Wyrick Enterprises

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

Online-Lean Sigma Integration Simulation

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LEAN SIGMA INTEGRATION SIMULATION

Have you *been-there-done-that* with simulations that pay more attention to building the product than explaining the application of tools to the process? Have you left a simulation feeling like you had a fun time but wondered about what you learned? ***WE*** have developed a simulation that helps you understand how, when, why and where to apply the Lean Sigma tools within the process and system.

Our Lean Sigma Integration Simulation will teach you how to implement the tools necessary to create flow and reduce variation in the service, administration, or manufacturing environment. ***WE*** will take you through eleven modules that will systematically introduce the Lean Sigma tools one-at-a-time. ***WE*** will apply a couple of different tools to each module to show you their impact on the process and compare it back to previous modules for purposes of measuring improvements. By module eleven ***WE*** will integrate all the concepts and tools taught in the previous modules to show you the power of Lean Sigma synergy.

WE will demonstrate how **"cherry picking low hanging fruit"** from your improvement opportunities will only create islands of isolated efficiencies that often cannot be sustained. By integrating improvements Enterprise wide in a strategic process, all business functions will be able to support and sustain the changes deployed. The **paradigm shift question** is: *"If you improve one process in the value stream, can up-stream processes support it, and can down-stream processes keep up with it?*

LEAN SIGMA INTEGRATION SIMULATION

Many organizations want to know which to implement first; Lean or Six Sigma. An understanding of their distinction is helpful:

- **Lean** eliminates waste (non-value activities) from the process to create flow.
- **Six Sigma** reduces variation in the process (usually within the value-added activities) and builds in repeatability.

When you look at your business' Enterprise System (Suppliers, Internal Units/Functions and Customers) a*re all your processes and procedures linked as effectively and efficiently as possible?* If they are not, then you have three opportunities for improvement. Lean, Six Sigma or an integration of the two tool sets (**Lean Sigma**).

When you lean-out the system through the elimination of waste, the ***SIMPLER*** your processes become, the ***SMOOTHER*** workflows through your value streams and the ***SHORTER*** your lead-times become for your customers. However, if your processes are still unstable you are only producing a defective product/service faster. You will need to deploy Six Sigma tools to get your processes in control. Remember that the process always helps identify which tool set to use and when you can integrate them.

COST, SCHEDULE, QUALITY, PROFIT and **GROWTH** are major concerns in most organizations. In fact, many businesses waste 70%-90% of available resources through improper management of material, time, information, people, equipment, inventory, and improvement tools. Whatever the industry, speed is critical to your business:

Beating your competition to market, effectively processing new orders, providing quality products/services, and delivering on time while operating at maximum efficiency and minimal cost.

LEAN TYPICAL RESULTS:

- **Inventory cut by 80%**
- **Product lead-time reduced from weeks to days**
- **Defects decreased by 50% or more**
- **Productivity increased 25-50%**
- **Floor space reduced 25-50%**

SIX SIGMA TYPICAL RESULTS:

- **Backlog cut by 90% or more**
- **Cycle time dropped from weeks to days**
- **Productivity increased 25-50%**
- **Customer service levels increased to 95-99%**
- **Lead times cut from days to hours**

LEAN SIGMA INTEGRATION SIMULATION

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)

WE Will Look at Measures That Count

TIME

Throughput	TAKT Time	Cycle Time	Lead Time	Distance/space

QUALITY

Process Capability	Process Repeatability

INVENTORY

Turns	Levels	Accuracy

Some Lessons You Will Experience

- By simply cutting inventory without a plan the result can even be worse than the current situation.
- By increasing the yield potential, the product flows smoother than ever.
- By planning and using overtime to control throughput the production goal can be achieved with even less overtime than you might expect.
- Controlling the supplier reduces WIP (Work-In-Process) in the process and can increase yield potential.
- A reduction in WIP reduces unit cost.
- Functional layout causes excessive movement, which is a waste of time and builds up large batches of WIP and inventory.
- Focused layout and/or cell design reduces movement, time, and the amount of WIP in the process.
- Increased yield potential cuts down on overtime usage.
- Indiscriminate change can be bad for the process.
- Inventory and lead-time are directly connected.
- Reduction in variation increases throughput.
- Overtime is neither good nor bad just how it is used.
- Push systems are created before the bottleneck and pull systems are implemented after the bottleneck.
- Waiting for large batches causes shortages in the process.
- Shipping whatever is produced to the next operation eliminates shortages.
- With a reduction in variation within the process product flows more evenly.
- With a reduction in inventory lead-time goes down.

Strategies and Tools Implemented During the Simulation

- Value Adding Activities
- Necessary Non-Value-Added Activities
- Supplier management
- Just-In-Time
- Continuous flow phase
- Kanban Systems
- Roll Throughput Yield
- Function layout verses Focus/Cellular layout
- Overtime management
- Inventory management
- Standardized operating procedures
- Work schedule based on TAKT time is utilized to determine customer order attainment
- Value Stream Management
- Cross training
- Non-Value Adding Activities
- 5S and Visual Control
- Push verses Pull Systems
- Customer demand rate
- Leveling phase
- First Past Yield
- Batch size management
- Bottleneck management
- Customer demand rate
- SPC (Six Sigma Tools)
- Visual management of the materials is implemented.
- The 7 Wastes
- SMED/TPM
- Total Employee Involvement

SIMULATION MODULES

Modules 1 - 3 Looks at Batch Sizes and Process Layout

Modules 4 & 5 Looks at Bottlenecks and Supplier Control

Module 6 Looks at Information and Material Movement

Module 7 Looks at Reduction of Variation and Higher Yield Potential

Modules 8 – 10 Looks at Inventory Control and Lead Time Reduction

Module 11 Shows How & When to Integrate the Lean Sigma Tool Set

The following example is a simulation that was ran with 12 people participating:

- **One Supplier**
- **Ten Operations**
- **One Assembly Operation**
- ***WE*** **tracked production over 11 modules looking at variables within a typical operation.**

◆ Throughput	◆ Labor	◆ WIP-Work in Process
◆ Overhead	◆ Material Cost	◆ Unit Cost
◆ Total Cost	◆ Lead Time	◆ Overtime

The Following Example:

Month One: Shows the results from a typical functional process. This type of organization operates in many industries today. Product is produced and pushed through the system with little use of the Lean Sigma Tool Set.

Ending Month puts all the strategies in place to show visually how you improve a company's bottom line by using the Lean Sigma Tool Set.

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

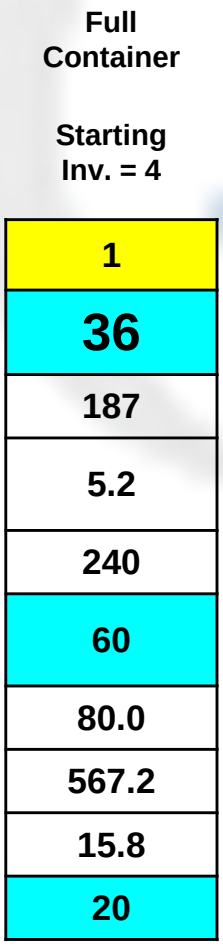
Number of Process Operations With Supplier	12
	Forecast
Thruput	70
Material Cost	364
Individual Mat. Unit Cost	5.2
Labor	240
Work In Proc. (Inventory)	44
Overhead	80.0
Total Cost	728.0
Unit Cost	10.4
Lead Time	13

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 throughput 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

Container Size = 1

Starting Inv. = 4

2
52
270
5.2
240
69
80.0
659.4
12.7
17

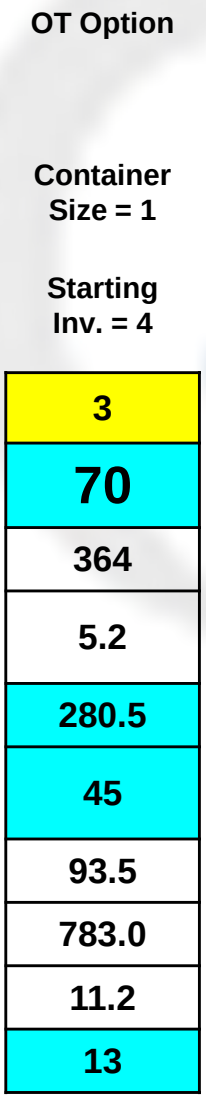
In Module Two we remove the constraints of full containers and un-focused layout. We start out with the same four chips and one die.

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



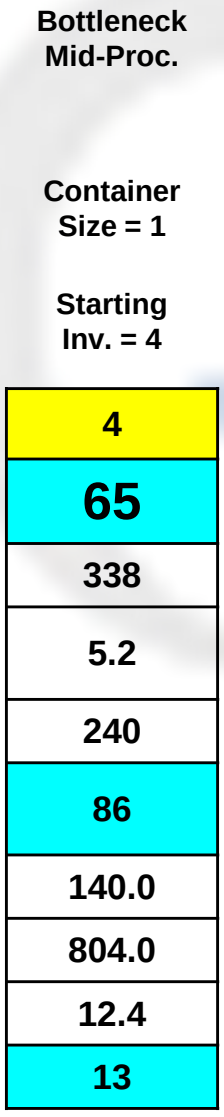
In Module Three begin the module with the same four chips and one die.

This module is exactly like the second module except for 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 throughput.

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

Lock Step Supplier

Container Size = 1

Starting Inv. = 4

5
66
343
5.2
240
34
140.0
757.2
11.5
13

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 throughput is severely hampered. The secondary learning is this is the first module that shows a push/pull system.

LEAN SIGMA INTEGRATION SIMULATION – MODULE SIX

Material Moved During Shift

Container Size = 1

Starting Inv. = 4

6
62
322
5.2
240
58
80.0
700.4
11.3
16

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

Reduced Variation, During Shift Movement

Container Size = 1

Starting Inv. = 4

7
61
317
5.2
240
49
80.0
686.2
11.2
13

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 throughput and cost.

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

LEAN SIGMA INTEGRATION SIMULATION – MODULE EIGHT & NINE

Reduced Inventory, During Shift Movement Container Size = 1 Starting Inv. = 2	Reduced Inventory, During Shift Movement Container Size = 1 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 throughput is impacted. We can show as inventory goes down unit cost goes up.

LEAN SIGMA INTEGRATION SIMULATION – MODULE TEN

Reduced Inventory, During Shift Movement OT Option

Container Size = 1

Starting Inv. = 1

10
70
364
5.2
302.5
18
100.8
785.3
11.2
4

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

Summary
Container Size = 1
Starting Inv. = 1
11
70
364
5.2
247.5
11
82.5
705.0
10.1
4

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.

What industries can benefit from this simulation?

Manufacturing, Service, Hotels, Medical, Mining, Banking, Mortgage, Health Care, and any company that works with people, processes, procedures, and systems.

Who should participate?

Anyone, at any level within your organization, that is committed to continuous improvement and wants to make a difference.

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If you are interested in learning more, ou may contact **Wyrick Enterprises at**
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Brad Wyrick, President

ONSIGHT

On-site Simulations – 8 hours

Minimum of 10 people – Maximum of 13 people per workshop

Employee Training - Lean & Six Sigma Integration Simulation **Workshop** – 40 hours

Train-The-Trainer '**Certification'** (Internal Facilitators) 32 hours

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