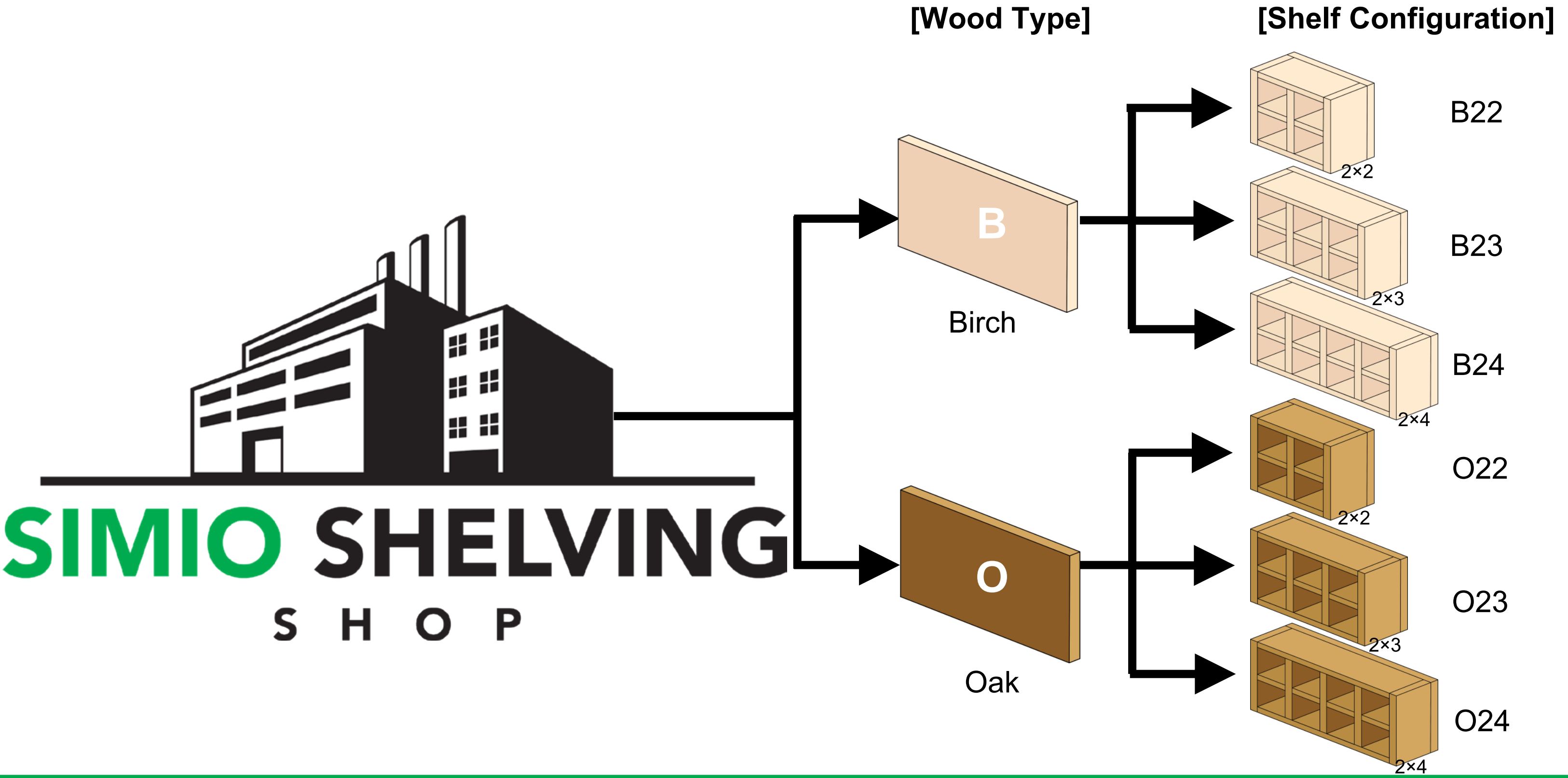
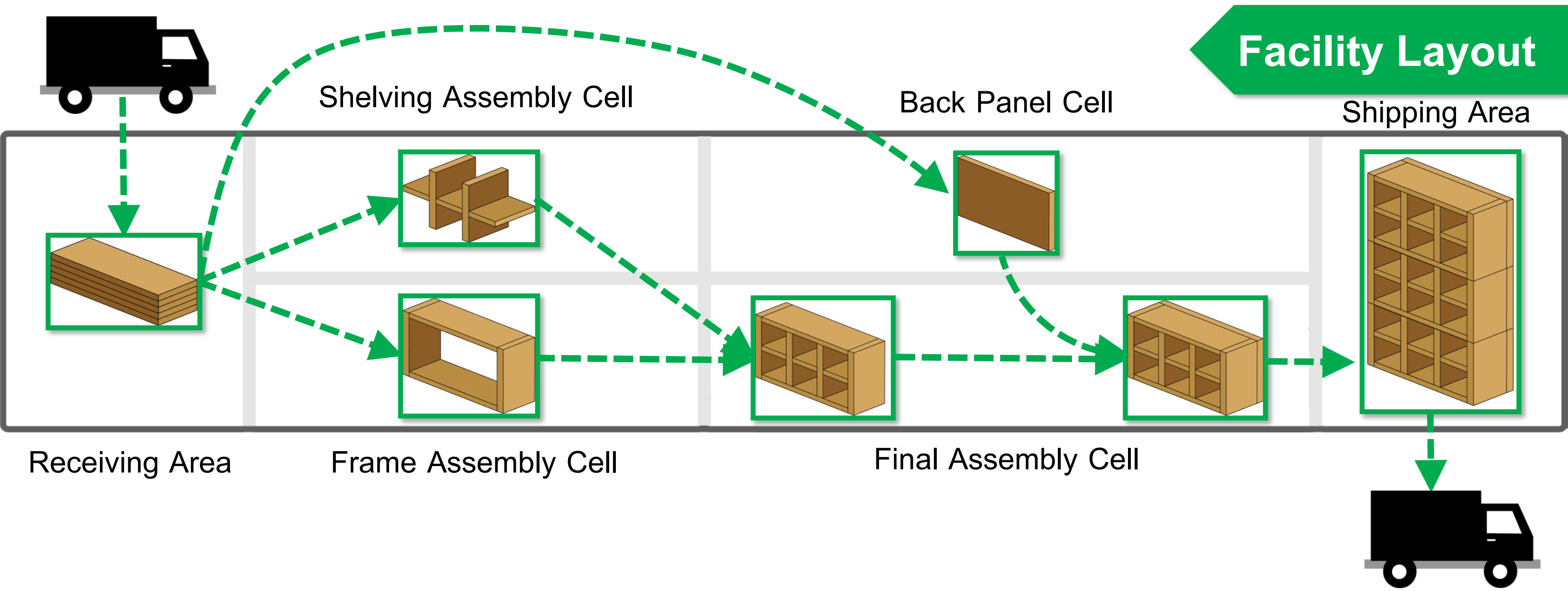
SIMIO SHELVING

SHOP



Simio Shelving Shop is a wholesaler and manufacturer expertizing in various shelf configurations.

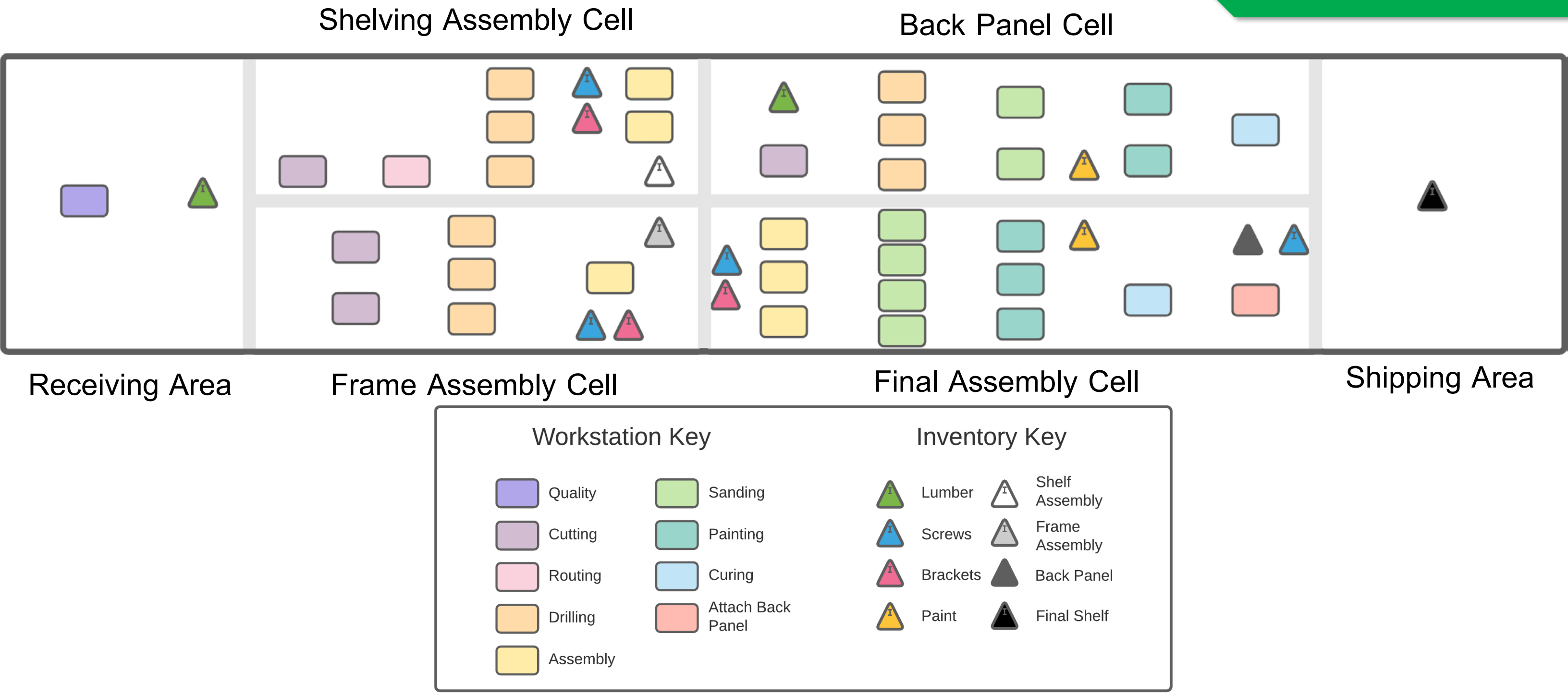
There are six product types varying in 2 types of wood and 3 designs of shelf configuration.



The factory uses cellular layout consisting of the receiving area, where the materials are stored, inspected, and ready to export to 3 sub-assembly cells including shelf assembly, back panel, and frame assembly, whose products will later be transported to

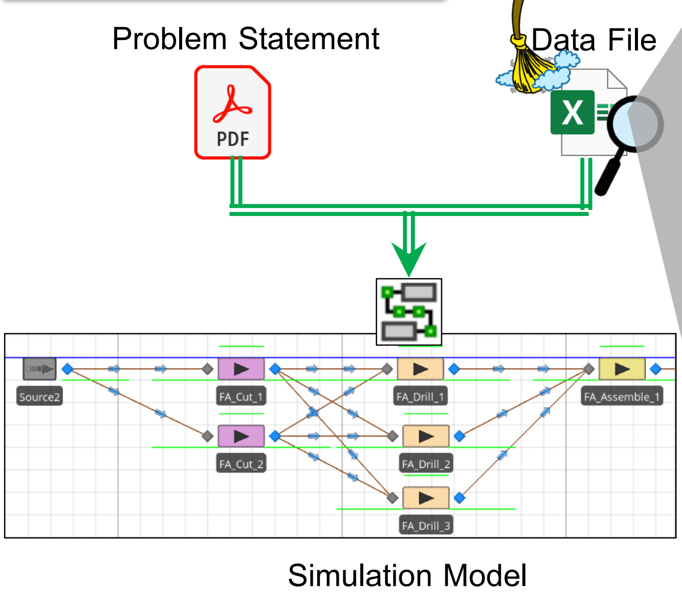
the final assembly cell, and then the final-assembly products will be sent to the shipping area to meet the market demand.

Facility Layout



In addition, each cell has a different workstation and inventory as shown in the figure.

Input Data Analysis



Start Time	End Time	Product Type	Station	Scrap Used
~~9/28/20 8:05:04~~	~~9/28/20 8:10:56~~	?	~~BP_Drill_2~~	~~FALSE~~
9/28/20 8:05:16	9/28/20 8:11:03	B22_SA	SA_Drill_2	FALSE
9/28/20 11:57:17	9/28/20 11:59:18	B23	Attach_BP_1	FALSE
~~9/28/20 11:57:17~~	~~9/28/20 11:59:55~~	~~O23_BP~~	?	~~FALSE~~
~~9/28/20 11:57:35~~	~~9/28/20 13:06:26~~	~~B24~~	~~Assemble_1~~	~~FALSE~~
~~9/28/20 11:58:27~~	~~9/28/20 13:04:18~~	~~B24_SA~~	~~SA_Assemble_1~~	~~FALSE~~
~~9/28/20 11:58:27~~	~~9/28/20 13:00:22~~	~~O22_FA~~	~~FA_Assemble_1~~	~~FALSE~~
~~9/28/20 11:58:28~~	~~9/28/20 13:02:48~~	?	~~FA_Cut_2~~	~~FALSE~~
~~9/28/20 11:58:43~~	~~9/28/20 13:00:51~~	~~O22_BP~~	~~BP_Paint_2~~	~~FALSE~~
~~9/28/20 11:59:25~~	~~9/28/20 13:15:13~~	~~B24~~	~~Sand_2~~	~~FALSE~~
~~9/28/20 11:59:35~~	~~9/28/20 13:01:35~~	~~B23~~	~~Attach_BP_1~~	~~FALSE~~
~~9/28/20 11:59:59~~	~~9/28/20 13:02:42~~	~~O23_BP~~	~~BP_Cut_1~~	~~FALSE~~
~~9/28/20 13:00:14~~	~~9/28/20 13:11:45~~	~~B24~~	~~Paint_3~~	?
9/28/20 13:00:21	9/28/20 13:04:34	O23_FA	FA_Cut_1	FALSE
~~9/28/20 16:50:50~~	~~9/29/20 8:00:33~~	~~O24~~	~~Paint_3~~	~~FALSE~~
~~9/28/20 16:51:56~~	~~9/28/20 16:54:14~~	~~O23~~	~~Attach_BP_1~~	?
~~9/28/20 16:52:58~~	~~9/29/20 8:00:45~~	~~O24~~	~~Assemble_2~~	~~FALSE~~
9/28/20 16:54:32	9/28/20 16:56:37	O23	Attach_BP_1	FALSE
~~9/28/20 16:55:35~~	~~9/29/20 8:04:21~~	~~O24~~	~~Assemble_3~~	~~FALSE~~
~~9/28/20 16:57:04~~	~~9/29/20 8:06:34~~	~~O24~~	~~Paint_1~~	~~FALSE~~
~~9/28/20 16:58:41~~	?	~~O24_SA~~	~~SA_Assemble_1~~	~~FALSE~~
9/28/20 16:59:25	9/29/20 8:13:57	O24	[illegible]	FALSE

... | DDMRP Buffer Chart Examples | **Processing Data** | Quality Data

To illustrate and improve the process in the factory by using a simulation model, some given data had to be analyzed.

However, some data are missing,

For example, in the processing data, the data are required to be eliminated are the missing data, and the data having the run time overlapping the lunch break time between 12 PM to 1 PM as well as the data having the start time and end time on different days.

Thus, the data are considered to be cleaned by eliminating the missing data and the data having abnormal time duration since the beginning to the end.

Input Data Analysis

Cleansing Data

Total Processing Time → Goodness of Fit test at $\alpha = 0.05$

Minitab® 18

H_0: The data follow the given distribution at $\alpha = 0.05$.

H_A: The data doesn't follow the given distribution at $\alpha = 0.05$.

Conclusion: Fail to reject H_0 when p-value > α,

then the data will follow the distribution.

Process type	Scrap Used	P-Value	Distribution
ATTACH BP(2*2)	FALSE	N/A	N/A
ATTACH BP(2*3)	FALSE	N/A	N/A
ATTACH BP(2*4)	FALSE	0.532	JohnsonSB(shape1 = 0, shape2 = 1.49855, min = 138, max = 185)
BP CUT(2*2)	FALSE	0.0575476	JohnsonSB(shape1 = -0.0757832, shape2 = 1.31405, min = 110, max = 144)
BP CUT(2*3)	FALSE	0.289	JohnsonSB(shape1 = 0.00841015, shape2 = 1.56198, min = 133, max = 181)
BP CUT(2*4)	FALSE	0.265317	JohnsonSB(shape1 = 0.123689,shape2 = 1.33518,min = 134, max = 185)
BP DRILL(2*2)	FALSE	0.768	JohnsonSB(shape1 = -0.126582,shape2 = 1.21011, min = 280, max = 394)

First, most cleansing data of the total processing time were tested using the goodness of fit test via Minitab with a significant level of 5%.

After cleaning the data, there are some categories of data which need to be analyzed.

Then the distribution results were shown in the following table.

Input Data Analysis

Cleansing Data

Total Processing Time

Minitab® 18

Goodness of Fit test at $\alpha = 0.05$

H0: The data follow the given distribution at $\alpha = 0.05$.

HA: The data doesn't follow the given distribution at $\alpha = 0.05$.

Conclusion: Fail to reject H0 when p-value > α,

then the data will follow the distribution.

Process type	Scrap Used	P-Value	Distribution
BP DRILL(2*3)	FALSE	0.976666	JohnsonSB(shape1 = 0.0562581, shape2 = 1.12971, min = 417, max = 584)
BP DRILL(2*4)	FALSE	0.789464	JohnsonSB(shape1 = -0.0556740, shape2 = 1.22833, min = 547, max = 774)
BP PAINT(2*2)	FALSE	0.246229	JohnsonSB(shape1 = 0, shape2 = 1.37471, min = 124, max = 174)
BP PAINT(2*3)	FALSE	0.512682	JohnsonSB(shape1 = -0.0800787, shape2 = 1.41104, min = 174, max = 240)
BP PAINT(2*4)	FALSE	0.469	JohnsonSB(shape1 = 0.279609, shape2 = 1.44327, min = 222, max = 315)
BP SAND(2*2)	FALSE	0.376	JohnsonSB(shape1 = 0.0475184, shape2 = 1.26475, min = 162, max = 225)
BP SAND(2*3)	FALSE	0.584	JohnsonSB(shape1 = 0.0377856, shape2 = 1.28055, min = 230, max = 331)

Then the distribution results were shown in the following table.

Input Data Analysis

Cleansing Data

Total Processing Time

Minitab 18

Goodness of Fit test at $\alpha = 0.05$

H_0: The data follow the given distribution at $\alpha = 0.05$.

H_A: The data doesn't follow the given distribution at $\alpha = 0.05$.

Conclusion: Fail to reject H_0 when p-value > α,

then the data will follow the distribution.

Process type	Scrap Used	P-Value	Distribution
BP SAND(2*4)	FALSE	0.45	JohnsonSB(shape1 = -0.156635, shape2 = 1.55232, min = 307, max = 438)
FA ASSEMBLY	FALSE	N/A	N/A
FA CUT(2*2)	FALSE	0.45	JohnsonSB(shape1 = -0.0956666, shape2 = 1.52679, min = 192, max = 263)
FA CUT(2*3)	FALSE	0.615	JohnsonSB(shape1 = 0.0825873, shape2 = 1.36419, min = 218, max = 300)
FA CUT(2*4)	FALSE	0.292205	JohnsonSB(shape1 = 0.0348239, shape2 = 1.48599, min = 222, max = 301)
FA DRILL(2*2)	FALSE	0.524	JohnsonSB(shape1 = 0, shape2 = 1.05873, min = 302, max = 426)
FA DRILL(2*3)	FALSE	0.887	JohnsonSB(shape1 = 0.124231, shape2 = 1.25349, min = 374, max = 523)

Then the distribution results were shown in the following table.

Input Data Analysis

Cleansing Data

Total Processing Time

Minitab® 18

H0: The data follow the given distribution at $\alpha = 0.05$.

HA: The data doesn't follow the given distribution at $\alpha = 0.05$.

Conclusion: Fail to reject H0 when p-value > α,

then the data will follow the distribution.

Goodness of Fit test at $\alpha = 0.05$

Process type	Scrap Used	P-Value	Distribution
FA DRILL(2*4)	FALSE	0.947	JohnsonSB(shape1 = 0.0281529, shape2 = 1.12484, min = 440, max = 622)
FINAL ASSEMBLY(2*2)	FALSE	0.675	JohnsonSB(shape1 = -0.0924023, shape2 = 1.15336, min = 220, max = 300)
FINAL ASSEMBLY(2*3)	FALSE	0.503528	JohnsonSB(shape1 = -0.111232, shape2 = 1.27658, min = 319, max = 457)
FINAL ASSEMBLY(2*4)	FALSE	0.211	JohnsonSB(shape1 = -0.181040, shape2 = 1.87452, min = 426, max = 604)
FINAL PAINT(2*2)	FALSE	0.696	JohnsonSB(shape1 = 0.116041, shape2 = 1.28538, min = 272, max = 386)
FINAL PAINT(2*3)	FALSE	0.477	JohnsonSB(shape1 = -0.0922465, shape2 = 1.33624, min = 391, max = 564)
FINAL PAINT(2*4)	FALSE	0.617157	JohnsonSB(shape1 = -0.00078952, shape2 = 1.11534, min = 525, max = 741)

Then the distribution results were shown in the following table.

Input Data Analysis

Cleansing Data

Total Processing Time

Minitab® 18

Goodness of Fit test at $\alpha = 0.05$

H_0: The data follow the given distribution at $\alpha = 0.05$.

H_A: The data doesn't follow the given distribution at $\alpha = 0.05$.

Conclusion: Fail to reject H_0 when p-value > α,

then the data will follow the distribution.

Process type	Scrap Used	P-Value	Distribution
FINAL SAND(2*2)	FALSE	0.896	JohnsonSB(shape1 = 0.123742, shape2 = 1.21653, min = 352, max = 508)
FINAL SAND(2*3)	FALSE	0.99493	JohnsonSB(shape1 = -0.138971, shape2 = 1.29666, min = 523, max = 754)
FINAL SAND(2*4)	FALSE	0.797847	JohnsonSB(shape1 = 0.217413, shape2 = 1.35326, min = 700, max = 1013)
SA ASSEMBLY(2*2)	FALSE	0.144	JohnsonSB(shape1 = -0.0266874, shape2 = 1.21059, min = 113, max = 156)
SA ASSEMBLY(2*3)	FALSE	0.197	JohnsonSB(shape1 = 0, shape2 = 1.17053, min = 208, max = 287)
SA ASSEMBLY(2*4)	FALSE	0.426	JohnsonSB(shape1 = 0.0370604, shape2 = 1.26423, min = 294, max = 420)
SA CUT(2*2)	FALSE	0.15	JohnsonSB(shape1 = -0.169636, shape2 = 1.20951, min = 116, max = 149)

Then the distribution results were shown in the following table.

Input Data Analysis

Cleansing Data

Total Processing Time

Goodness of Fit test at $\alpha = 0.05$

Minitab 18

H_0: The data follow the given distribution at $\alpha = 0.05$.

H_A: The data doesn't follow the given distribution at $\alpha = 0.05$.

Conclusion: Fail to reject H_0 when p-value > α,

then the data will follow the distribution.

Process type	Scrap Used	P-Value	Distribution
SA CUT(2*2)	TRUE	0.07	Normal(mean = 103.605948, stdDev = 5.51937918423538)
SA CUT(2*3)	FALSE	0.139	JohnsonSB(shape1 = 0.0723778, shape2 = 1.42571, min = 164, max = 224)
SA CUT(2*4)	FALSE	0.438	JohnsonSB(shape1 = 0.0424019, shape2 = 1.61045, min = 219, max = 298)
SA DRILL(2*2)	FALSE	0.267	JohnsonSB(shape1 = -0.0723096, shape2 = 1.22951, min = 285, max = 397)
SA DRILL(2*3)	FALSE	0.581	JohnsonSB(shape1 = -0.102668, shape2 = 1.43298, min = 480, max = 675)
SA DRILL(2*4)	FALSE	0.988	JohnsonSB(shape1 = -0.0200903, shape2 = 1.18170, min = 675, max = 971)
SA ROUTING(2*2)	FALSE	N/A	N/A

Then the distribution results were shown in the following table.

Input Data Analysis

Cleansing Data

Total Processing Time → Goodness of Fit test at $\alpha = 0.05$ (Minitab 18)

H_0: The data follow the given distribution at $\alpha = 0.05$.

H_A: The data doesn't follow the given distribution at $\alpha = 0.05$.

Conclusion: Fail to reject H_0 when p-value > α, then the data will follow the distribution.

Process type	Scrap Used	P-Value	Distribution
SA ROUTING(2*3)	FALSE	N/A	N/A
SA ROUTING(2*4)	FALSE	N/A	N/A

Data fitted with the given distribution → Enter into input parameter → Simio

Data not fitted with any given distribution → Import to table & refer the table in input parameter → Simio

Observing from the results, we can conclude that most of data processing data can be fitted to the given distribution so it can be simply entered into the input parameter.

However, some data aren't fitted so those of data should be directly imported to the table and refer it in the input parameter of Simio.

Then the distribution results were shown in the following table.

Input Data Analysis

Cleansing Data

- Inspection time from quality data
- Sales data
- Lead time (LT) from supplier data

Material	Avg LT	Material	Avg LT	Material	Avg LT	Material	Avg LT
MAT001	3.948718	MAT003	1.272727	MAT005	3	MAT007	2.392857
MAT002	3.236842	MAT004	1.333333	MAT006	1.928571		

- Defect rate from quality data

Material	Avg %defect	Material	Avg %defect	Material	Avg %defect	Material	Avg %defect
MAT001	4.7892983	MAT003	1.4397906	MAT005	1.9485621	MAT007	4.4440792
MAT002	7.000466	MAT004	1.0510511	MAT006	0.9635741		

Import to table

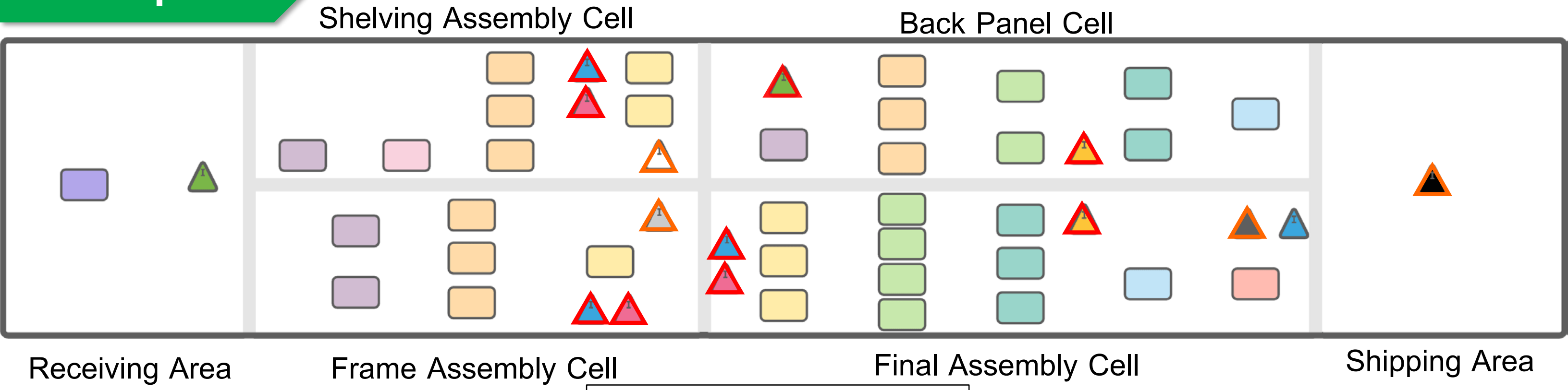
& refer the table in input parameter

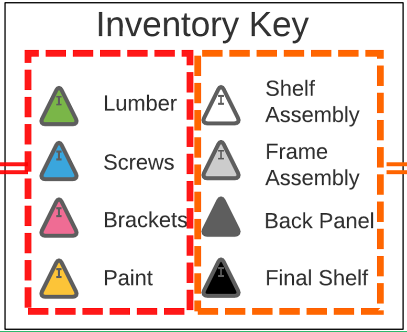
Simio

In addition, the mean value of both lead time and the defect rate for each data category were computed and added to the table correspondingly.

Next, the cleansing data of inspection time, sales data, and lead time were used to create the inventory table.

Assumptions #1





Beginning Inventory

$$= \begin{cases} \text{order-up-to-level for MAT001-MAT007} \\ \text{0 for MAT008-MAT009} \end{cases}$$

Beginning Inventory = 0

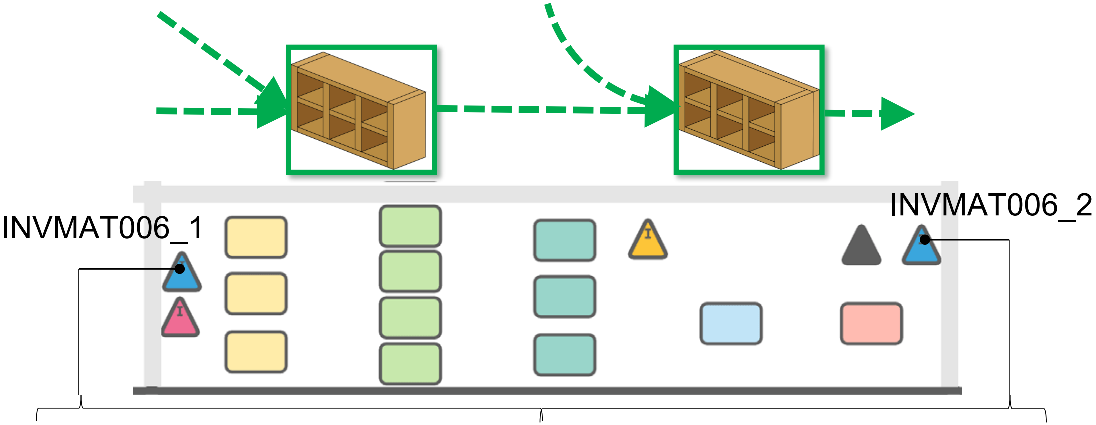
In order to create the simulation model, some assumptions were made.

First, the initial number of products in inventory at subassembly and final assembly are given to be zero.

Additionally, the initial number of products in raw material inventory for MAT001 to MAT007 equal to the order-up-to-level as the given current state inventory policy while the initial number of products in raw material inventory for MAT008&MAT009 equal to zero.

Assumptions #2

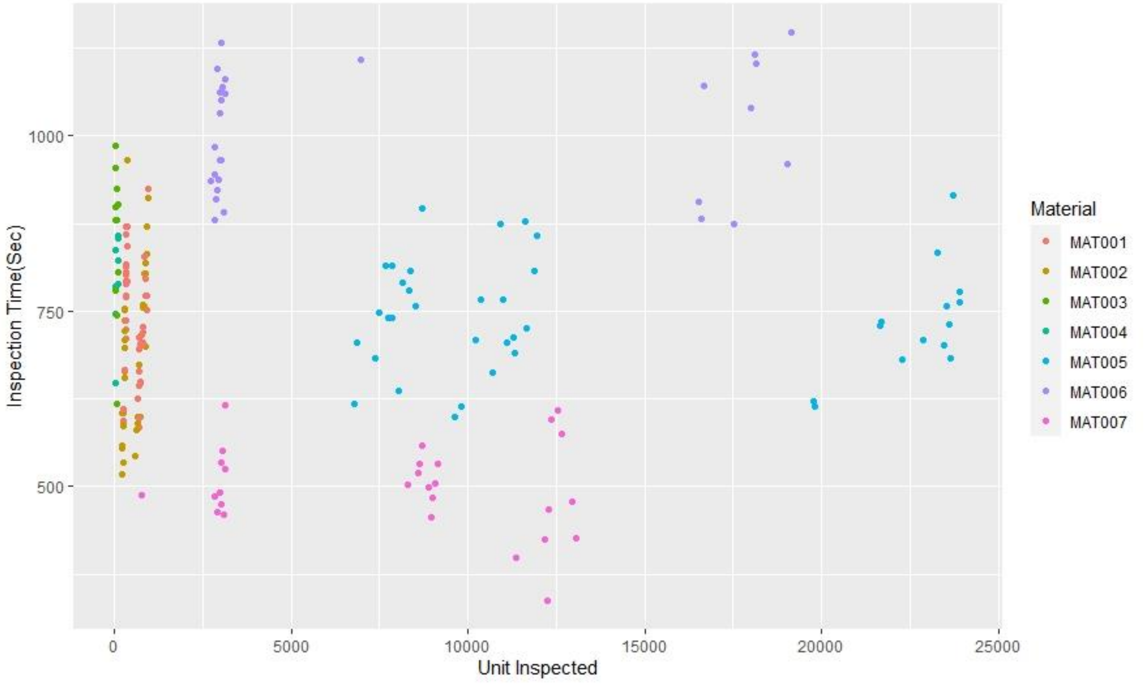
Final Assembly Cell



	Reorder Point of INVMAT006_1	Order-up-to-level of INVMAT006_1	Reorder Point of INVMAT006_2	Order-up-to-level of INVMAT006_2
Given policy:	1080	3780	6544	22904
Edited policy:	**6544**	**22904**	**1080**	**3780**

Next assumption, in practice, the demand volume of INVMAT006_1 is supposed to be more than in INVMAT006_2 but their given data of both reorder point and order-up-to-level don't make sense as INVMAT006_1 is lower while INVMAT006_2 is higher. As a result, an assumption was made that these two data had to be switched.

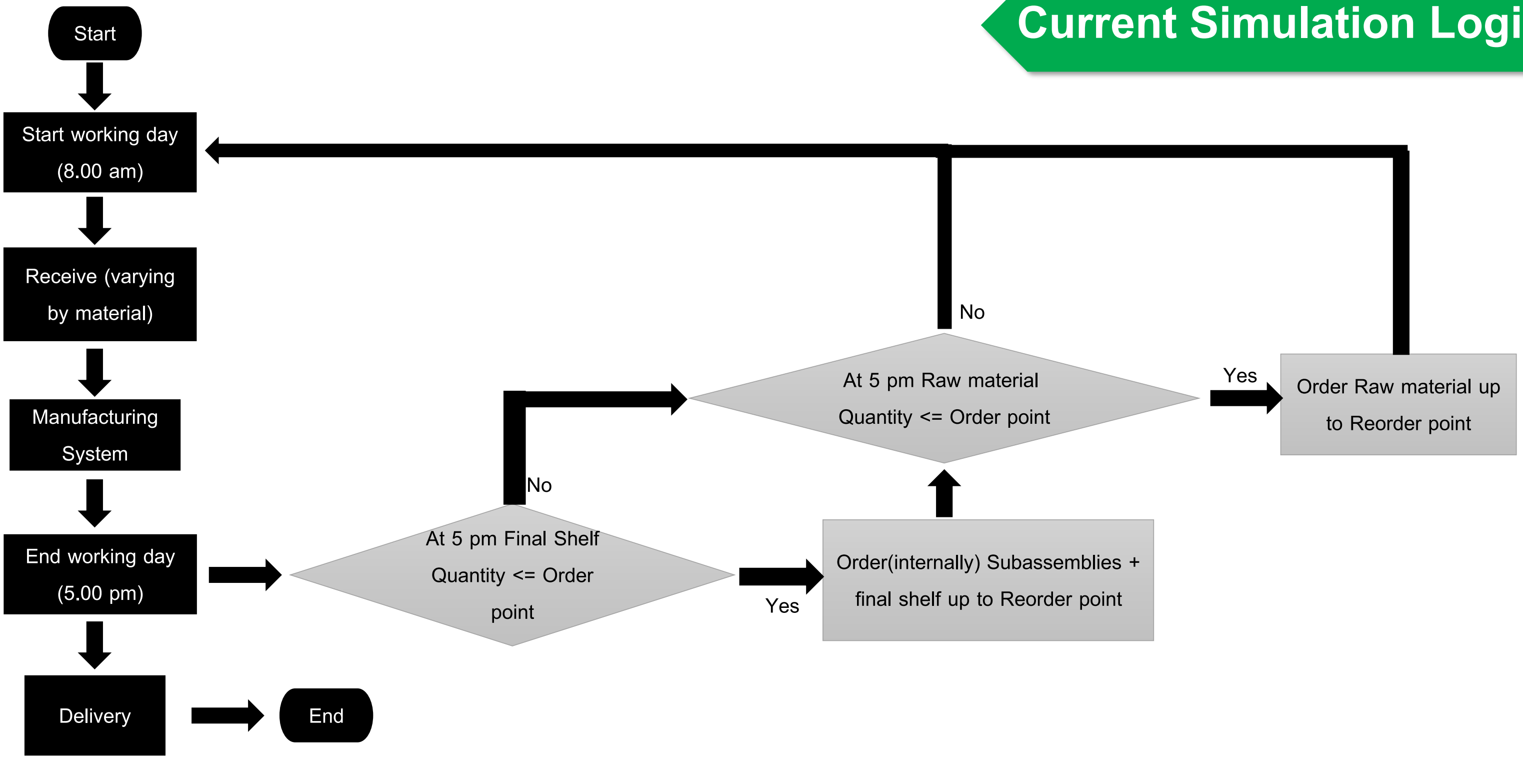
Assumptions #3



Last assumption, the total inspection time was used instead of the inspection time per unit

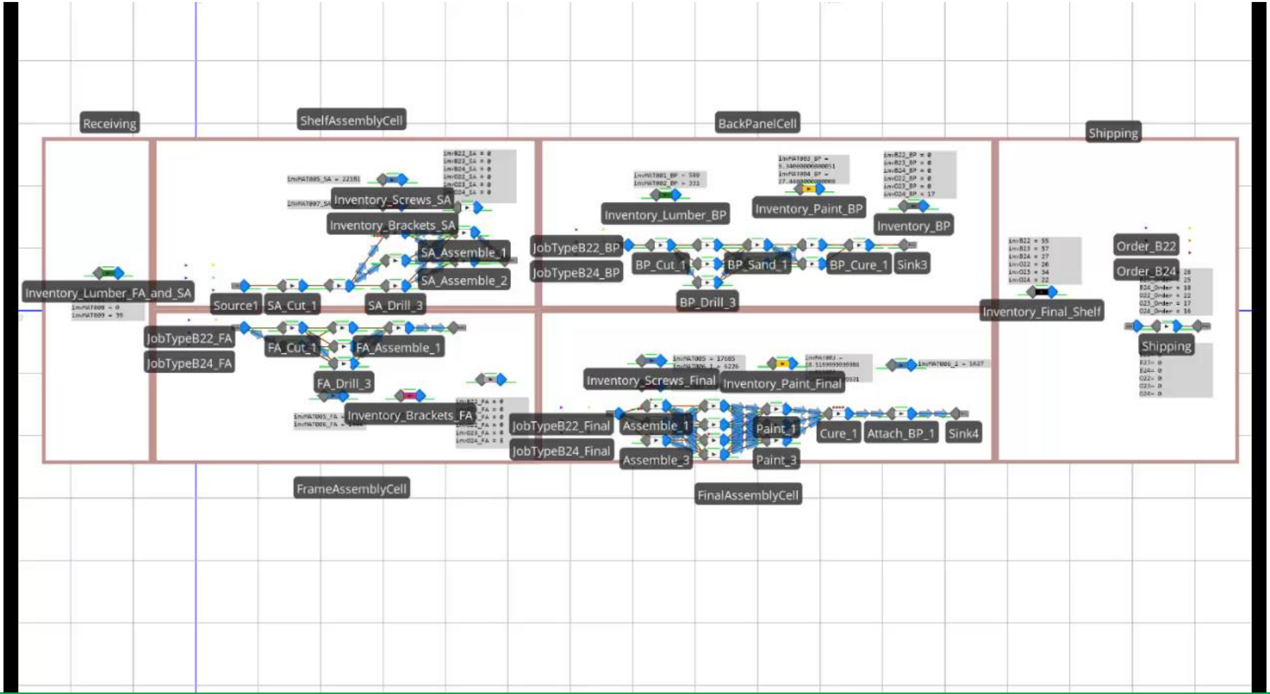
In addition, the total inspection time didn't vary by material since the given data might be insufficient in some material. due to no relationship between the inspected unit and its inspection time.

Current Simulation Logic



To understand the logic of current simulation model, the flowchart of current MRP process is illustrated as the following.

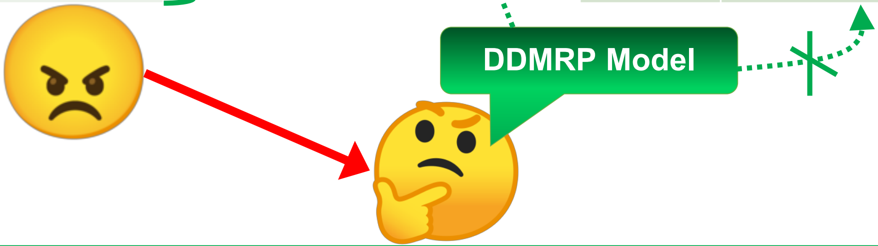
Current Simulation Model



Result of the Current Simulation Model

KPIs	Current
Throughput [units]	550.75
Average unit time in system [units]	9.49
Workstation utilization	65.83%
Average inventory cost [$]	43,766.49
Number of stockouts [units]	35
Unmet demand	78.37%

Material	Inventory Cost[$]
MAT001	7,973.82
MAT002	6,241.76
MAT003	1,430.55
MAT004	1,265.98
MAT005	1,569.30
MAT006	967.69
MAT007	16,324.26



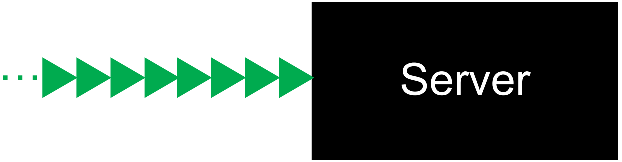
Assumptions for Alternative Simulation Model

#1

Lead time = 46 hour = 1.92 days

#2

Buffer capacity = ∞

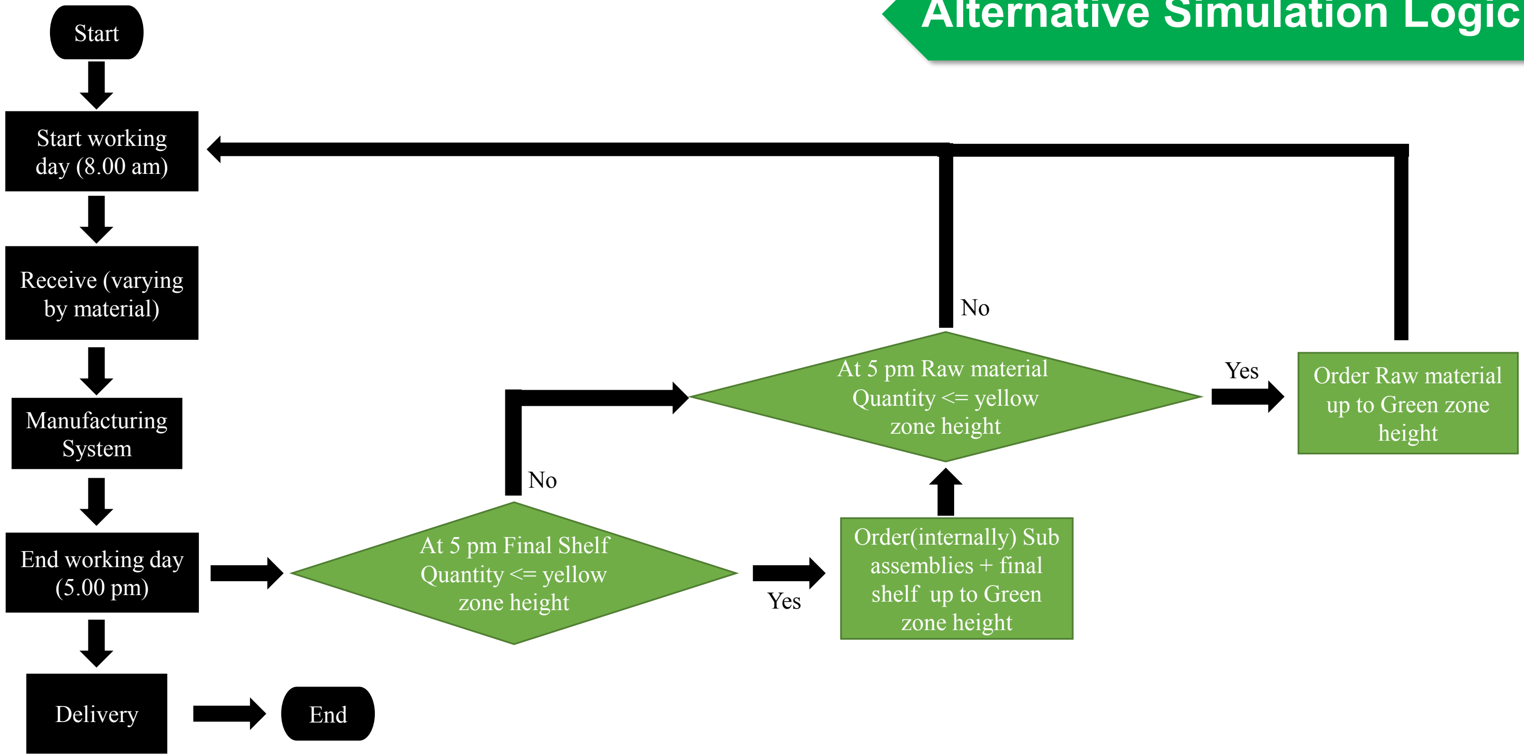


First, the lead time of the final shelf in the DDMRP model is given to be equal to the unit production time of traditional MRP which is approximately 46 hours or 1.92 days.

Before the DDMRP simulation model was created, some additional assumptions had been made.

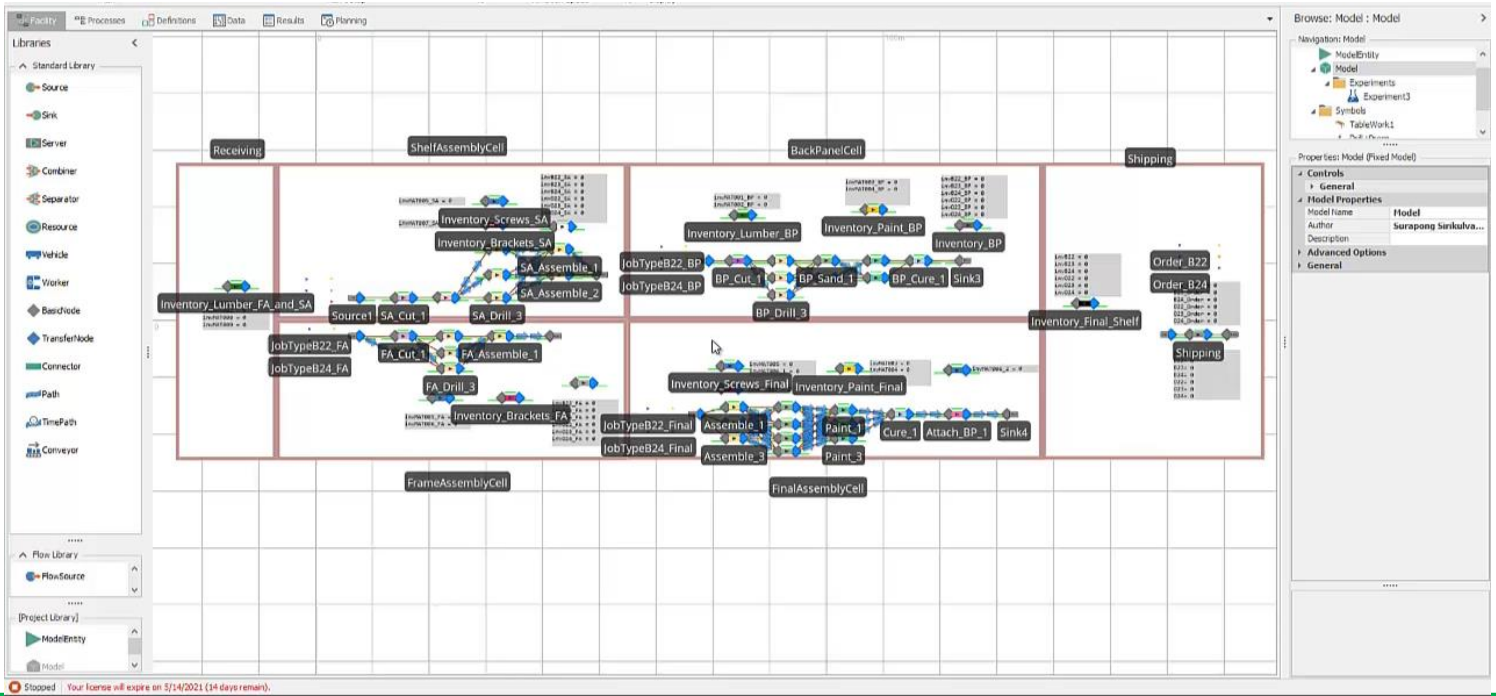
In addition, the buffer capacity is infinite.

Alternative Simulation Logic



To understand the logic of alternative simulation model, the flowchart of DDMRP process is illustrated as the following.

Alternative Simulation Model



This model can be simply modified into DDMRP model by changing the reorder point
After modifying the current MRP model, the DDMRP simulation is displayed as the following.
and order-up-to-level of the current policy according to the concern of DDMRP.

Design of experiment

KPIs		B	C	D	E	F	KPI's weight
Throughput	A	B – 2	A – 1	D – 4	E – 5	F – 5	A = 1
Average unit time in system	B		B – 3	D – 4	E – 4	F –4	B = 5
Workstation utilization	C			D – 2	E – 5	F – 5	C = 0
Average inventory cost	D				E – 4	F – 3	D = 10
Number of stockouts	E					F – 3	E = 18
Unmet daily demand	F						F = 20

Guidelines for LTF and VF

Lead Time	LTF
Long	20% – 40%
Medium	41% – 60%
Short	61% – 100%

Variation	VF
High	61% – 100%
Medium	41% – 60%
Low	20% – 40%

The following matrix table illustrates the comparison of importance for each KPI with (1–5) the different levels of priority scale from one to five.

Optimization

LTF	VF	AvgUnitTimeInSys	WeeklyThroughput	No.Stockout	InventoryCost	UnmetDamand
0.5	0.5	9.01557	681.167	25	147679	19.0461
0.25	0.5	8.7459	657.5	31	128628	21.1363
0.75	0.75	22.9647	672.583	32.3333	188206	34.8423
⋮	⋮	⋮	⋮	⋮	⋮	⋮

LTF	
Description	
OptQuest for Simio - Parameters	
Include in Optimizati...	**Yes**
Minimum Value	**0**
Maximum Value	**1**
Increment	**0.25**

Given: $\bar{x}$ is the average for each KPI calculated from Simio

S is the standard deviation for each KPI calculated from Simio

Objective of KPI: to minimize | to maximize

KPIs	Score = 1	Score = 2	Score = 3	Score = 4	Score = 5
Throughput	$[0, \bar{x} - 1S)$	$(\bar{x} - 1S, \bar{x} - 0.5S)$	$(\bar{x} - 0.5S, \bar{x} + 0.5S)$	$(\bar{x} + 0.5S, \bar{x} + 1S)$	$(\bar{x} + 1S, \infty)$
Average unit time in system	$(\bar{x} + 1S, \infty)$	$(\bar{x} + 0.5S, \bar{x} + 1S)$	$(\bar{x} - 0.5S, \bar{x} + 0.5S)$	$(\bar{x} - 1S, \bar{x} - 0.5S)$	$[0, \bar{x} - 1S)$
Workstation utilization	Neglect $\because$ weight of workstation utilization = 0				
Average inventory cost	$(\bar{x} + 1S, \infty)$	$(\bar{x} + 0.5S, \bar{x} + 1S)$	$(\bar{x} - 0.5S, \bar{x} + 0.5S)$	$(\bar{x} - 1S, \bar{x} - 0.5S)$	$[0, \bar{x} - 1S)$
Number of stockouts	$(\bar{x} + 1S, \infty)$	$(\bar{x} + 0.5S, \bar{x} + 1S)$	$(\bar{x} - 0.5S, \bar{x} + 0.5S)$	$(\bar{x} - 1S, \bar{x} - 0.5S)$	$[0, \bar{x} - 1S)$
Unmet daily demand	$(\bar{x} + 1S, \infty)$	$(\bar{x} + 0.5S, \bar{x} + 1S)$	$(\bar{x} - 0.5S, \bar{x} + 0.5S)$	$(\bar{x} - 1S, \bar{x} - 0.5S)$	$[0, \bar{x} - 1S)$

Then the experiment was run with a constant increment of 0.25 for all buffer.

After that, the criteria for each KPI's score were determined as the following to calculate the weight average score.

Optimization

Optimal (LTF,VF) = (0.5,0.5) ; for all buffers

LTF	VF	AvgUnitTimeInSys	WeeklyThroughput	No.Stockout	InventoryCost	UnmetDamand
0.5	0.5	9.01557	681.167	25	147679	19.0461
~~0.75~~	~~0~~	~~10.3646~~	~~689.417~~	~~23.6667~~	~~163832~~	~~19.4408~~

<

Rate from 1–5 according to the given criteria

LTF	VF	R(AvgUnitTimeInSys)	R(WeeklyThroughput)	R(No.Stockout)	R(InventoryCost)	R(UnmetDamand)
0.5	0.5	4	5	5	3	5
0.75	0	4	5	5	3	5
Weight: w( )		5	1	18	10	20

4.537

4.537

=

Highest weight rank

$$\text{Weight average} = \frac{\sum_{\forall \text{KPI}} R(\blacksquare)\times w(\blacksquare)}{\sum_{\forall \text{KPI}} w(\blacksquare)}$$

After both results had been rated and compared with KPI and computed the weight average score, it's obvious that both of them have the same weight score is equals to 4.537. As a result, (LTF, VF) optimal value for LTF and VF are shown as the following.

However, if both of the results are compared with unmet daily demand which is the highest weight rank among other KPIs, the unmet daily demand of (LTF, VF) at (0.5, 0.5) is less than those of (LTF, VF) at (0.75, 0). Consequently, (LTF, VF) at (0.5, 0.5) is chosen to be the optimal value of this model.

Result of Alternative Simulation Models

Optimal (LTF,VF) = (0.5,0.5) ; for all buffers

KPIs	Alternative
Throughput [units]	681.17
Average unit time in system [units]	9.02
Workstation utilization	70.67%
Average inventory cost [$]	72,619.73
Number of stockouts [units]	25
Unmet daily demand	19.05%

Material	Inventory Cost[$]
MAT001	19,720.41
MAT002	15,893.84
MAT003	1,914.63
MAT004	1,167.67
MAT005	2,901.36
MAT006	829.79
MAT007	11,696.20

After running an experiment by giving the optimal value of both LTF and VF at 0.5 for all buffers,
the results of this model are shown as the following.

Results Comparison of Simulation Models

Compare with KPIs

KPIs	Current	Alternative
Throughput [units]	550.75	681.17
Average unit time in system [units]	9.49	9.02
Workstation utilization	65.83%	70.67%
Average inventory cost [$]	43,766.49	72,619.73
Number of stockouts [units]	35	25
Unmet daily demand	78.37%	19.05%

Compared to the traditional MRP,

Results Comparison of Simulation Models

Compare with KPIs

KPIs	Current	Alternative	Percent change
Throughput [units]	550.75	681.17	+23.68%
Average unit time in system [units]	9.49	9.02	-4.95%
Workstation utilization	65.83%	70.67%	+4.84%
Average inventory cost [$]	43,766.49	72,619.73	+65.92%
Number of stockouts [units]	35	25	-28.57%
Unmet daily demand	78.37%	19.05%	-59.32%

although the inventory cost of DDMRP is higher, the other KPIs in DDMRP perform much better, meeting most of the factory’s objectives.

Results Comparison of Simulation Models

Compare with inventory cost for each material

Material	Current	Alternative	Amount Difference
MAT001	$ 7,973.82	$ 19,720.41	$ 11,746.59
MAT002	$ 6,241.76	$ 15,893.84	$ 9,652.08
MAT003	$ 1,430.55	$ 1,914.63	$ 484.08
MAT004	$ 1,265.98	$ 1,167.67	- $98.31
MAT005	$ 1,569.30	$ 2,901.36	$ 1,332.06
MAT006	$ 967.69	$ 829.79	- $ 137.9
MAT007	$ 16,324.26	$ 11,696.20	- $ 4,628.06

Top 3 highest inventory cost: MAT001 > MAT002 > MAT007

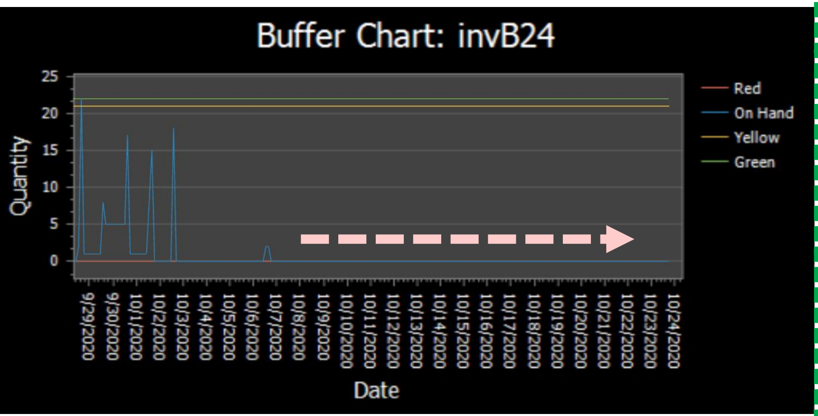
Top 3 highest inventory cost: MAT007 > MAT001 > MAT002

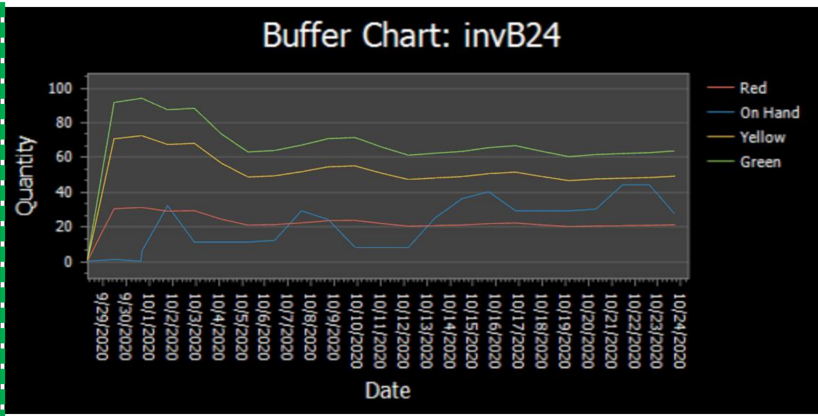
3 materials having highest inventory cost in the current model are MAT007, MAT001, and MAT002 respectively

while 3 materials having highest inventory cost in the alternative model are MAT001, MAT002, and MAT007.

Results Comparison of Simulation Models

Project success from buffer plots





Stockout in long term!!!

Decrease of stockouts

Current Model

Vs.

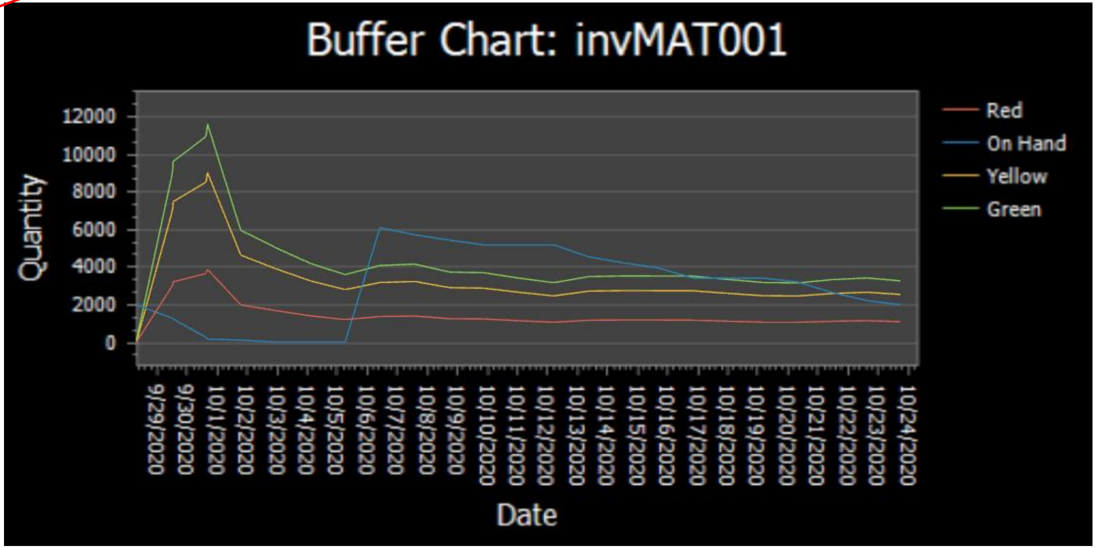
Alternative Model

Evaluating the project success from buffer plots, the risk of the inventory being out-of-stock in the alternative model is less than the current model significantly.

According to the buffers in the alternative model,

Top 5 highest inventory cost: invMAT001

1st highest inventory cost

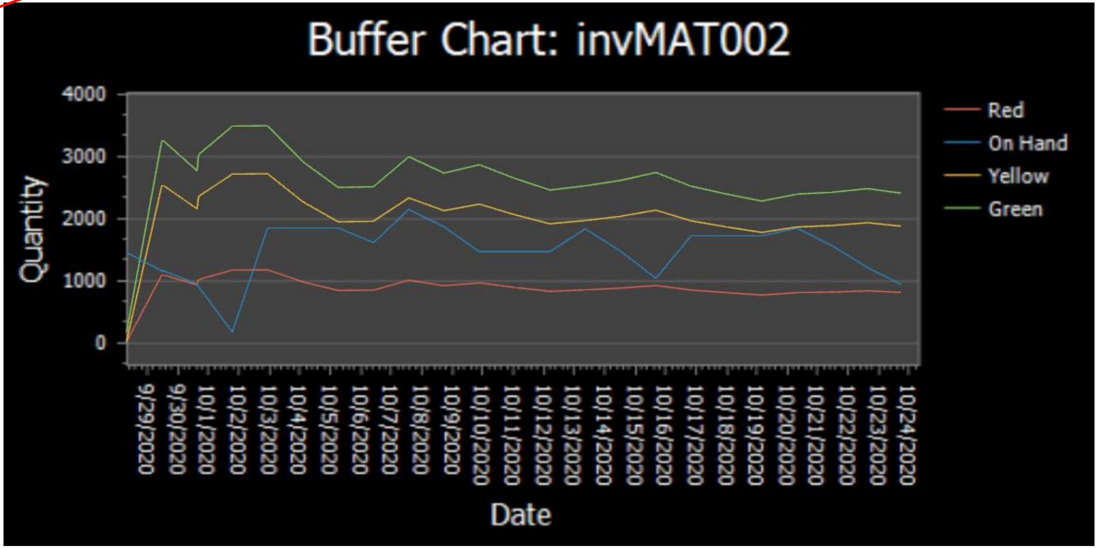


According to the alternative model, five buffers in the DDMRP model which has the highest inventory are invMAT001

According to the buffers in the alternative model,

Top 5 highest inventory cost: invMAT001 > invMAT002

2nd highest inventory cost

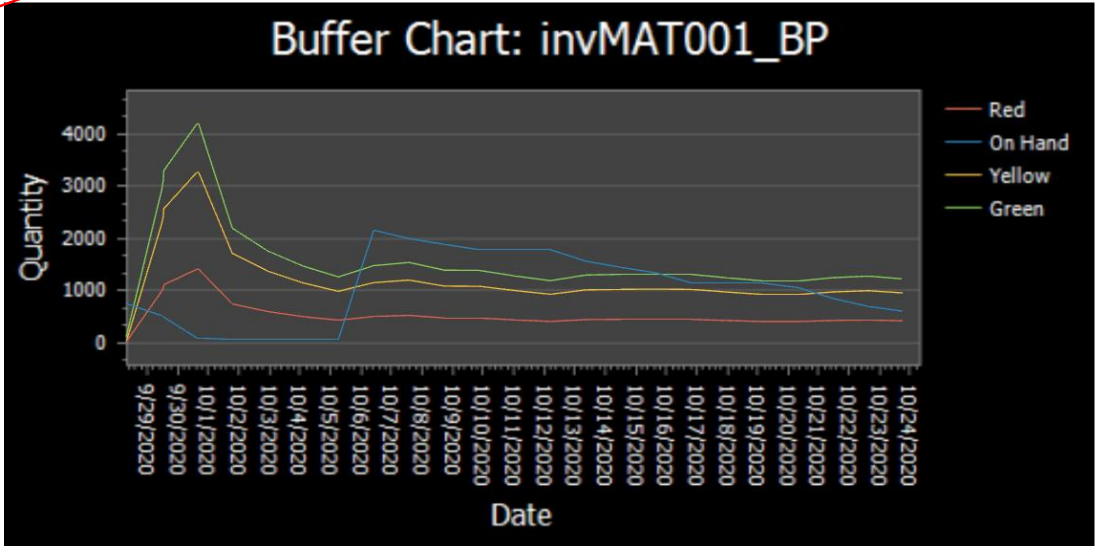


invMAT002

According to the buffers in the alternative model,

Top 5 highest inventory cost: invMAT001 > invMAT002 > invMAT001_BP

3rd highest inventory cost

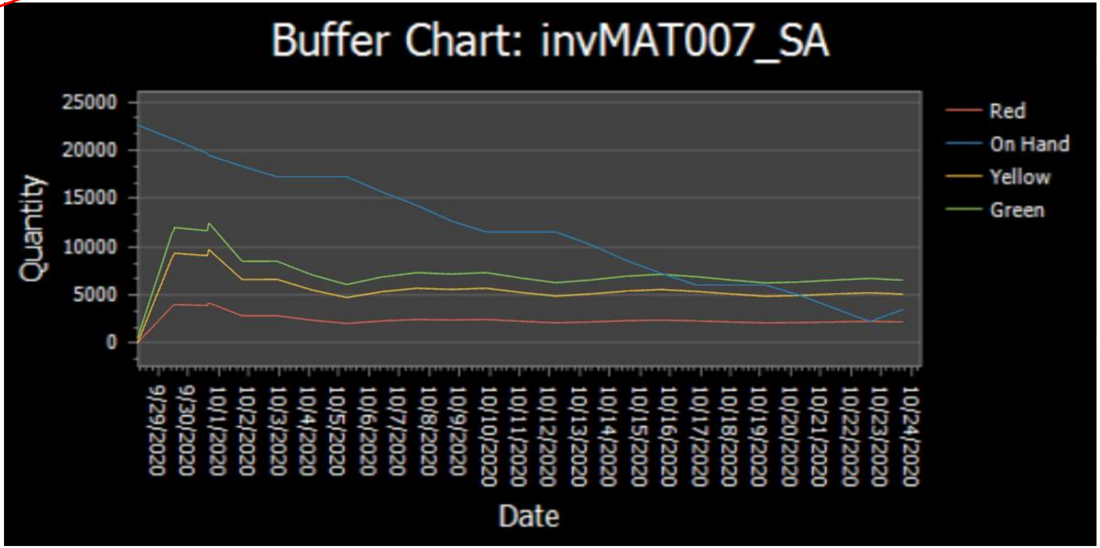


invMAT001_BP

According to the buffers in the alternative model,

Top 5 highest inventory cost: invMAT001 > invMAT002 > invMAT001_BP > invMAT007_SA

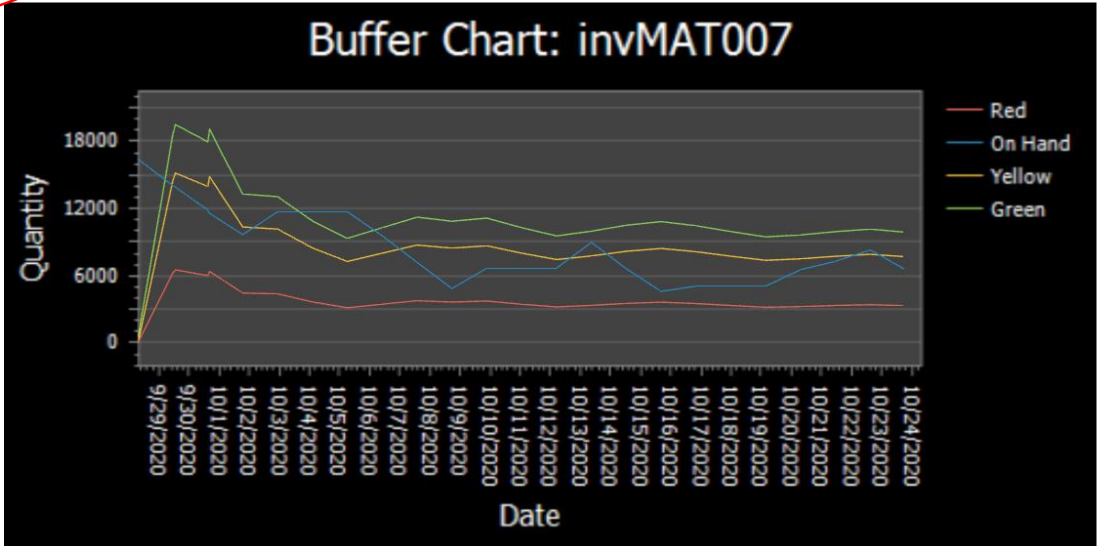
4th highest inventory cost



According to the buffers in the alternative model,

Top 5 highest inventory cost: invMAT001 > invMAT002 > invMAT001_BP > invMAT007_SA > invMAT007

5th highest inventory cost



invMAT007

Results Comparison of Simulation Models

Predicted Change on Order Fill Rate

Order	Current	Alternative	Percent difference
B22	36.36%	100%	+63.64%
B23	29.03%	99.6%	+70.57%
B24	24.62%	91.02%	+66.40%
O22	25.24%	80.87%	+55.63%
O23	8.35%	74.89%	+66.54%
O24	6.15%	65.36%	+59.21%
Average	**21.63%**	**85.29%**	**+63.66%**

Compared with predicted change in order fill rate, it can be concluded that the order fill rate can be increased in the alternative rather than the current model.

Summary & Recommendation

Current Model Vs. Alternative Model

KPIs	Improve?
Throughput [units]	✓
Average unit time in system [units]	✓
Workstation utilization	✓
Average inventory cost [$]	✗
Number of stockouts [units]	✓
Unmet demand	✓

$ ↑

The smaller increment is,

the more possible the true optimal value can be obtained.

LTF	
Description	
OptQuest for Simio - Parameters	
Include in Optimizati...	Yes
Minimum Value	0
Maximum Value	1
Increment	0.25 → 0.10 → 0.05 ···

? Is (LTF,VF) optimal?

New simulation model ⇐ LEAN 6σ

Minimize: Inventory

NVAN

Note: NVAN = Non-value-added activity but necessary