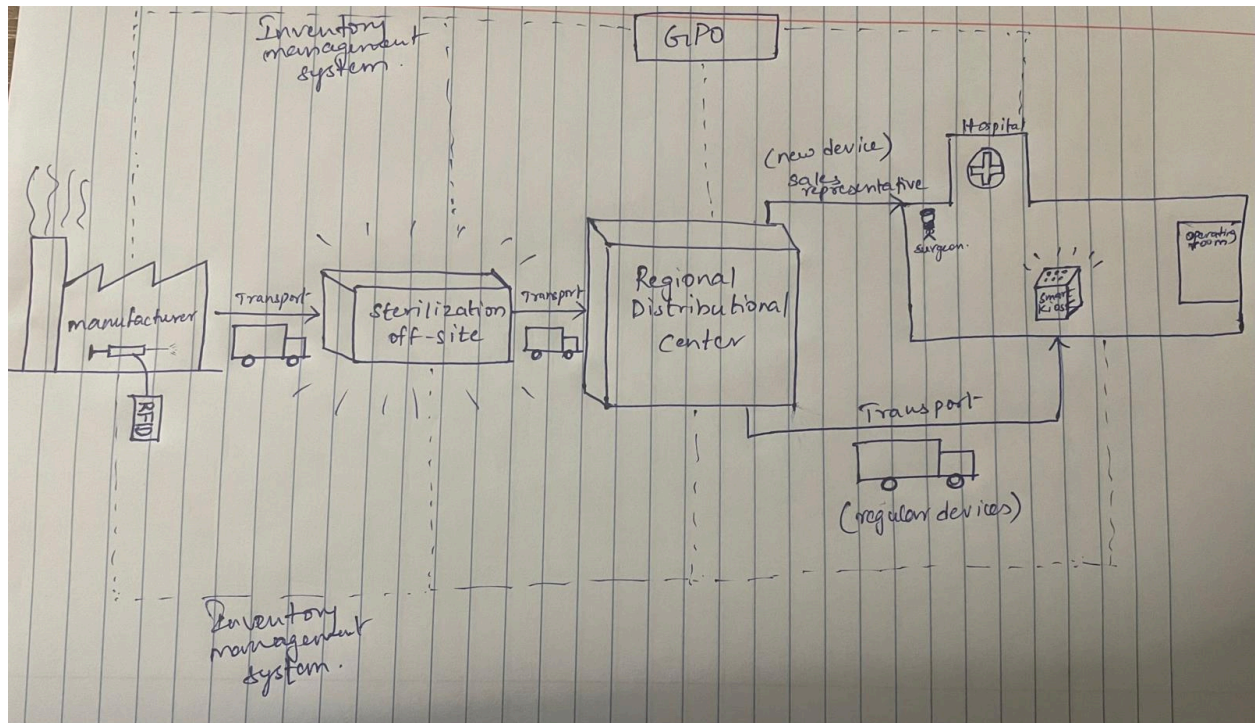
Forecasting 2015:

To estimate performance for 2015, we used four forecasting methods utilizing 2014 data. The charts below illustrate the results of applying the Naive forecast, Cumulative Mean, Moving Average, and Exponential Smoothing techniques across each stage of the supply chain: Starting, Shipping, Production, and Ending.
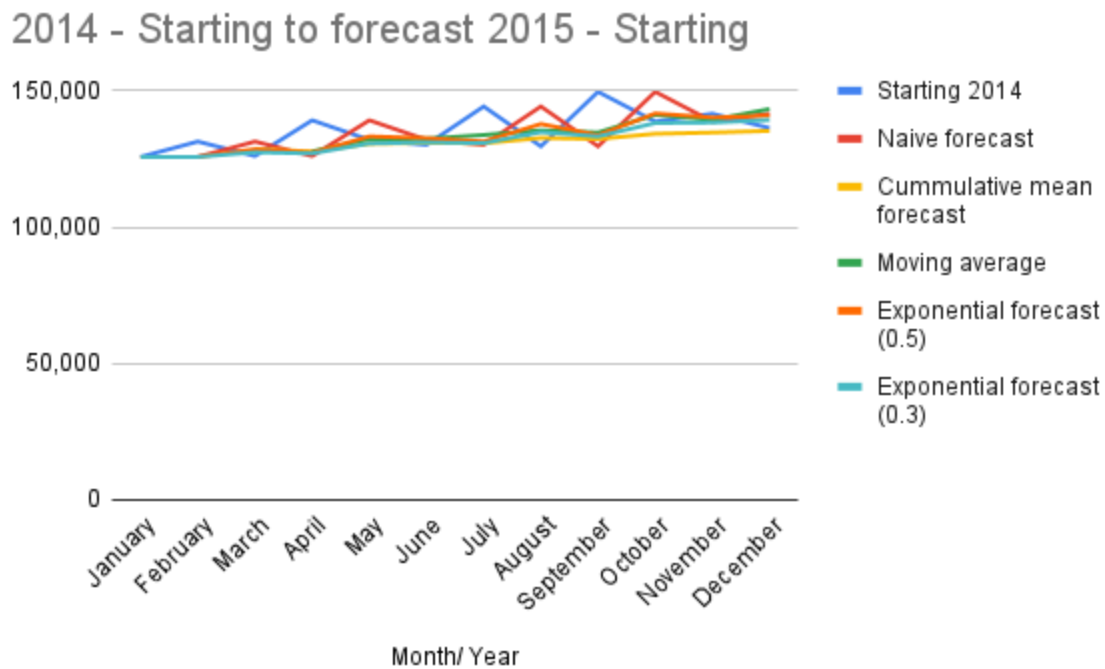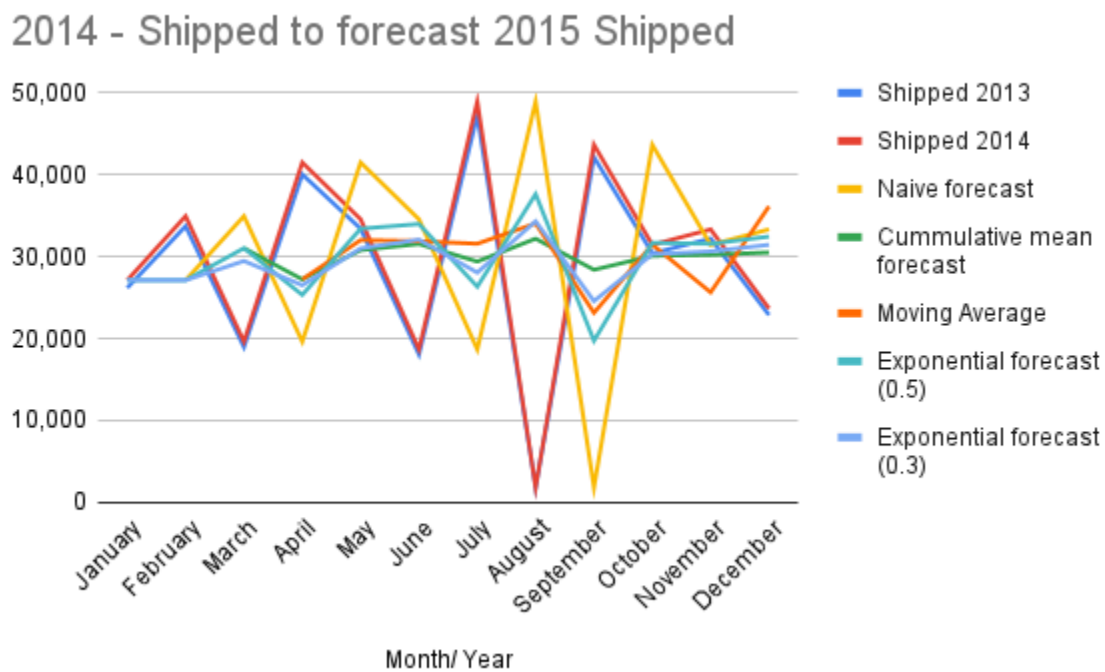
Fig: forecast for 2015 for the 'Starting' stage

Fig: forecast for 2015 for the 'Shipped' stage
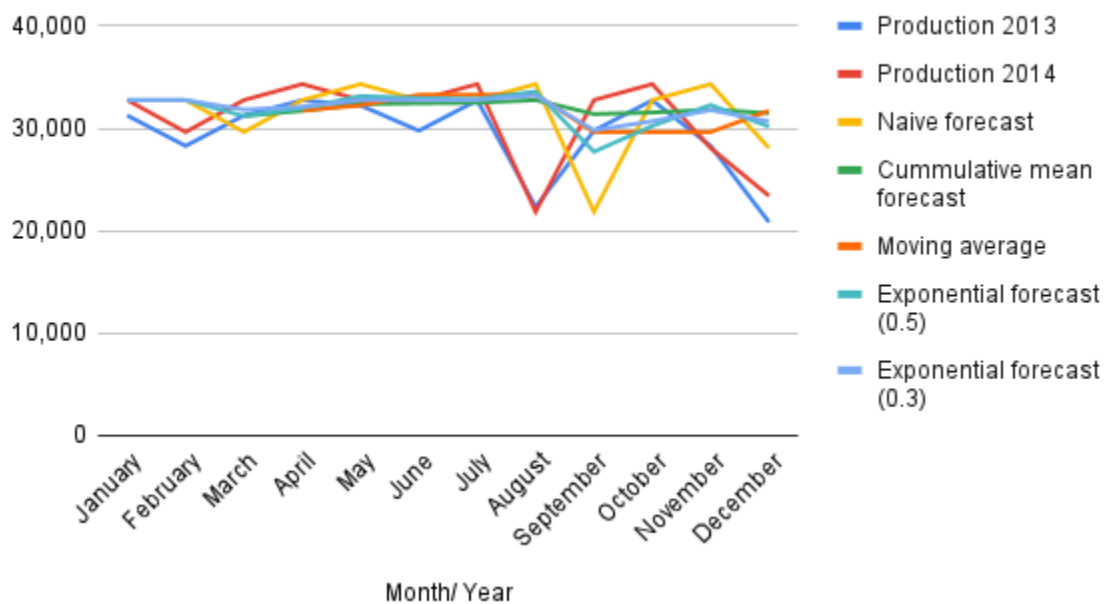
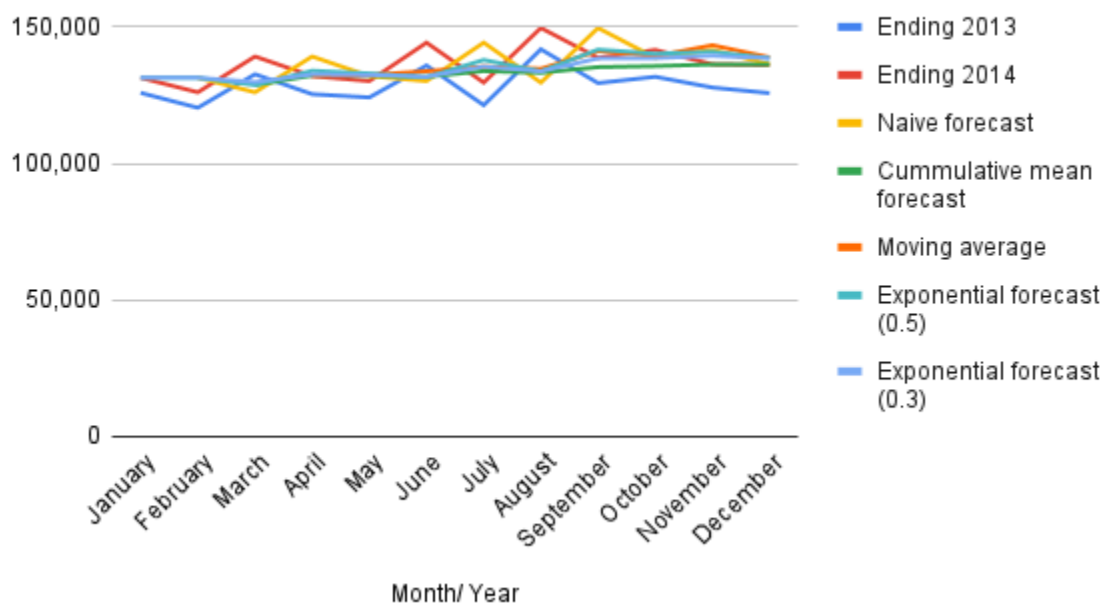Fig: forecast for 2015 for the 'Production' stage

Fig: forecast for 2015 for the 'Ending' stage

Based on the above forecasting methods, the **cumulative mean** seems to be the best fit for this use case. This is the order of forecast methods from best to worst fit:

1. Cumulative mean forecast: This is the best performer of all the methods here, the most consistent, and has the lowest error rate.
2. Moving average forecast: This has the second place; it performed well with production and ending data.
3. Exponential smoothing (alpha = 0.3): Is the next pick, slightly reactive, but did a fine job with starting and ending data.
4. Exponential smoothing (alpha = 0.5): This is quite reactive, has a higher error rate, but did better than the naive forecast.
5. Naive forecast: It did the worst job; it is the most volatile method for this data.

Calculations Reference:
https://github.com/tej-kanuri/Supply-chain-specialization/blob/main/Planning%20-%20forecast%202015%20-%20calculations%20sheet.pdf

It's also important to highlight that among all the stages, the **Shipping stage exhibits the highest level of noise**. This area requires focused attention to improve consistency and streamline the process.

How can we improve the shipping phase?

To enhance the shipping process, we are proposing several key changes. First, we plan to eliminate the distributor layer and instead utilize third-party logistics (3PL) providers to manage product movement from origin to final destination. Additionally, after sterilization, devices will be directly shipped to the regional distribution center, removing the current step of returning them to the manufacturer. The use of RFID tags further improves tracking and visibility through the inventory management system. These changes reduce touchpoints in the shipping phase, simplifying the process with shorter lead time and ultimately positively influence the COGS.

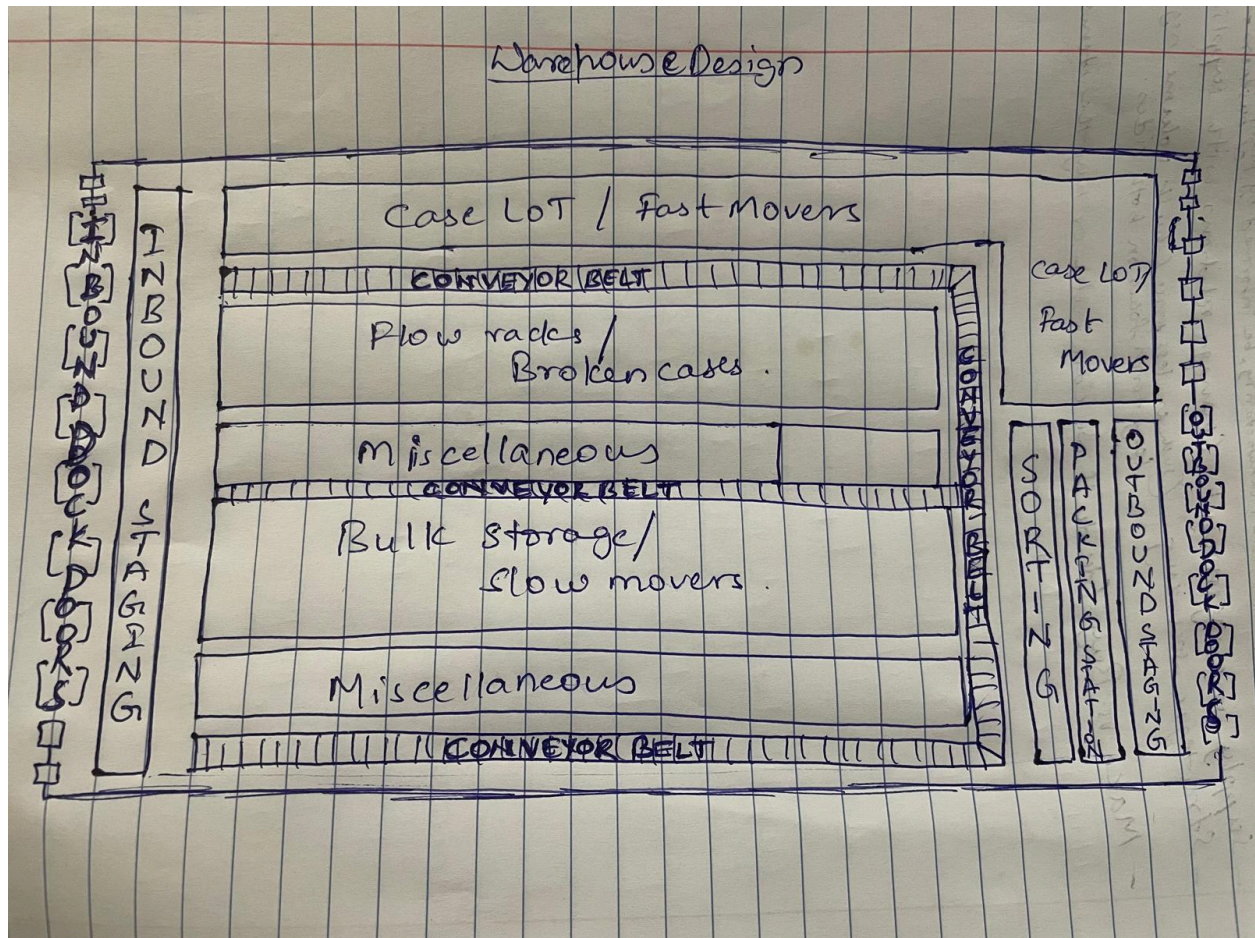## How would I design a warehouse for this use case?

Fig: My Warehouse house design

Above is how I would design the warehouse for maximum efficiency: All storage blocks would be positioned adjacent to the inbound staging area, with a conveyor belt system running throughout the warehouse to connect each block directly to the outbound area. This setup enables faster handling of items before they are sorted, packed, and moved to the outbound staging zone. Additionally, the fast-moving items block would be strategically placed with direct access to both inbound and outbound areas, ensuring it gets priority handling within the warehouse.

Major areas of improvement:
1. Remove Distributor layer: Direct manufacturer-to-hospital distribution reduces costs and improves delivery times.
2. Smart kiosks utilization: Smart kiosks ensure just-in-time availability and better inventory management, and the manufacturer can have the last-mile details of each device.
3. Sales Representative Optimization: Shift to consultant-based sales representatives for new or specialized products only.
4. RFID Implementation at the warehouse: Enhances device traceability and visibility throughout the supply chain.

5. Sterilization Process Planning: A long-term plan to bring sterilization in-house to reduce outsourcing costs.
6. Technology Integration: Use of 3D printing for customizable devices allows for innovation and patient-specific solutions to attract customers.
7. Improve the device standards as per the Centers for Medicare and Medicaid Services (CMS)

Resources needed for the improvement:
1. **Investment in adding in-house 3PL operations:** trucks, logistics staff, and Inventory management system software.
2. **RFID tagging:** Within the warehouse, right after the devices are assembled, we can add a step of creating an RFID tag for each device. This will be highly used during the tracking of the product until it reaches the last mile.
3. **Smart kiosk utilization and maintenance at hospitals:** The other supplies already are using the smart kiosks; we too can upgrade to start using them, which will eliminate the manual work of carrying the devices to the very inefficient operating room.
4. **Training and onboarding of consultant sales representatives:** The sales reps salary is highly competitive and is directly adding up to the final product, which can be optimized since we can design to make these roles as consultants and utilize their skills only when a new product is launched and the surgeons needs the introduction and training of the new devices.
5. **3D printing adaptation:** R&D and implementation of 3D printing will open up the scope for the company, as these orders will be customizable as per the customer's request, and we can gradually save on making costs with this adaptation.
6. Long-term planning and budgeting for **in-house sterilization facilities**.

Risks to the new proposal:
1. **Complexities without distributors**: Currently, the manufacturers do not have strong relations with the GPO and are mediated via the distributors. And also, we need to convince the GPO to start maintaining the catalog for the devices which was previously communicated via the distributor. This can cause some friction if we do not come up with a better plan for cost savings.
2. **Initial costs for RFID tags and 3PL infrastructure**: The initial setup of the RFID tags at the manufacturing stage and the third-party logistics setup, such as the cost of trucks, logistics staff, and the inventory management software.
3. **Delays or disruptions in third-party sterilization:** As we are proposing to move the devices from the off-site sterilization to be directly shipped by the 3PL to the regional distribution center by creating shipments via the inventory management software, the users might experience disruptions with the new software or delays with the new flow.
4. **Possible pushback from hospitals or surgeons used to traditional sales representatives**: The hospitals and the surgeons might not be too happy with the change to making the sales rep position a contractual role, which makes them available only when a new device comes into the market which is when they make the hospital visits to train the surgeon(s).

5. **Internal skill gaps related to the adaptation of technologies such as 3D printing and RFID**: There might be a delay in training the internal staff on exploring 3D printing and getting accustomed to RFID tagging.

Ways to mitigate the risk:
1. **Gradual implementation beginning with smaller hospitals or specific areas**: Instead of making all the changes at once at all hospital locations, implement the changes in the smaller regions first. Train, learn, negotiate well, and satisfy customer needs.
2. Raise awareness among hospitals about the value of RFID in enhancing device traceability and maintaining accountability throughout the supply chain. Train the customers on how it will be beneficial when using an Inventory management system and the advantages of real-time data and data transparency.
3. Maintain third-party sterilization agreements in check until internal capabilities are fully developed.
4. **Provide comprehensive training and ongoing support for consultant representatives and hospital staff**: Use software to save the training sessions, which the surgeons can always go back and revisit whenever needed. This step will bring down the physical attendance of the sales reps even after presenting the training sessions.
5. Start 3D printing with low-risk devices to see if it works well and get feedback, and gradually move to the complex devices.

Conclusion

By implementing the suggested improvements, such as enhancing RFID tags, modifying the off-site sterilization process, eliminating distributors, incorporating third-party logistics, utilizing an inventory management system to optimize operations, transitioning sales representatives to contract roles, adopting 3D printing, and planning for in-house sterilization, will significantly reduce costs and overall enhance the entire process. Furthermore, by using the cumulative mean forecast method, which is the best fit for this use case, we can reduce demand volatility and manage inventory costs more effectively.