Wyrick Enterprises

Lean and Six Sigma® Integration Specialists
It's all about Time • Quality • Results

Lean Sigma Integration Simulation

LEAN SIGMA INTEGRATION SIMULATION

Creates an understanding of how ALL the pieces of Lean/Sigma fit together to increase flow, reduce costs and generate revenue plus the order that they should be integrated into the change process.

The simulation covers the following:

- ✓ Focused layouts (Cell design)
- ✓ 5s and visual management of inventory
- ✓ Inventory control
- ✓ Supplier control
- ✓ Overtime – how to use it effectively
- ✓ Increased yield potential
- ✓ Reduced variation in the processes
- ✓ Kanban systems in a pull environment
- ✓ Pull systems and their effectiveness over push
- ✓ Reduction of inventory

The simulation is run on a module by module basis and each module is compared to a forecast built at the beginning. Through this process it is proven graphically that Lean/Sigma is much more effective overall than any other operating process.

LEAN SIGMA INTEGRATION SIMULATION - SCORING CHART

All Cells In Blue Need Will Be Populated During The Simulation

				OT Option	Bottleneck Mid-Proc.	Lock Step Supplier	Material Moved During Shift	Reduced Variation, During Shift Movement	Reduced Inventory, During Shift Movement	Reduced Inventory, During Shift Movement	Reduced Inventory, During Shift Movement OT Option	Summary
		Full Container	Container Size = 1	Container Size = 1	Container Size = 1	Container Size = 1	Container Size = 1	Container Size = 1	Container Size = 1	Container Size = 1	Container Size = 1	Container Size = 1
Number of Process Operations With Supplier	12	Starting Inv. = 4	Starting Inv. = 4	Starting Inv. = 4	Starting Inv. = 4	Starting Inv. = 4	Starting Inv. = 4	Starting Inv. = 4	Starting Inv. = 2	Starting Inv. = 1	Starting Inv. = 1	Starting Inv. = 1
	Forecast	1	2	3	4	5	6	7	8	9	10	11
Thruput	70	36	52	70	65	66	62	61	62	56	70	70
Material Cost	364	187	270	364	338	343	322	317	322	291	364	364
Individual Mat. Unit Cost	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Labor	240	240	240	280.5	240	240	240	240	240	240	302.5	247.5
Work In Proc. (Inventory)	44	60	69	45	86	34	58	49	29	25	18	11
Overhead	80.0	80.0	80.0	93.5	140.0	140.0	80.0	80.0	80.0	80.0	100.8	82.5
Total Cost	728.0	567.2	659.4	783.0	804.0	757.2	700.4	686.2	671.4	636.2	785.3	705.0
Unit Cost	10.4	15.8	12.7	11.2	12.4	11.5	11.3	11.2	10.8	11.4	11.2	**10.1**
Lead Time	13	20	17	13	13	13	16	13	7	3	4	4

LEAN SIGMA INTEGRATION SIMULATION – FORECAST MODULE

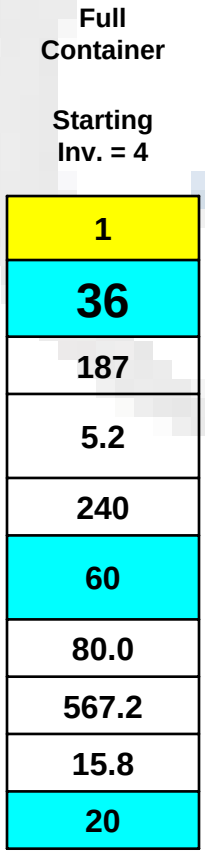
Number of Process Operations With Supplier	12
	Forecast
Thruput	70
Material Cost	364
Individual Mat. Unit Cost	5.2
Labor	240
Work In Proc. (Inventory)	44
Overhead	80.0
Total Cost	728.0
Unit Cost	10.4
Lead Time	13

The beginning of the simulation sets up the forecast for the remaining modules. In the forecast we use standard and accepted general accounting numbers to derive operating costs that we must perform to (Forecast).

All of the other eleven modules will be compared to this module to determine if the strategies utilized are effective or not.

During this module we establish a selling price in order to check profits against the cost of making the units.

LEAN SIGMA INTEGRATION SIMULATION – MODULE ONE



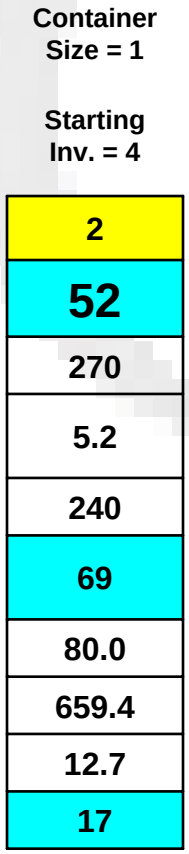
In Module One we put two constraints on the system, one is shipping full containers (Batching) and two is layout of the operations. This module starts out with four chips and one die.

During the module it is clearly shown the amount of movement due to a non-focused layout and the amount of time that is required to deal with it.

This module also shows how thruput is impacted by having a batching constraint placed upon the system.

The end result of this module is the attendee can see the impact these constraints place upon the system and the financial outcomes of the system.

LEAN SIGMA INTEGRATION SIMULATION – MODULE TWO



In Module Two we remove the constraints of full containers and un-focused layout. We start out with the same four chips and one die.

This module simulates one piece flow within a focused layout and the attendee can see how material flows within this process as we compare Module Two to Module One.

At the end of the module we can once again show graphically the improvement that occurs in productivity through one piece flow and a reduction in movement because of layout issues.

This module moves the attendee closer to the forecast but it is not achieved yet.

LEAN SIGMA INTEGRATION SIMULATION – MODULE THREE

OT Option

Container Size = 1

Starting Inv. = 4

3
70
364
5.2
280.5
45
93.5
783.0
11.2
13

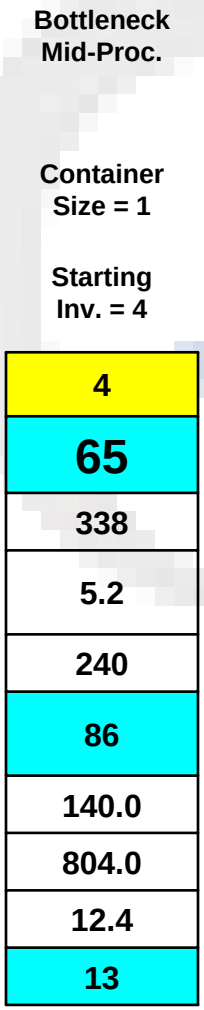
In Module Three begin the module with the same four chips and one die.

This module is exactly like the second module with the exception of adding overtime to achieve scheduled delivery.

During this module we give the attendee a scheduled production chart that will ultimately help them achieve their set goal of 70 units thruput.

After this module is finished we can graphically show that overtime is a tool to be used, but not abused.

LEAN SIGMA INTEGRATION SIMULATION – MODULE FOUR

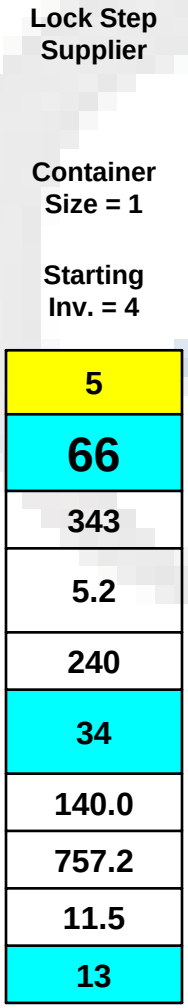


In Module Four we begin the module with the same four chips, but we have added dice in different amounts at the beginning and end of the process, thus creating a bottleneck in the center.

We remove the overtime option and instruct the class to watch what happens to stock levels.

At the end of this module the attendee can graphically see how a bottleneck can impact the overall process and thus the operating costs. We also talk about effective strategies to reduce the impact of bottlenecks in the process.

LEAN SIGMA INTEGRATION SIMULATION – MODULE FIVE

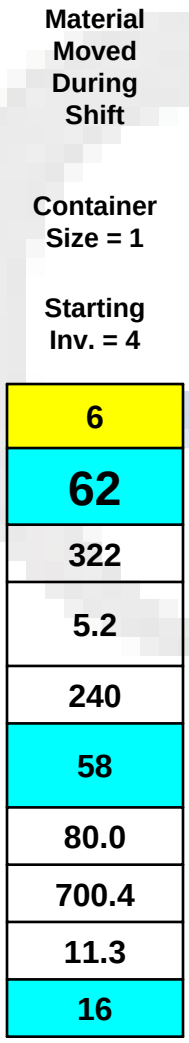


In Module Five we begin the module with the same four chips but now we have added a new strategy to reduce inventory – a lockstep supplier.

During this module the supplier is ordered to only introduce the amount of chips that the bottleneck actually processes. The goal is to reduce inventory.

At the end of the module you can see an improvement in the inventory levels, but you also see that thruput is severely hampered. The secondary learning is this is the first module that shows a push/pull system.

LEAN SIGMA INTEGRATION SIMULATION – MODULE SIX

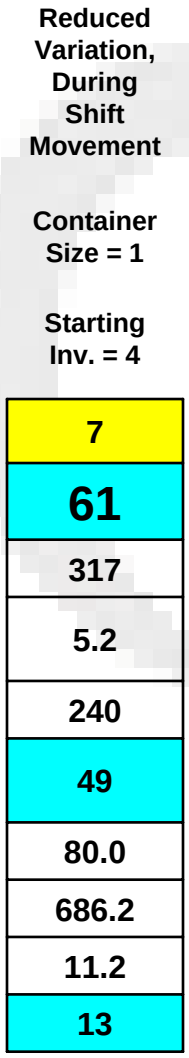


In Module Six we begin the module with the same four chips and one die but now we have added a strategy improve product movement – DURING SHIFT SHIPPING.

During this module we see how the process is improved once we go to multiple shipments during the day.

This module simulates a Kanban system and how it would impact the process overall.

LEAN SIGMA INTEGRATION SIMULATION – MODULE SEVEN



In Module Seven we now see how Six Sigma fits into the improvement process overall. In this module we still start with four chips and one die.

We use alternate dice to simulate improving the process and removing the radical shifts of production and show how smooth production in amounts closer to the average, rather than large swings of variation can help the process overall and what the impact would be on thruput and cost.

This module graphically shows how removing the defects can make your process highly productive, stable and consistent in it's output.

LEAN SIGMA INTEGRATION SIMULATION – MODULE EIGHT & NINE

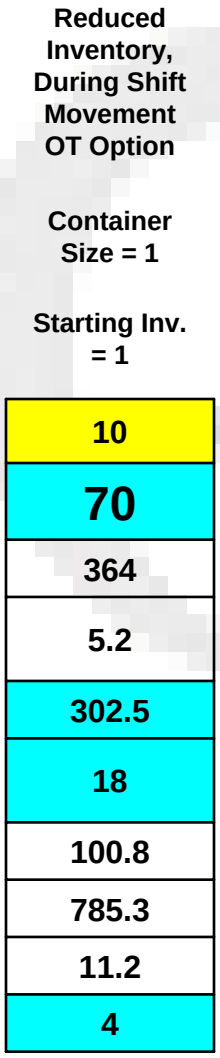
Reduced Inventory, During Shift Movement	Reduced Inventory, During Shift Movement
Container Size = 1	Container Size = 1
Starting Inv. = 2	Starting Inv. = 1
8	9
62	56
322	291
5.2	5.2
240	240
29	25
80.0	80.0
671.4	636.2
10.8	11.4
7	3

In Module Eight and Nine attack lead time.

We continue to use the reduced variation dice but now have unilaterally cut starting inventory by half, then half again, until they are only starting with one chip.

This process clearly shows how Kanban systems along with reductions in inventory work, but it does not deliver and so thruput is impacted. We can show as inventory goes down unit cost goes up.

LEAN SIGMA INTEGRATION SIMULATION – MODULE TEN

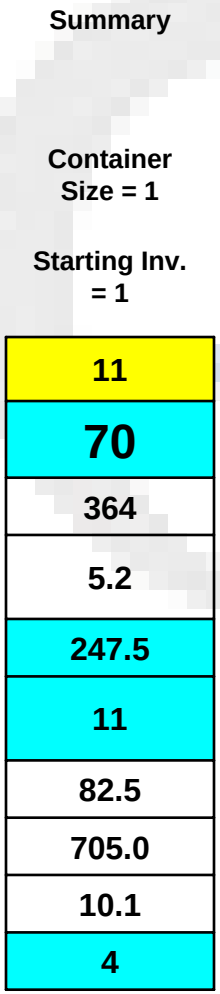


In Module Ten we continue our journey to reduce lead time and thus inventory, since they are connected.

We continue to use the reduced variation dice but now have added the overtime option back into the equation to achieve delivery.

With this combination of factors the attendee can clearly see the impact that these strategies have on the bottom line.

LEAN SIGMA INTEGRATION SIMULATION – MODULE ELEVEN



In Module Eleven we give the class of setting up all the different impacting strategies. This gives everyone a chance to review what they have learned.

The strategies we go over are: Batch sizes, starting inventory, type of dice, overtime options, material movement, consistent suppliers and increased yield potential. All with the end goal of beating the forecast.

Simulation Learning Objectives:

- Create a process picture of the before and after implementation of Lean Sigma Tools
- Introduce concept of Lean Sigma Integration as a business strategy
- Demonstrate the use of tools for reducing inventory, waste, and cycle time of all business processes.
- Lean Sigma tools are one of the most effective strategies for improvement by World-Class Organizations.

Simulation Key Points:

- Strives to eliminate waste through continuous improvement of processes
- Ideally, no waiting time between steps in a process
- Product is continually being worked on, increasing its value to the customer
- Reducing variation increases yield and quality
- Lean Sigma impacts two key measures of all processes:
  - Effectiveness – A quality based measurement (defects/errors)
  - Efficiency – A time based measurement (cycle time/speed)