Technology and Operations Management

Analysis and Improvement of a Consumer Goods Pick Pack Operation

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I. Description and Analysis of the Current Situation
II. How to Improve It
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According to Snow, a process is "the sequence of operations and events taking up **time, space, expertise and other resources which lead to the production of some outcome**" (Snow, 2019). The business process that I am examining is the pick pack operations and product throughput for order fulfillment at a consumer packaged goods (CPG) direct selling company in Russia. In this process, the **resources** are boxes of inventory containing product items such as lipstick, mascara, eyeshadow and skin creams (SKUs),[1] as well as the warehouse, boxes and packing materials, warehouse workers and pick line equipment.

The SKUs are placed on racks consisting of three levels of tilted horizontal shelves. In front of these shelves is a roller bar conveyor belt along which a warehouse worker slides a carboard box. These shelves and roller conveyor belt are the **space** where this process takes place.

As the warehouse worker slides the box along the conveyor, he or she picks the items from the boxes located on the shelves according to a pick ticket which tells him or her which item to pick and place (pack) in the box. To become proficient at this sequence of activities requires experience, training and **expertise**.

Once all items have been picked and packed into the box, the box is checked for accuracy. If correct, it is sealed and placed in the order loading zone.[2] The order that is produced is the

[1] Stock Keeping Units (SKUs)

[2] If an error is found, the order is returned to the pick line to be corrected.

outcome of this process. The time it takes for the worker to pick and pack the order, have it inspected and then sealed and removed to the delivery loading zone is the **time T** that it takes for the process to be completed.

Mapping the process is a useful tool to visualize the current order fulfillment process (Snow, 2019) (See diagrams below).

Figure 1: Schematic Diagram of Pick Pack Operations

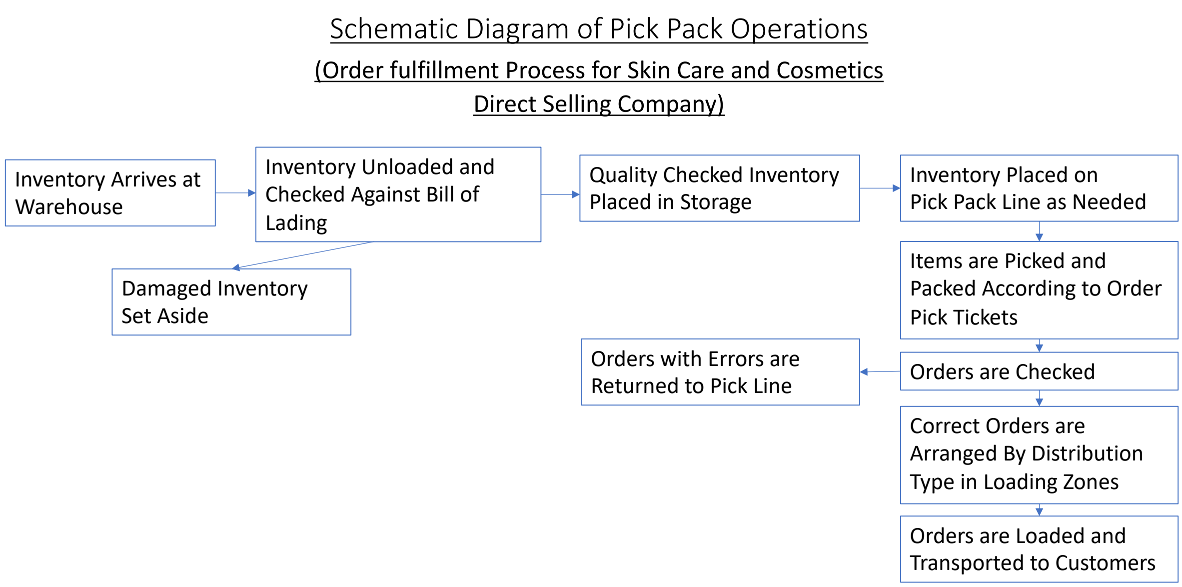


Figure 2: Picture of Pick Pack Line[3]

Picture of Pick Pack Line

View: Looking Straight at Line which is tilted horizontal shelves with roller bar conveyor belt in front similar to the line shown below *

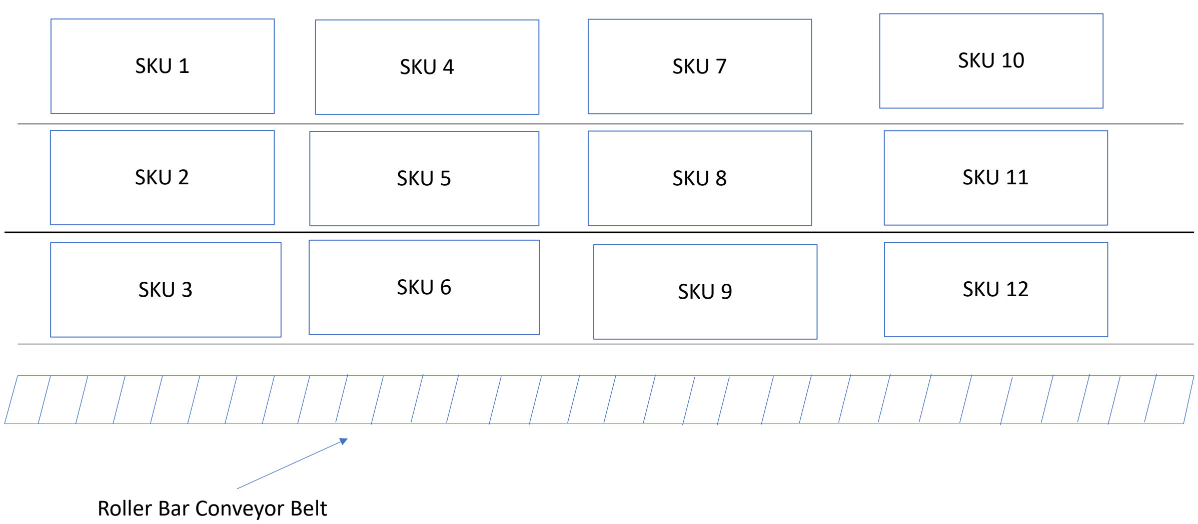
* This is actually a pick to light system – the system being described here looks like this but does not use pick to light.

Source: http://www.logisticsmart.net/knapp-pick-to-light

Figure 3: Schematic Diagram of Section of Pick Pack Line shown in Figure 2

Schematic Diagram of Section of Pick Pack Line

View: Looking Straight at Line which is tilted horizontal shelves with roller bar conveyor belt in front similar to the line shown in previous picture *



[3] Pick to Light is a system designed to improve picking and packing operation efficiency. According to 6 River Systems, a supplier of Pick to Light systems, “Pick to light is a type of order-fulfillment technology designed to improve picking accuracy and efficiency, while simultaneously lowering your labor costs. Notably, pick to light is paperless; it employs alphanumeric displays and buttons at storage locations, to guide your employees in light-aided manual picking, putting, sorting, and assembling.” (6 River Systems, 2019)

Because of political, economic and financial risk the company does not want to invest in capital equipment that would make warehouse operations more efficient. Therefore, we must make the process more efficient by reengineering the current manual processes and increasing the throughput per worker, in other words, by increasing labor productivity without the use of automation or investment into property, plant and equipment.

<u>Six Sigma</u>

The Six Sigma "DMAIC Framework" provides a road map for understanding and describing this process. The core concepts are: "everything is a process, every process has variation, every process can be measured, every process can be improved by reducing undesired variation." The desired outcome is "3.4 defects per million 'opportunities' in customer output" (Snow, 2019). The DMAIC Framework consists the following five steps: 1) **D**efining the goals of the improvement activity, 2) **M**easuring the existing system, 3) **A**nalyzing the system to eliminate the gap between the current performance and the desired goal, 4) **I**mproving the system and 5) **C**ontrolling the new system (Snow, 2019).[4]

In this process, the goals of the improvement activity (Point 1), are **defined** as improving labor productivity on the pick pack line while achieving no more than 3.4 errors per million (six sigma). To do this, I will **measure** the throughput of the existing system (Point 2). Then, in Part II, How to Improve It, I will conduct an **analysis** of the gap between the current system and the desired goal (Point 3), with a view towards **improving** the current system (Point 4). Once the improvements are made, I will continue to monitor throughput to **control** the system (Point 5).

[4] The bolded letters in **D**efine, **M**easure, **A**nalyze, **I**mprove and **C**ontrol make up the acronym DMAIC.

Measuring the Existing System

Below are a series of data, or Standard Process Metrics (Snow, 2019) that measure the productive capacity of the system both in physical output of orders and units (SKUs) and use of a key resource, labor, during time period T of the month of December. Standard Process Metrics (SPM) measure key performance indicators like Throughput Time (TPT), Output Rate (OR), Cycle Time (CT), Work in Progress (WIP) and Utilization (Snow, 2019). Here, output is also measured against sales to obtain an output to sales ratio.

Figure 4: Warehouse Employees

Russia Warehouse Staff Month	Manager	Supervisors	Staff	Temp	Whse Equivalent Total	Office Employees	Ratio Whse to Office	Total Equivalent Employees
December	1	2	12	7.34	18	98	18%	157

Figure 5: Units Processed Measurements

Units Sold Measurements	
Total Units Sold	
December	578,180
Average Units Per Order	
December	24
Average Units Per Warehouse Employee	
December	32,121
Average Units Per Total Employees	
December	3,683

Figure 6: Orders Processed Measurements

Orders Processed Measurements	
Number of Orders Processed	
December	19,129
Number of Orders Per Warehouse Employee	
December	1,062

Figure 7: Error Rates[5]

Error Rates

Orders

Number of Orders Processed	Number of Orders with Any Error	Percentage of Orders with Any Error	Rate of Orders with Any Error Expressed as %
19,129	57	0.003	0.3

Units

Number of Units Picked	Number of Wrong Units Picked	Percentage of Wrong Units Picked as Decimal	Rate of Wrong Units Picked as Percentage	Number of Wrong Units Picked Per Million	Current Sigma	Six Sigma Error Rate	Six Sigma Number of Wrong Units Picked Per Million	Difference
578,180	37	0.000063994	0.006399391	64	5.31	0.0000034	3.4	61

5 NOTE: For the error rate to be at six sigma, it would have to be 3.4 errors per one million possible chances to make an error. Any given order can have a varying amount of opportunities to make an error including wrong date, wrong address, wrong name, data entry error, etc. and depends on the number of units in the order. Orders with more units and information have more opportunities to make an error. In this case, we did not examine the rates and sources of all errors, just the errors in the rate of wrong units picked. In this case, errors involving picking the wrong unit, failing to include a unit or including a unit by mistake all contribute to the Rate of Wrong Units Picked. In order to be within the Six Sigma error rate, the error rate would have to be .0000034, not .000063994, or 3.4 wrong units per million and not 64. The current sigma is about 5.31, not 6. SEE APPENDIX 1: How to Calculate a Sigma Level

Figure 8: Cost of Sales Measurements

Cost of Sales Measurements

Average Sales per Unit Sold		
December	$4.34	
Average Cost per Unit Sold		COGS
December	$1.47	34%

Figure 9: Sales Ratio Measurements

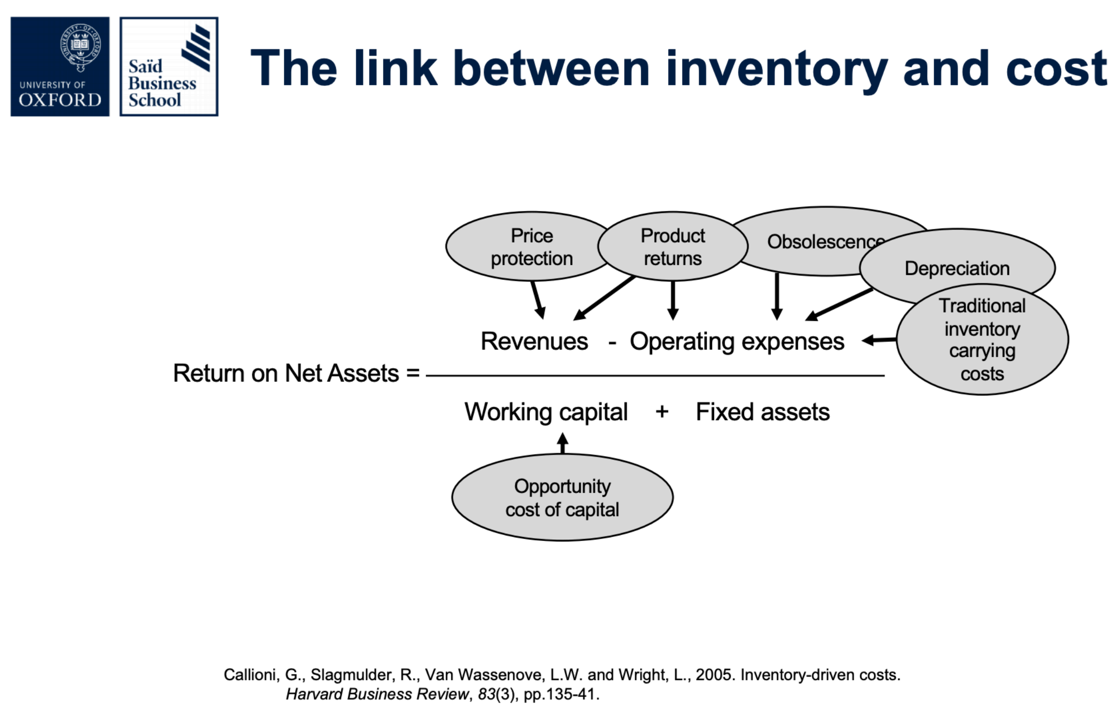
Sales Ratio Measurements

Total Net Sales	
December	$2,510,423
Total Net Sales Per Order (Average Order Size)	
December	$131
Net Sales Per Labor Dollar	
December	$8
Net Sales Per Employee	
December	$13,425
Net Sales per Warehouse Employee	
December	$139,468

Little’s Law

Because inventory on hand consists of invested capital (the money that was used to purchase the inventory), the more inventory that is on hand, the more capital that is tied up. Too much inventory decreases available working capital, places additional demands for more working capital and decreases profitability (Snow, 2019). (See Figure 10 Below).

Figure 10: The Link Between Inventory and Cost



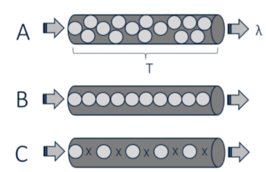
Little’s Law is an equation that provides a value for Work in Progress (WIP) that allows us to directly measure the amount of capital tied up in inventory WIP (Snow, 2019). (See Figure 11 Below).

Figure 11: Little's Law (Snow, 2019)

Little's law $N = \lambda * T$ (Little 1961)

In our terms: TPT * OR = WIP

(Throughput Time * Output Rate = Work-In-Process Inventory)



Little, J.D., 1961. A proof for the queuing formula: L= λ W. *Operations research*, *9*(3), pp.383-387.

TPT X OR = WIP

(Throughput Time X Output Rate = Work-in-Process Inventory)

Using the above metrics, we can insert values into the equation:

Output Rate = 578,180 units per month or 26,281 units per day based on 22 working days per month or 182.5 units per hour per worker based on 22 days of 8 hours per day per worker.

For Example:

22 days X 26,281 units per day = 578,182 per month[6]

Or

1 month X 578,178 processed in 1 month = 578,178 units per month

Or

[6] There are small differences in figures due to rounding errors

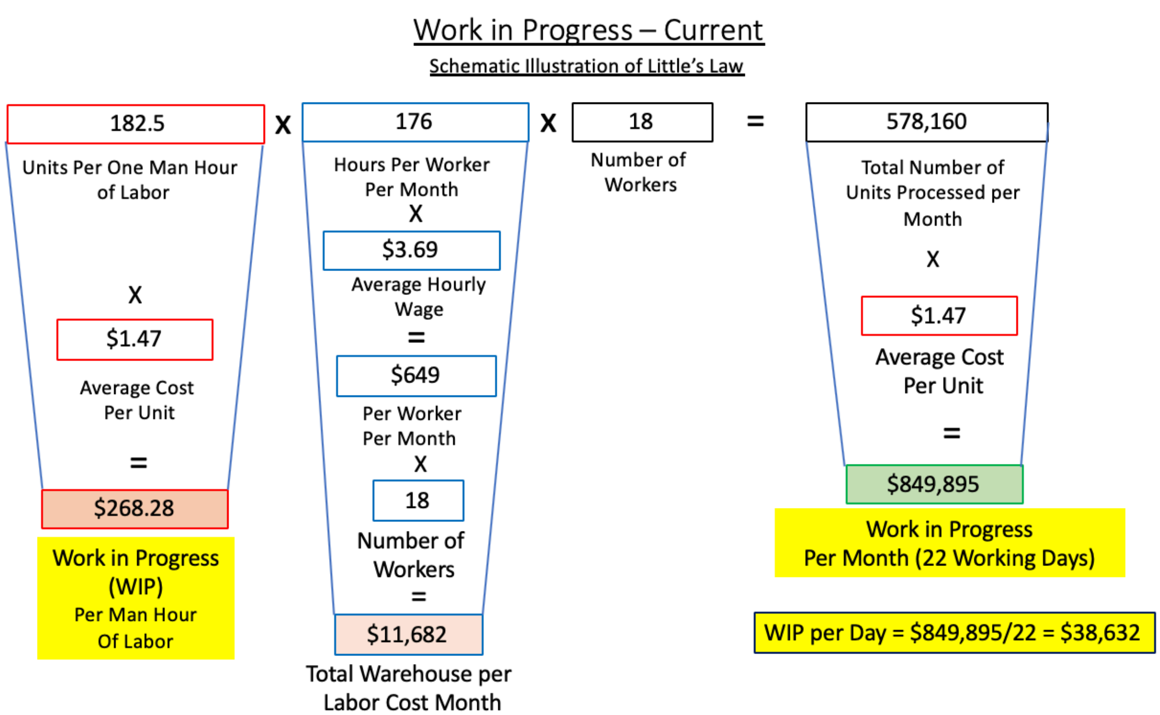
1 man hour X 182.5 units per man hour = 182.5 units per man hour of labor

We can also measure efficiency by the number of units processed per worker per month, in this case 578,178 / 18 = 32,121.1 units per worker per month. (See Figure 12 and 13 Below).

Figure 12: Key Productivity Measures

Man Hours of Labor Per Month (Total Labor)	3,168.0
Units Per Man Hours of Labor Per Month	182.5
Hours Worked per Worker per Month	176.0
Units per Worker per Month	32,121.1

Figure 13: Schematic Illustration of Work in Progress (WIP)



In this case, the goal is to reduce the WIP (or inventory) in the overall system by increasing throughput on the pickline. As we **increase** throughput or WIP on the pickline, inventory will move through the system at a faster rate, exiting sooner and reducing the overall amount of inventory or WIP in the system as a whole. This increase in inventory turnover reduces overall cost by having less capital tied up in inventory, as shown in Figure 10, it also improves customer service by reducing the order cycle time.[7] Improvements in customer service have a positive effect on revenue by increasing repeat customer purchases and attracting new customers. Additional benefits of reducing inventory will be discussed below.

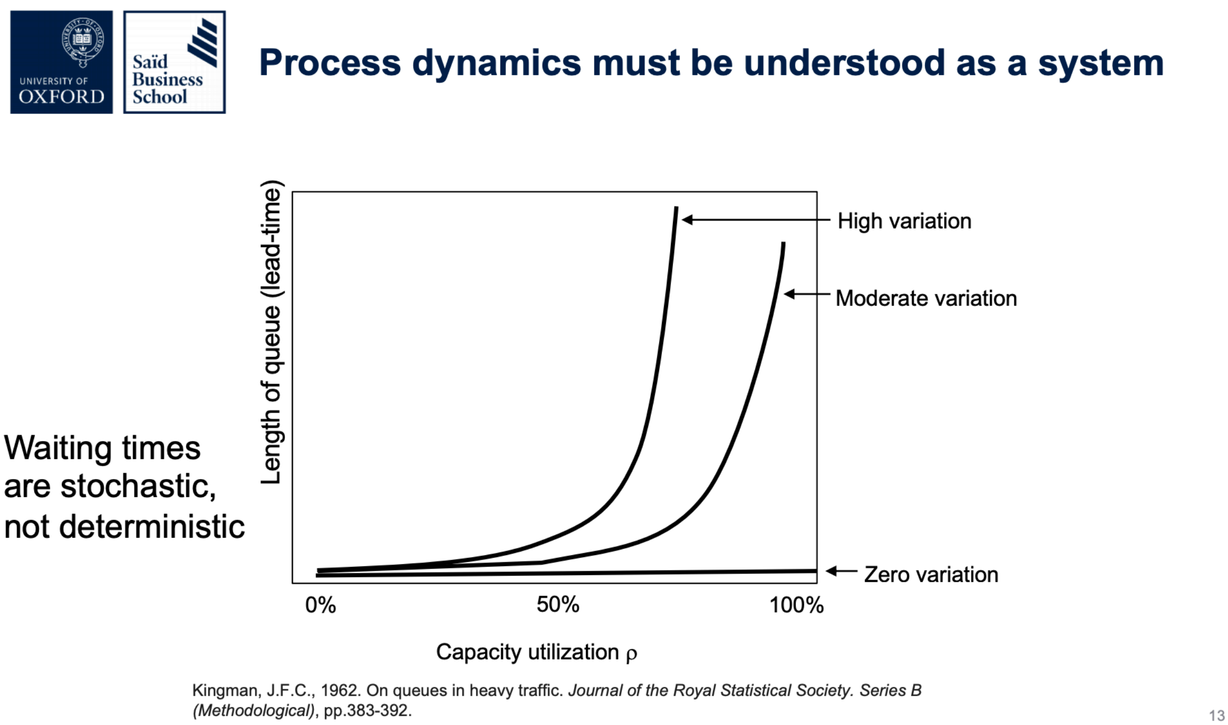
IV. How to Improve the Efficiency of the Current Pick Pack Operations Described Above

Objective

Reducing variance in the process of picking and packing orders will increase throughput, decrease capital tied up in inventory by increasing the rate at which inventory flows through the process and reduce operating expenses related to labor. As shown by Figure 14 below, the process must be understood as a system in which variation reduces capacity utilization (Snow, 2019).

[7] Order cycle time is the time it takes to process and fill and order and ship it to customers

Figure 14: Understanding Process Dynamics as a System



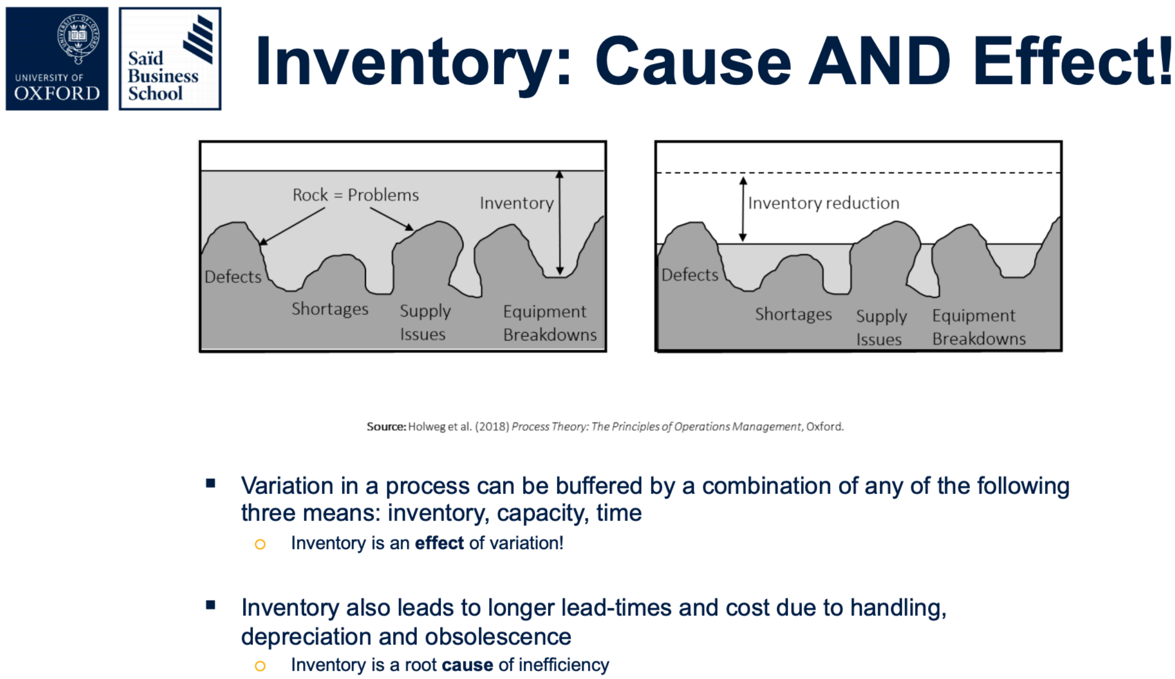
Reduced capacity utilization increases costs or conversely, increased capacity utilization reduces costs as the same throughput can be processed with the same or less use of inventory, capital and labor. Capacity is the ability of a system to produce throughput (Snow, 2019). Here, inventory can be defined as "an accumulation of a commodity that will be used to satisfy future demand" (Johnson and Montgomery as quoted by Snow (Snow, 2019)) as well as "the stocks or items used to support production" such as "raw materials and work-in-process items, supporting activities …such as maintenance, repair and operating supplies, and customer service (finished goods and spare parts) (APICS Dictionary as quoted by Snow (Snow, 2019)).

Producing more with less is the very definition of efficiency (Investopedia, 2019)[8] and increased productivity and efficiency improves profitability.

[8]Investopedia describes efficiency as "a level of performance that describes using the least amount of input to achieve the highest amount of output. Efficiency requires reducing the number of unnecessary resources used to produce a given output including personal time and energy. It is a measurable concept that can be determined using the ratio of useful output to total input. It minimizes the waste of resources such as physical materials, energy, and time while accomplishing the desired output" (Investopedia, 2019).

We can also view inventory as a symptom of a larger problem – a “substitute for information” (Michael Hammer, process reengineering guru as quoted by Snow (Snow, 2019)) or even as “dead material” (Taiichi Ohno, Father of the Toyota Production System as quoted by Snow (Snow, 2019)). Inventory simply covers up underlying causes of inefficiency in the system such as product defects, low supply levels and system breakdowns due to poorly trained workers or malfunctioning equipment. When these issues are masked by inventory, we are unable to see information that exposes the underlying root causes of the inefficiencies in the system as shown graphically in Figure 15 below.

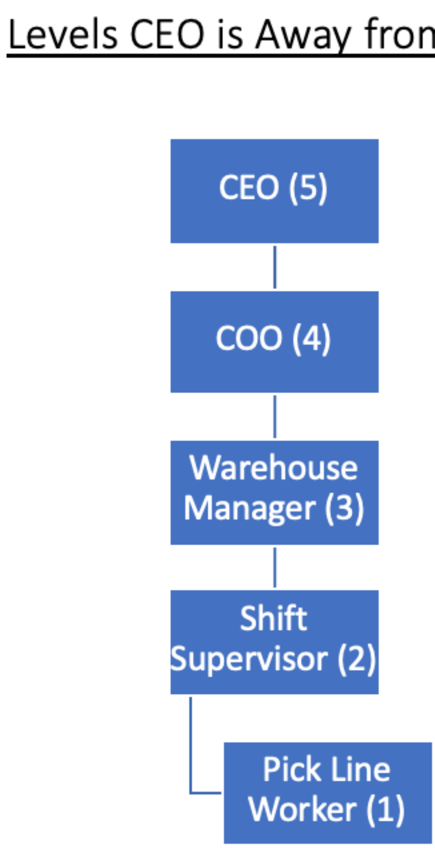
Figure 15: Inventory Cause and Effect



Gap Analysis

As the country head and line manager for this company (CEO), my goal is not only to increase revenue, but maximize profit. Squeezing cost and inefficiency out of operations and improving customer service is essential to this goal. As the CEO of the operation, I am five levels removed from the daily activities of the pick worker on the pick pack line (See Figure 16).

Figure 16: Levels CEO is Away from Pick Line



As such, I have no first hand hourly experience of the issues that workers and managers face on a daily basis. Also, I have no *a priori* knowledge of what the possible limits of efficiencies are that can be achieved given the current level of automation and training of the workers in the current system. I am aware however of the general principles of increasing operational efficiency discussed above and shown in Figure 17 below.

Figure 17: The Principles of Operations Management (Snow, 2019)

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The Principles of Operations Management

BOX 10.1 THE TEN PRINCIPLES OF OPERATIONS MANAGEMENT

Foundation principles

- **Principle #1**: All operations are composed of processes.
- **Principle #2**: Variation is inherent in all process inputs, tasks, and outputs.

Design principles

- **Principle #3**: Work-in-process is determined by throughput rate and throughput time.
- **Principle #4**: Complexity in process design amplifies managerial challenges.
- **Principle #5**: Process choice requires fit between the task and the external requirements.

Measurement principles

- **Principle #6**: No single measure can capture the performance of a process.
- **Principle #7**: Process metrics can drive unintended behavior.

Improvement principles

- **Principle #8**: Processes are improved by reductions in throughput time or in undesired variation.
- **Principle #9**: The rate of process improvement is subject to diminishing returns.
- **Principle #10**: Processes do not operate in isolation.

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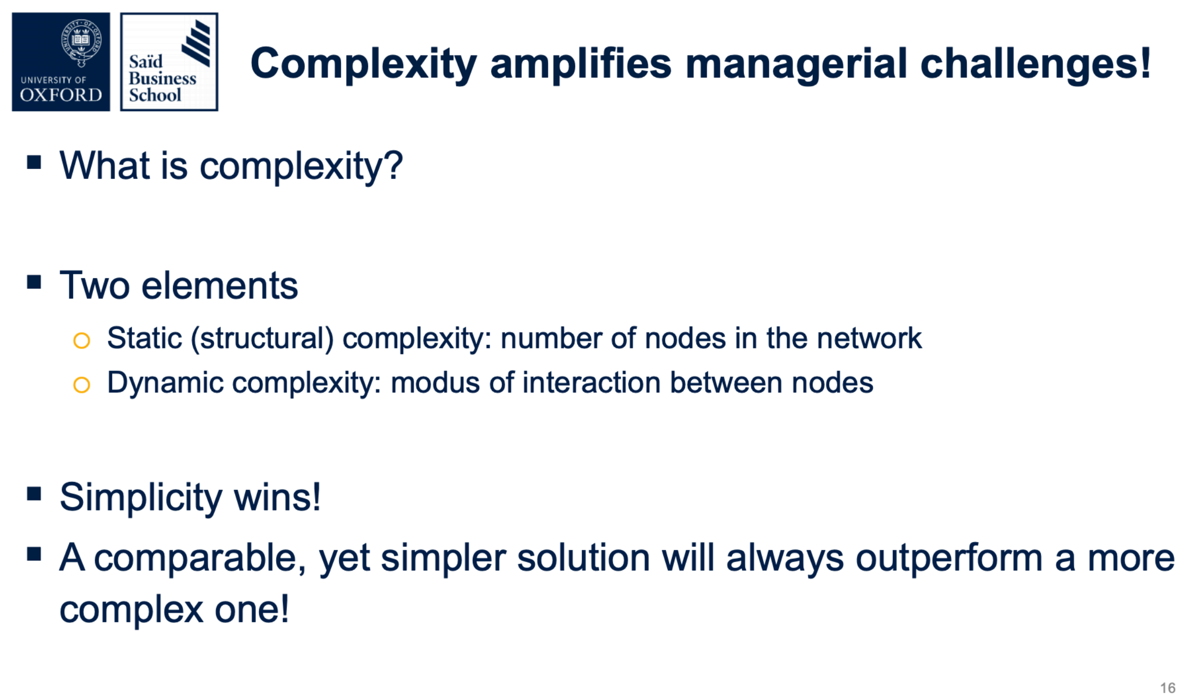
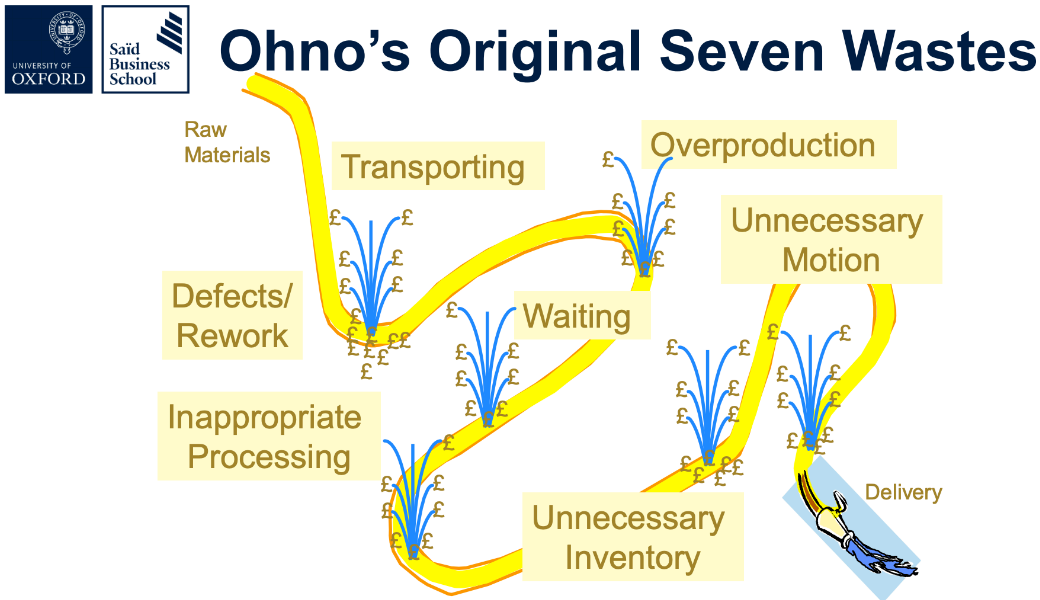
I also pay a lot of money to my COO and Warehouse Manager to add value to my operations. Therefore, my challenge to my Chief Operating Officer and my Warehouse Manager is to make the pick pack line more effective by increasing the throughput using the same or less resources while at the same time improving the error rate. One of the keys to doing this, as mentioned above is to reduce variability. Other key points are to analyze the system to find bottlenecks and other areas where errors and slowdowns are most the most prone to occur. A key principle is analyzing the system is to understand where it is complex and where and how it could be made more simple. As noted by Snow, complexity increases the difficulty of managing systems. In terms of efficiency, simplest is best. (See Figure 18).

Figure 18: Complexity Amplifies Managerial Challenges (Snow, 2019)



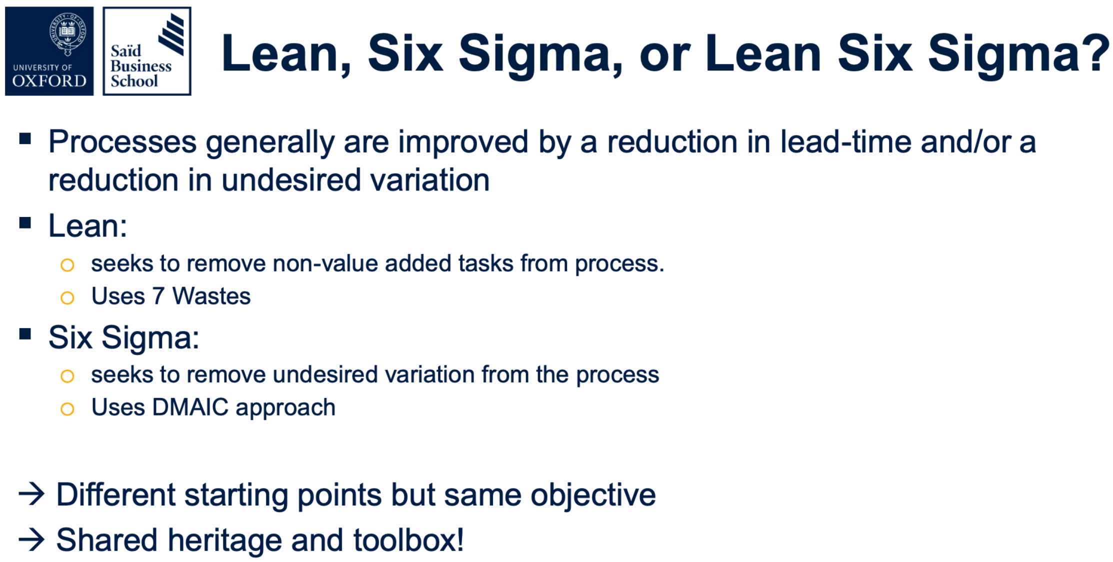
With this in mind, I would instruct them to examine the existing pick pack operations using a systems point of view to understand at each step of the way where there is unnecessary motion, waiting, processing, inventory and other wastes as per Ohno's concept of the "Original Seven Wastes as show in Figure 19 below.

Figure 19: Ohno's Original Seven Wastes (Snow, 2019)



I would advise them not only to look for waste in the areas of the Original Seven Wastes but also to use the Six Sigma DMAIC approach outlined above and in Figure 20 below to "**D**efine, **M**easure, **A**nalyze, **I**mprove and **C**ontrol" all changes made to the system so that all increases to productivity and reductions in waste are quantified. I would also advise them to use the principles of Lean Six Sigma shown in Figure 20 below.

Figure 20: Lean, Six Sigma or Lean Six Sigma (Snow, 2019)

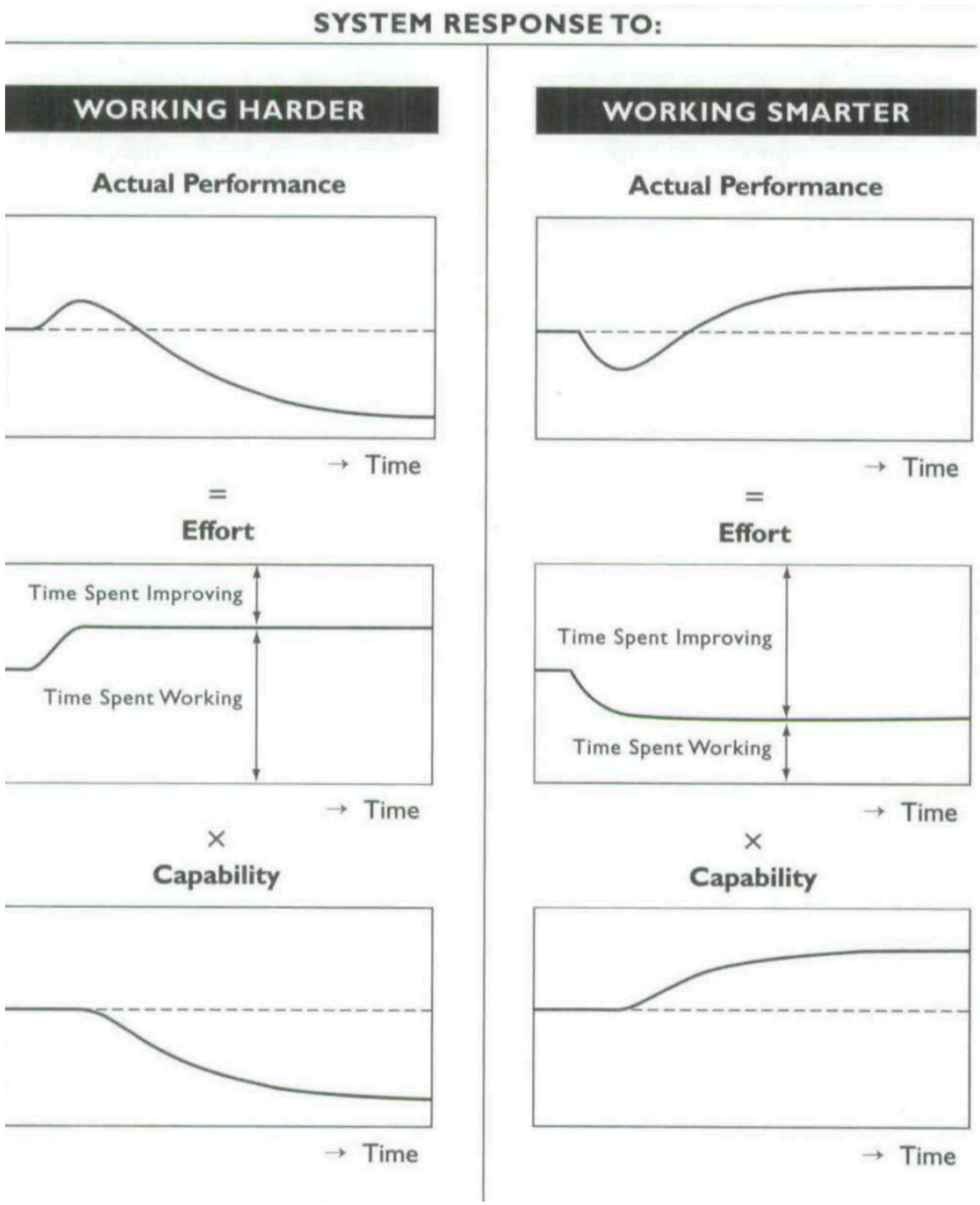


Being aware of falling into the trap of always doing what is "urgent" rather than what is "important," called by Nelson and Repenning falling into the "work harder" rather than "work smarter" or the "capability trap," I would give them time to do root cause analysis of inefficiencies in the system and try different methods of improvement before demanding to see any throughput improvements. In other words, it would be up to them to tell me when they are finished with their process reengineering and then to present me with the results of how the process capability has been improved using the Standard Process Metrics (SPMs) and KPIs shown in Part I.

In the interim, I would expect that output might fall as investments are made into "working smarter" versus "working harder" (Repenning & Sterman, 2001).[9] (See Figure 21 Below).

[9] Working smarter means investing time in doing what is important – that is, improving the capability of the system which will produce a virtuous cycle of improvement and long term capacity increases versus simply working harder which can produce short term capacity improvements due to increased work but which eventually leads to decline in long term capacity as worker burnout occurs and critical maintenance and other improvements are foregone in favor of short term gains (Repenning & Sterman, 2001).

Figure 21: Simulations of the Working Harder and Working Smarter Strategies (Repenning & Sterman, 2001)



I would expect monthly updates on progress even if the update is simply "we are still working on it" but would expect to have discussions on what aspects of the system were being worked on and what the expected outcome would be as quantified by SPMs and KPIs. The improvement process itself would also be subject to analysis and adjustment to make sure it is going in the right direction.

Further, in keeping with the principles of the Toyota Production System (TPS), I would use the Four Rules to push the root cause analysis and subsequent improvements down to the lowest possible level in the organization (Spear & Bowen, 1999) in this case, to the level of the pick line worker (See Figure 16 Above: Levels the CEO is Away from the Pick Line and Figure 22 Below).

Figure 22: The Four Rules of the Toyota Production System (TPS) (Spear & Bowen, 1999)

The Four Rules

The tacit knowledge that underlies the Toyota Production System can be captured in four basic rules. These rules guide the design, operation, and improvement of every activity, connection, and pathway for every product and service. The rules are as follows:

Rule 1: All work shall be highly specified as to content, sequence, timing, and outcome.

Rule 2: Every customer-supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses.

Rule 3: The pathway for every product and service must be simple and direct.

Rule 4: Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization.

All the rules require that activities, connections, and flow paths have built-in tests to signal problems automatically. It is the continual response to problems that makes this seemingly rigid system so flexible and adaptable to changing circumstances.

I would bring in executives with knowledge of improving pick pack operations from our headquarter operations in the US to guide the team in asking themselves the following four questions from Figure 23 below: How do you do this work? How do you know you are doing this work correctly? How do you know the outcome is free of defects? What do you do if you have a problem?

Figure 23: How Toyota's Workers Learn the Rules (Repenning & Sterman, 2001)

How Toyota's Workers Learn the Rules

If the rules of the Toyota Production System aren't explicit, how are they transmitted? Toyota's managers don't tell workers and supervisors specifically how to do their work. Rather, they use a teaching and learning approach that allows their workers to discover the rules as a consequence of solving problems. For example, the supervisor teaching a person the principles of the first rule will come to the work site and, while the person is doing his or her job, ask a series of questions:

- How do you do this work?
- How do you know you are doing this work correctly?
- How do you know that the outcome is free of defects?
- What do you do if you have a problem?

This continuing process gives the person increasingly deeper insights into his or her own specific work. From many experiences of this sort, the person gradually learns to generalize how to design all activities according to the principles embodied in rule 1.

All the rules are taught in a similar Socratic fashion of iterative questioning and problem solving. Although this method is particularly effective for teaching, it leads to knowledge that is implicit. Consequently, the Toyota Production System has so far been transferred successfully only when managers have been able and willing to engage in a similar process of questioning to facilitate learning by doing.

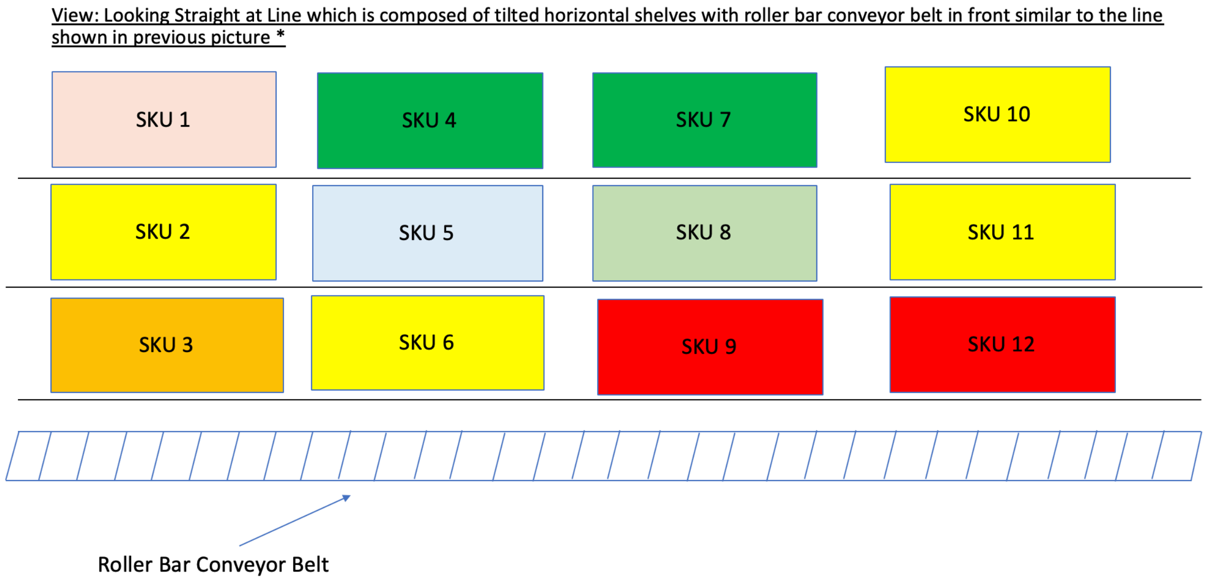
Examples of Reducing Waste and Increasing Efficiency in the Picking Line

Since the pick pack operation was originally set up under my supervision and I have a good understanding of the process, I would have my team look at the frequency rate of the SKUs that are picked, making sure that the most frequently picked items are the easiest to reach while those that are picked less frequently occupy the harder to reach higher shelves. By placing the most frequently picked items within easy reach, waste related to unnecessary motion could be reduced as less motion is required to pick an object within easy reach than one that is farther away.

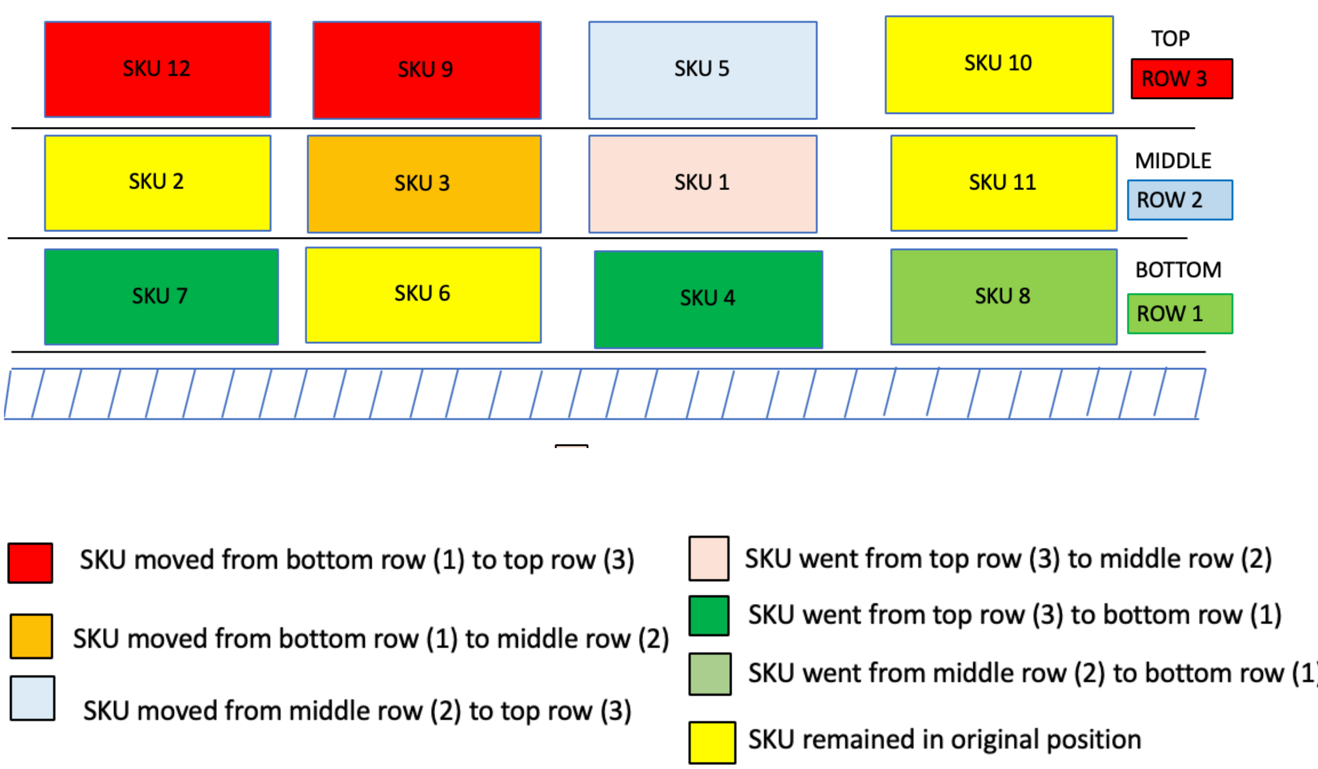
For example, going back to our schematic diagram of the pick line in Figure 3 above, the rearranged placement of the SKUs might look like this (See Figure 24 Below):

Figure 24: Schematic Diagram of Section of Pick Pack Line **Before** and **After** Being Adjusted for Frequency

Schematic Diagram of Section of Pick Pack Line **Before** Being Adjusted for Frequency



Schematic Diagram of Section of Pick Pack Line **After** Being Adjusted For Frequency



In the adjusted line, the most frequently picked SKUS, items 7, 6, 4 and 8 are placed at waist height in the bottom row to make them accessible with the least amount of effort and motion while SKUs 3 and 1, which are picked less often, have been placed on the middle row and SKUs 5, 9 and 12 which are picked the least often have been placed on the furthest top row respectively.

The SKUs in red indicate least frequently picked SKUs (9 and 12) which occupied the most easily accessible row, Row 1, which have now been moved to the least easily accessible row, Row 3. Conversely, the SKUs in dark green indicate the most frequently picked SKUs (4 and 7) which occupied the least easily accessible row, Row 3, which have now been moved to the most easily accessible row, Row 1.

The dark green color indicates that moving these SKUs will have the most effect in removing excess or wasted motion. The motion saved by moving the positions of these SKUs can be calculated by multiplying the frequency with which these SKUs are picked by the length of the movement and the time needed to reach them.

For example, the distance to Row 3 is 36 inches but only 12 inches to Row 1. Therefore, 24 inches will be saved every time SKU 7 is picked (36 – 12 = 24). Similarly, if it takes 3 seconds to pick a SKU from Row 3 but only 1 second to pick a SKU from Row 1, then 2 seconds will be saved every time SKU 7 is picked (3 – 1 = 2). If SKU 7 represents 16% of all SKUs picked, then by moving SKU 7, the following savings can be achieved (See Figure 25 Below):

Figure 25: Time and Distance Savings Achieved by Adjusting the Position of SKU 7

Savings for Adjusted Position for SKU 7

SKUs Picked Per Day	Frequency of SKU 7 of All SKUs Picked	Number of Times SKU 7 is Picked Per Day	Inches of Movement Saved Per Pick	Total Inches Of Movement Saved per Day	Total Number Of Feet Saved Per Day	Feet Saved Per Month*	**Miles of Movement Saved Per Month**
26,281	0.16	4,205	24	100,919	8,410	185,018	**35**

Time Saved Per Pick in Seconds	Time Saved Per Day in Seconds	Time Saved Per Month in Seconds	Time Saved Per Month in Minutes	Hours Saved Per Month	Average Hourly Wage Rate	**Wages Saved Per Month**
2	8,410	185,018	3,084	51	$3.69	**$190**

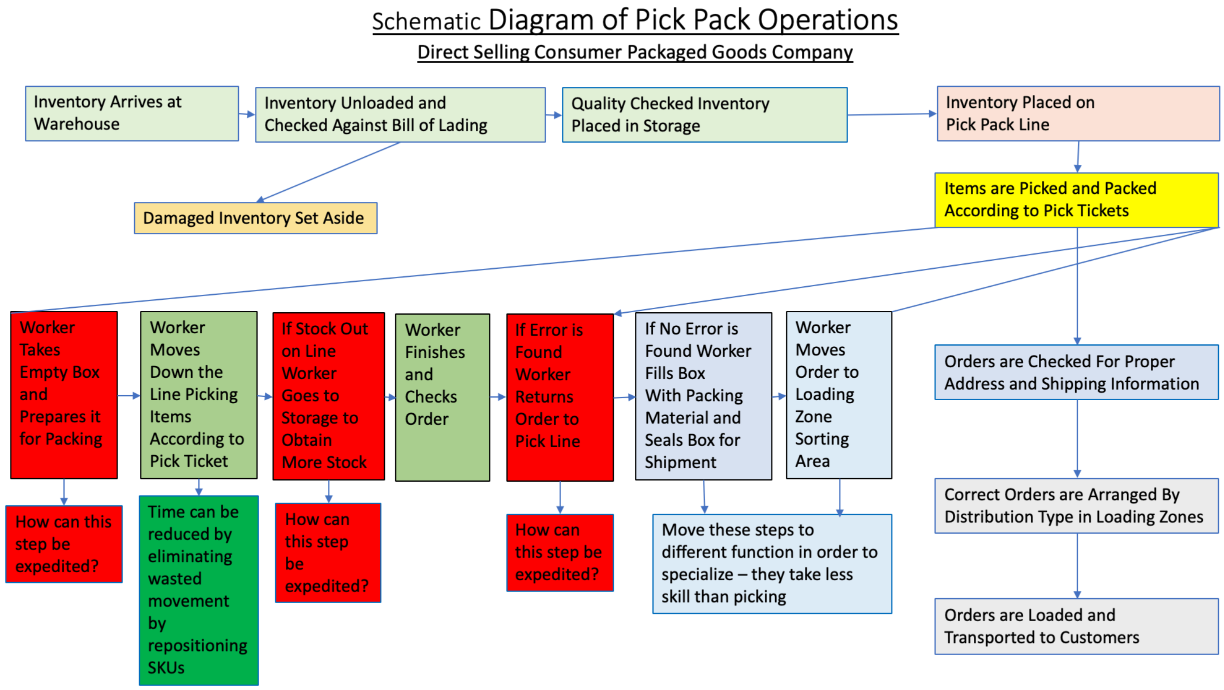
*22 working days in month

Repeating this process for every one of approximately 1,200 SKUs will add up to substantial time, movement and wage savings.[10]

Looking back at our process map in Figure 1, I would advise the team to reexamine the process and look for bottlenecks and ways to expedite functions and reduce variation at the process points marked in red and move steps marked in light blue to other functions (See Figure 26 below).

[10] As noted in Figure 13, the monthly cost of warehouse labor is $11,682. If $190 dollars per month can be saved for just 6 SKUs, then warehouse labor costs can be cut by almost 10%.

Figure 26: Reexamine Pick Pack Process for Bottlenecks and Opportunities to Expedite Steps at Boxes Marked in Red



The time and movement savings achieved by reducing waste in defects/rework, transporting inventory to the pick line, inappropriate processing, waiting for inventory replenishment and unnecessary motion (Figure 19) should be measured in a similar fashion to the reduced movement and time achieved by repositioning SKUs by order of their pick frequency in the pick line. Ultimately, as waste is reduced and the process becomes lean, throughput will increase, costs will go down and more will be produced with less.[11] Not only will cost be reduced, but customer service times will be improved leading to improved customer retention, acquisition and sales. Continuous monitoring of the SPMs and KPIs will insure quality control and provide a basis for continuous process improvement, the final step of our DMAIC and Lean Six Sigma framework.

[11] In fact, this is what happened.

Appendix One: How to Calculate a Sigma Level and Yield to Sigma Conversion Table

How to calculate a sigma level?

Step 1: Calculate the DPMO

First we calculate Defects Per Million Opportunities (DPMO) and based on that a Sigma is decided from a predefined table:

$$\text{DPMO} = \frac{\text{Number of defects observed}}{\text{Number of units produced}} \times 1{,}000{,}000$$

Where:

- Number for defects is total number of defects found;
- Number of units is the number of units produced;

Step 2: Covert DPMO into a Sigma Level

- Use the conversion table

Cave: A 1.5 Sigma Shift ("Process Walk") process should be considered in most cases, as short-term measurement data is used to predict long-term performance of the process

In our case we had 37 wrong units (wrong SKU, missing SKU or additional not ordered SKU) out of 578,180 units. Inserting the values into the above equation yields 37/578,180 or .000063994. Multiply by 1,000,000 to get 64. Use the below table to look up the sigma level associated with this defect rate. The closest value is 70, with a yield of 99.9930 or sigma of 5.31.

Yield to Sigma Conversion Table

Yield %	Sigma (1.5 Sigma process walk considered)	Defects Per Million Opportunities
99.9997	6.00	3.4
99.9995	5.92	5
99.9992	5.81	8
99.9990	5.76	10
99.9980	5.61	20
99.9970	5.51	30
99.9960	5.44	40
99.9930	5.31	70
99.9900	5.22	100
99.9850	5.12	150
99.9770	5.00	230
99.9670	4.91	330
99.9520	4.80	480
99.9320	4.70	680
99.9040	4.60	960
99.8650	4.50	1,350
99.8140	4.40	1,860
99.7450	4.30	2,550
99.6540	4.20	3,460
99.5340	4.10	4,660
99.3790	4.00	6,210
99.1810	3.90	8,190
98.9300	3.80	10,700
98.6100	3.70	13,900
98.2200	3.60	17,800
97.7300	3.50	22,700
97.1300	3.40	28,700
96.4100	3.30	35,900
95.5400	3.20	44,600
94.5200	3.10	54,800
93.3200	3.00	66,800
91.9200	2.90	80,800
90.3200	2.80	96,800
88.5000	2.70	115,000
86.5000	2.60	135,000
84.2000	2.50	158,000
81.6000	2.40	184,000
78.8000	2.30	212,000
75.8000	2.20	242,000
72.6000	2.10	274,000
69.2000	2.00	308,000
65.6000	1.90	344,000
61.8000	1.80	382,000
58.0000	1.70	420,000
54.0000	1.60	460,000
50.0000	1.50	500,000
46.0000	1.40	540,000
43.0000	1.32	570,000
39.0000	1.22	610,000
35.0000	1.11	650,000
31.0000	1.00	690,000

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