# Modeling Operations at Pharmaceutical Distribution Warehouses

Cardinal Health, a billion dollar pharmaceutical distribution and logistics firm, manages multiple products from brand name pharmaceuticals and generic drugs to over the counter drugs, health & beauty items and their own private label. They face a multitude of typical distribution warehouse challenges that are further complicated by the nature of pharmaceutical products, which are smaller in size, consumable, expensive, and could be life critical. Brian Heath, Director of Advanced Analytics at Cardinal Health, and an experienced user of AnyLogic software, employed agent based modeling to solve various business problems, saving Cardinal Health over $3 Million annually.

PROBLEM:

Cardinal Health is an essential link in the healthcare supply chain, offering next day delivery to over 30,000 locations including hospitals, retail pharmacies, physicians' offices, and direct to consumer. Other value added services including efficiency and demand management, working capital management and contract credit management add to the difficulties of poor manufacturing reliability and supply disruptions in the market due to FDA and DDA regulations. In summary, Cardinal Health must keep up with the variability in pharmaceutical distribution management.

Cardinal Health considers facility layout, flow of product, order picking, labor planning & scheduling, customer order requirements and congestion for analysis and day to day operations management. Traditional analysis tools such as empirical trial and error, are risky, expensive and difficult to make changes. Industrial engineering operations researchers would suggest mathematical models, inexpensive, but the models do not capture unexpected dynamics. If anything is open or has emergent behaviors such as congestion, a standard mathematical model would not be able to solve. Thirdly, process driven or discrete event modeling is not advantageous due to its inability to represent a facility naturally. This led Brian Heath and Cardinal Health to explore alternative analysis options.
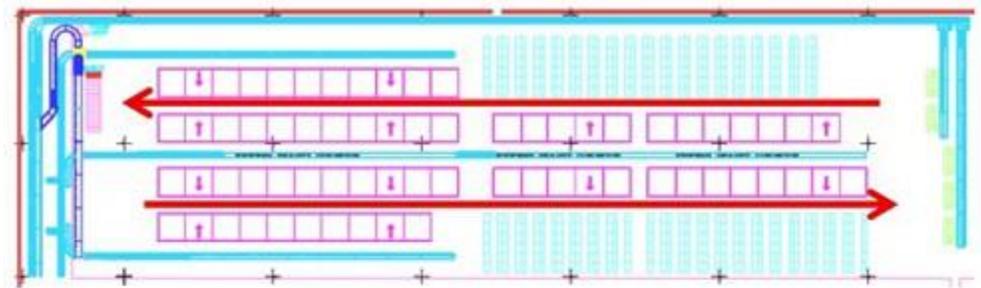

Tested Warehouse Layout Configurations

Case Study

SOLUTION:

Agent Based Modeling (ABM) with AnyLogic Simulation and Modeling software gave Cardinal Health the device required to tackle many distribution warehouse issues without the restrictions of traditional tools. ABM represents abstractions of distributed autonomous entities that can interact with each other and their environment through space and time, allowing Cardinal Health to capture work time allocation, congestion wait time, cycle times, distance traveled, worker variability and other important metrics.

3D Animation
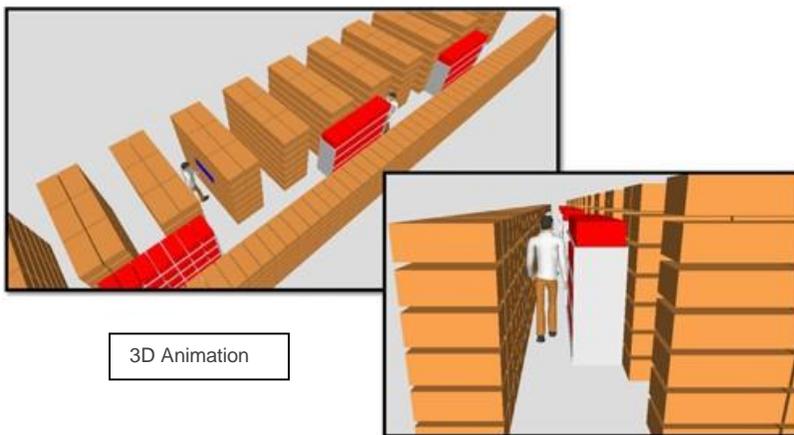
The model built was ultimately concerned with the activities of employees and the interaction with each other during the day, making it necessary to import data such as picking time and performance standards into the model. Now, Cardinal Health can gather congestion wait time data and see how much of a problem it is causing in the warehouse since "agents" are modeled as individuals with special relationships to each other.

Additional parameters included in the model are several worker speeds, worker behavior, learning curves, cycle times, product turn-around and distance covered walking or driving.

The ability to import Excel files was also imperative as Cardinal Health has numerous warehouses, and it is mandatory to test multiple layouts. Using AnyLogic, if a change is needed, it's as simple as updating the Excel file, importing it into the model and running the model again.

OUTCOME:

The Agent Based Model built with AnyLogic software allows Cardinal Health to compare layouts, picking technology and product slotting strategies. In addition, they can evaluate different methods of picking to update staffing models and for on-the-floor support if a workload changes as orders vary on a day to day basis. Statistics is also gathered such as tact time, how many batches are completed in an hour, truck unloading time, and sequencing of events.
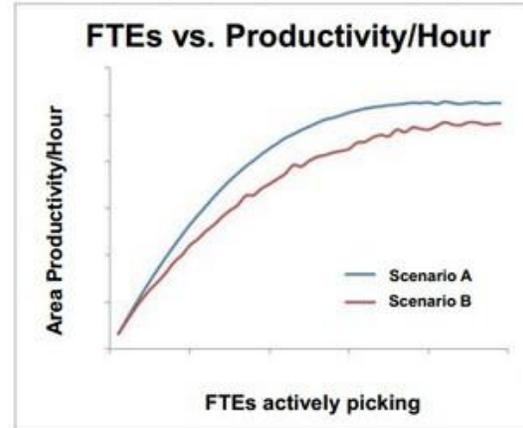
Besides the clarity given through the above metrics, the model revealed a problem due to the random distribution of work. Each employee's work load was uneven making one faster and one slower. By balancing the workload, employees began working at a similar pace and congestion decreased dramatically.
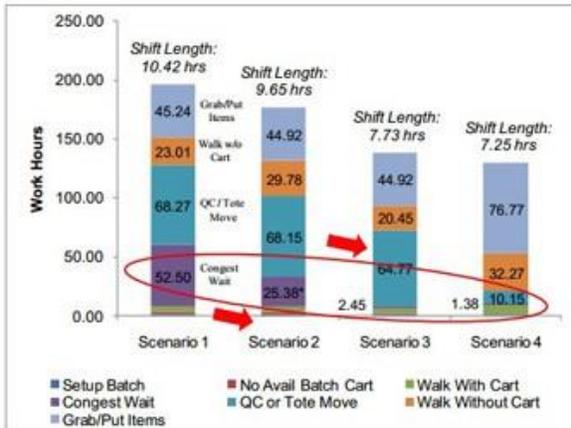
Discovered how to minimize congestion

Discovered Area Capacity by Scenario

Some of the Project's Results

By minimizing congestion using AnyLogic software, Cardinal Health was able to decrease the average shift length from 10.5 hours to 7.25 hours and increase the amount employee capacity. Cardinal Health saves over $3 Million annually using Agent Based Modeling with AnyLogic Simulation technology.

"AnyLogic's agent libraries, flexible architecture, and integrated animation enables the continuing success of this project," declares Brian Heath, Director of Advanced Analytics at Cardinal Health, you can view his presentation and learn more about using Agent Based Modeling for real world application: