SIMIO SHELVING

SHOP

[Wood Type]

[Shelf Configuration]

B — Birch

O — Oak

B22 2×2
B23 2×3
B24 2×4

O22 2×2
O23 2×3
O24 2×4

The Shelving Shop is a wholesaler and manufacturer expediting various shelf configurations.

Facility Layout
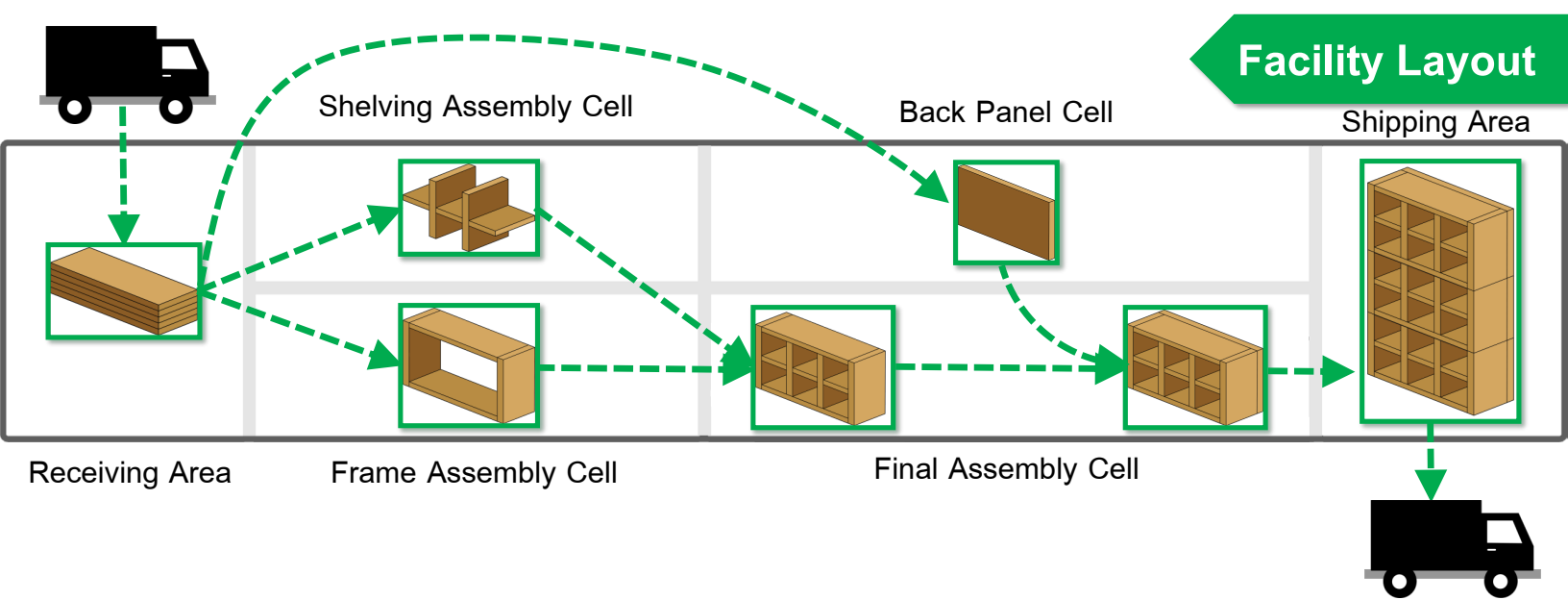
Shelving Assembly Cell

Back Panel Cell

Shipping Area

Receiving Area

Frame Assembly Cell

Final Assembly Cell

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

Facility Layout

Shelving Assembly Cell

Back Panel Cell

Receiving Area

Frame Assembly Cell

Final Assembly Cell

Shipping Area

Workstation Key

Quality
Cutting
Routing
Drilling
Assembly

Sanding
Painting
Curing
Attach Back Panel

Inventory Key

Lumber
Screws
Brackets
Paint

Shelf Assembly
Frame Assembly
Back Panel
Final Shelf
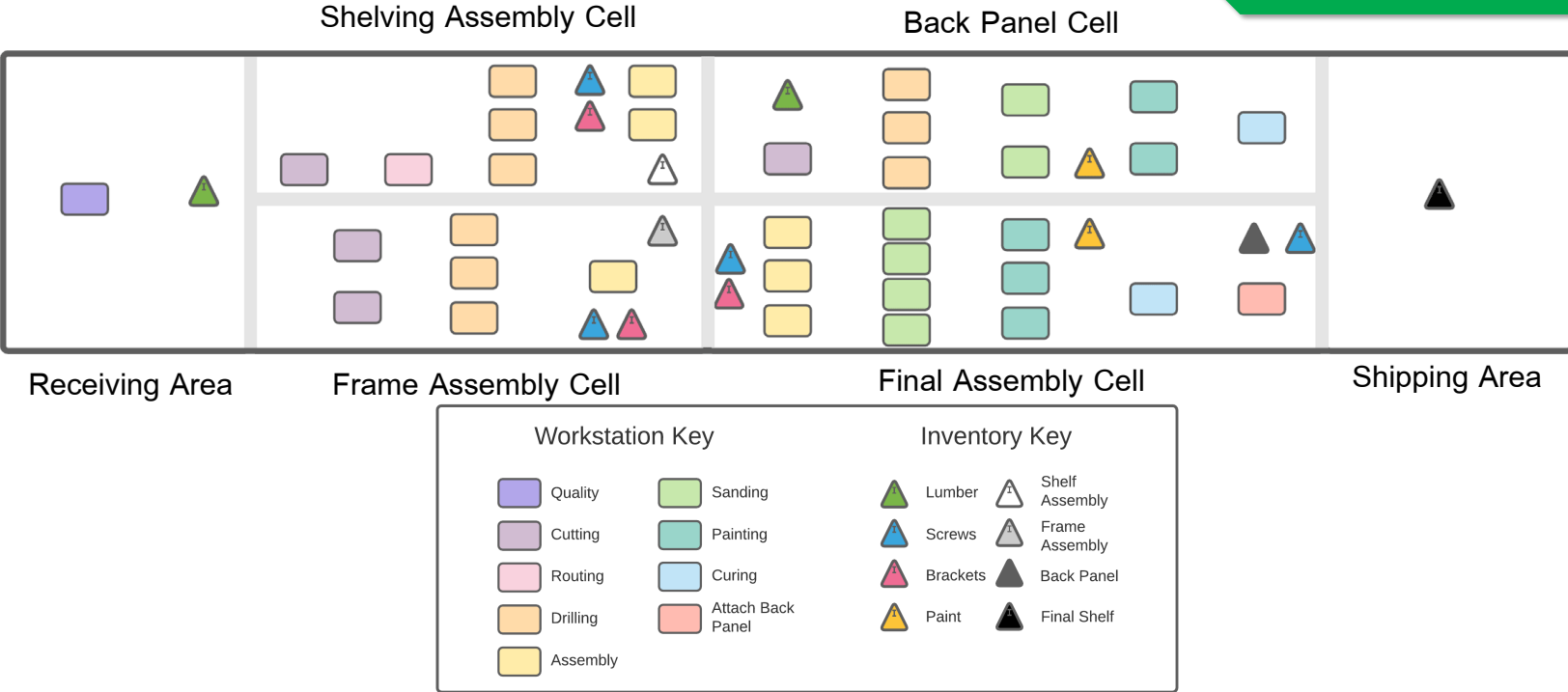
In addition, each cell has a different workstation and inventory as shown in the figure.

Input Data Analysis

Problem Statement
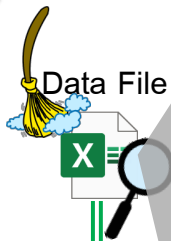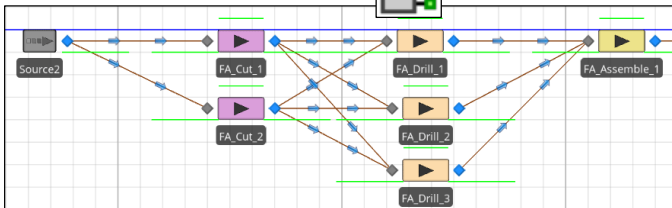
Data File

Simulation Model

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		?	SA_Assemble_1	FALSE
9/28/20 16:59:25	9/29/20 8:13:57	O24_SA		FALSE

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

For example, in the processing data, the data are considered to be cleaned by eliminating the missing data and the data having the run time
To illustrate and improve the process in the factory by using a simulation model, some given data had to be analyzed.
overlapping the lunch break and between 12 PM to 1 PM as well as the data having the start to the end time on different days.

Cleansing Data

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

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.

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
After cleaning the data, there are some categories of data which need to be analyzed.
with a significant level of 5%.

Input Data Analysis

Cleansing Data

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

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 $> \alpha$,

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 → Goodness of Fit test at $\alpha = 0.05$

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.

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 [X≣]

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

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.

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 → Goodness of Fit test at $\alpha = 0.05$

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,
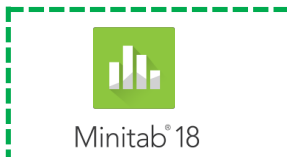
then the data will follow the distribution.

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 [X≡]

└─ 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

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
SA ROUTING(2*3)	FALSE	N/A	N/A
SA ROUTING(2*4)	FALSE	N/A	N/A

Data fitted with the given distribution

Data not fitted with any given distribution

Enter into input parameter

Import to table

& refer the table in input parameter

Simio
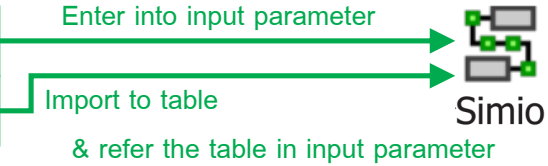
Observing from the results, some data could fitted as most of data processing data can be fitted to the given distribution so therefore simply refer the input parameter of Simio.

Input Data Analysis

Cleansing Data

Inspection time from quality data

Sales data

Lead time (LT) from supplier data

Import to table

& refer the table in input parameter

Simio

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		

In addition, the mean value of both lead time and the defect rate for each data category were computed
Next, the cleansing data of inspection time, sales data, and lead time were used to create the inventory table.
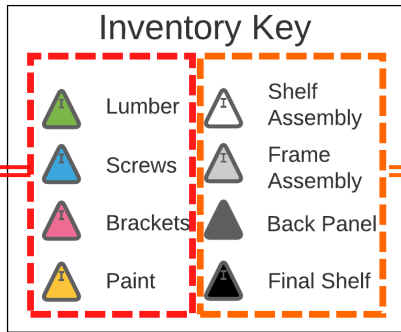and added to the table correspondingly.

Shelving Assembly Cell

Back Panel Cell

Receiving Area

Frame Assembly Cell

Final Assembly Cell

Shipping Area

Inventory Key

Lumber		Shelf Assembly
Screws		Frame Assembly
Brackets		Back Panel
Paint		Final Shelf
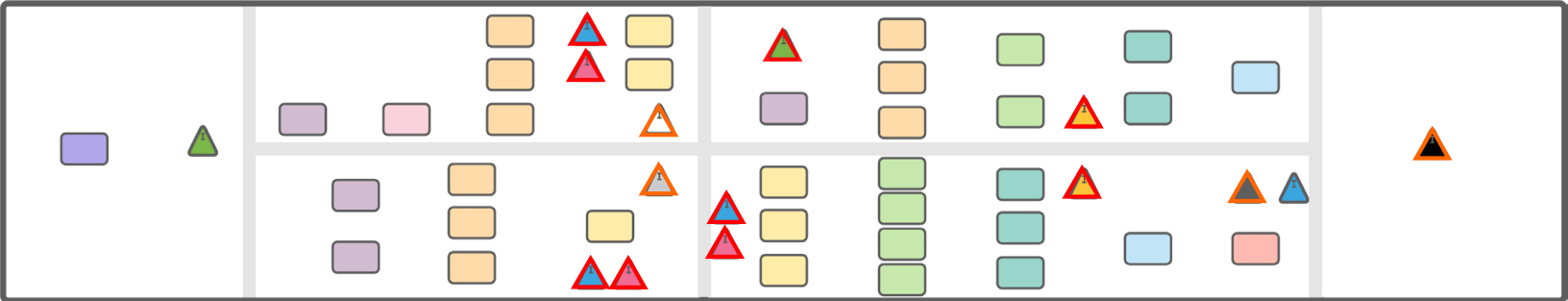
Beginning Inventory

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

Beginning Inventory = 0

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.

First, the initial number of products in work-in-process assembly and final assembly are given to be zero.

Assumptions #2

Final Assembly Cell

INVMAT006_1

INVMAT006_2

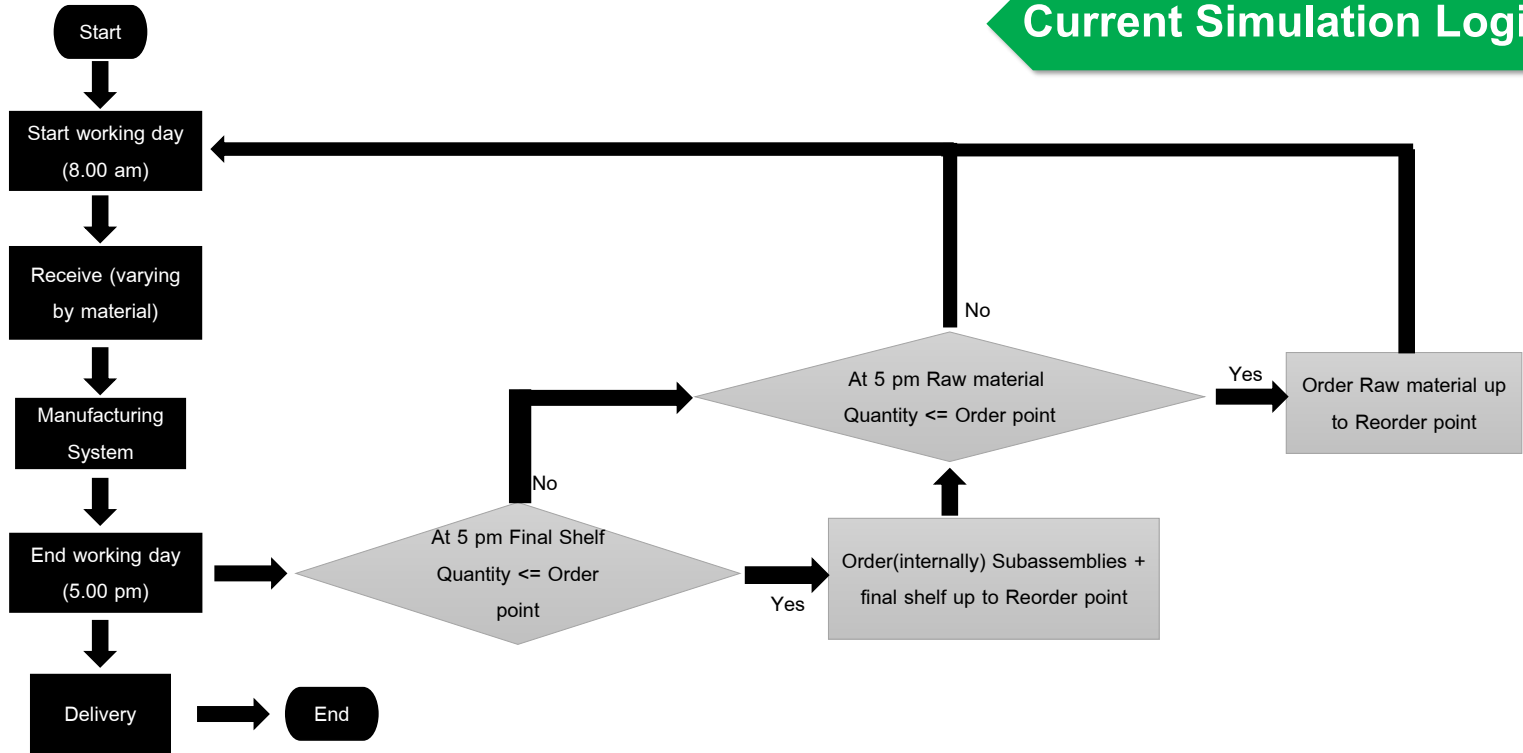| Reorder Point of INVMAT006_1	Order-up-to-level of INVMAT006_1	Reorder Point of INVMAT006_2	Order-up-to-level of INVMAT006_2
Given policy:			
1080	3780	6544	22904
Edited policy:			
6544	22904	1080	3780
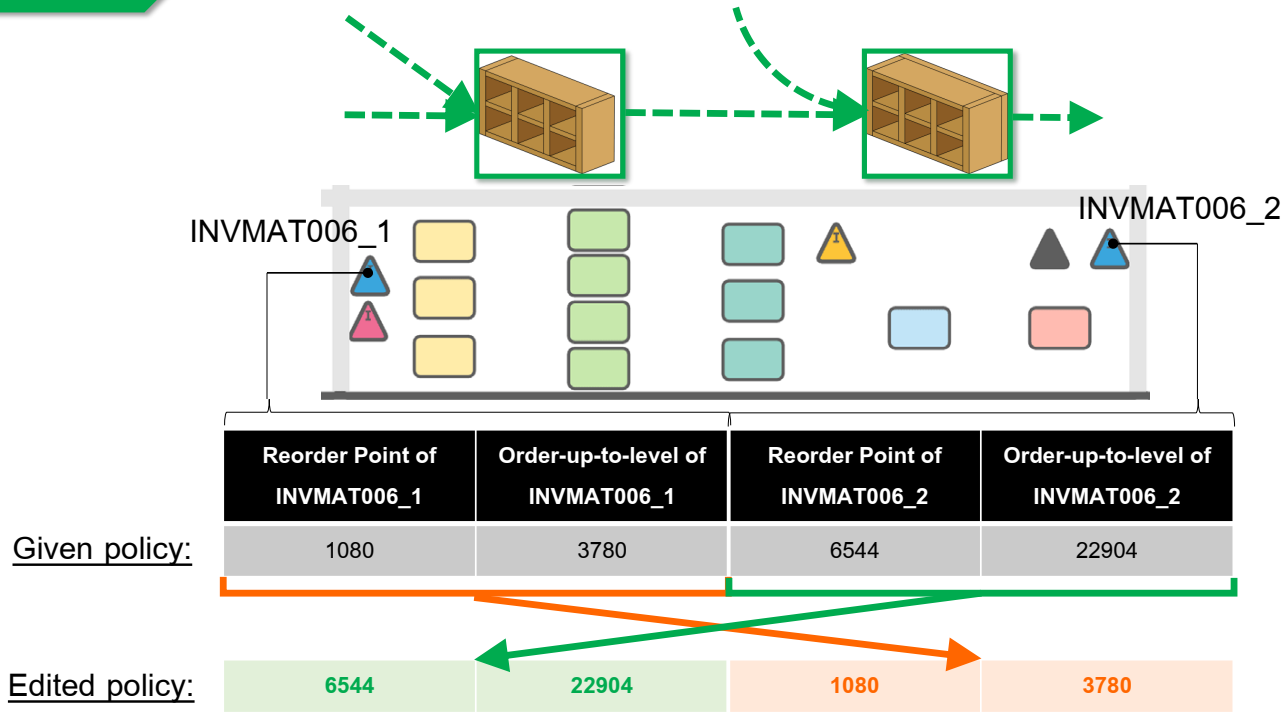
Next assumption, in practice, the demand volume of INVMAT006_1 is supposed to be more than in INVMAT006_2 but their given
data of both reorder point and order-up-to-level don't make sense as INVMAT006_1 is lower while INVMAT006_2 is higher.
As a result, an assumption was made that these two data had to be switched.
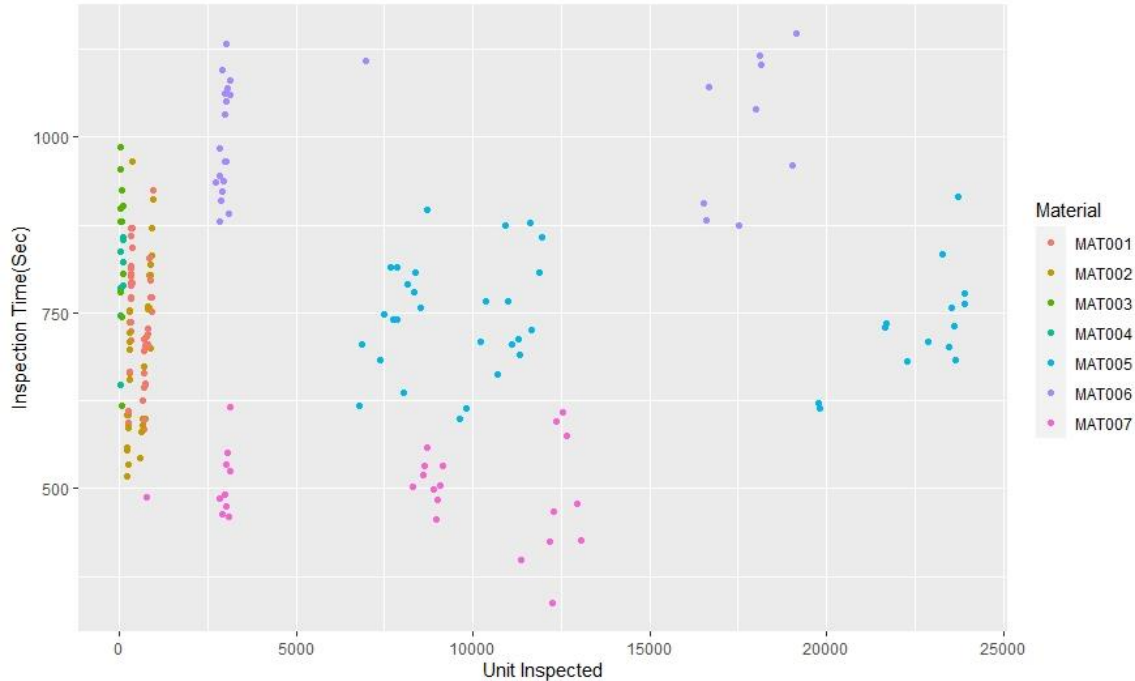
Last assumption, the total inspection time was used instead of the inspection time per unit
In addition, the total inspection time didn't vary by material since the given data might be insufficient in some material.
due to no relationship between the inspected unit and its inspection time.

Current Simulation Logic

Start

Start working day
(8.00 am)

Receive (varying
by material)

Manufacturing
System

End working day
(5.00 pm)

Delivery

End

At 5 pm Final Shelf
Quantity <= Order
point

No

Yes

Order(internally) Subassemblies +
final shelf up to Reorder point

At 5 pm Raw material
Quantity <= Order point

No

Yes

Order Raw material up
to Reorder point

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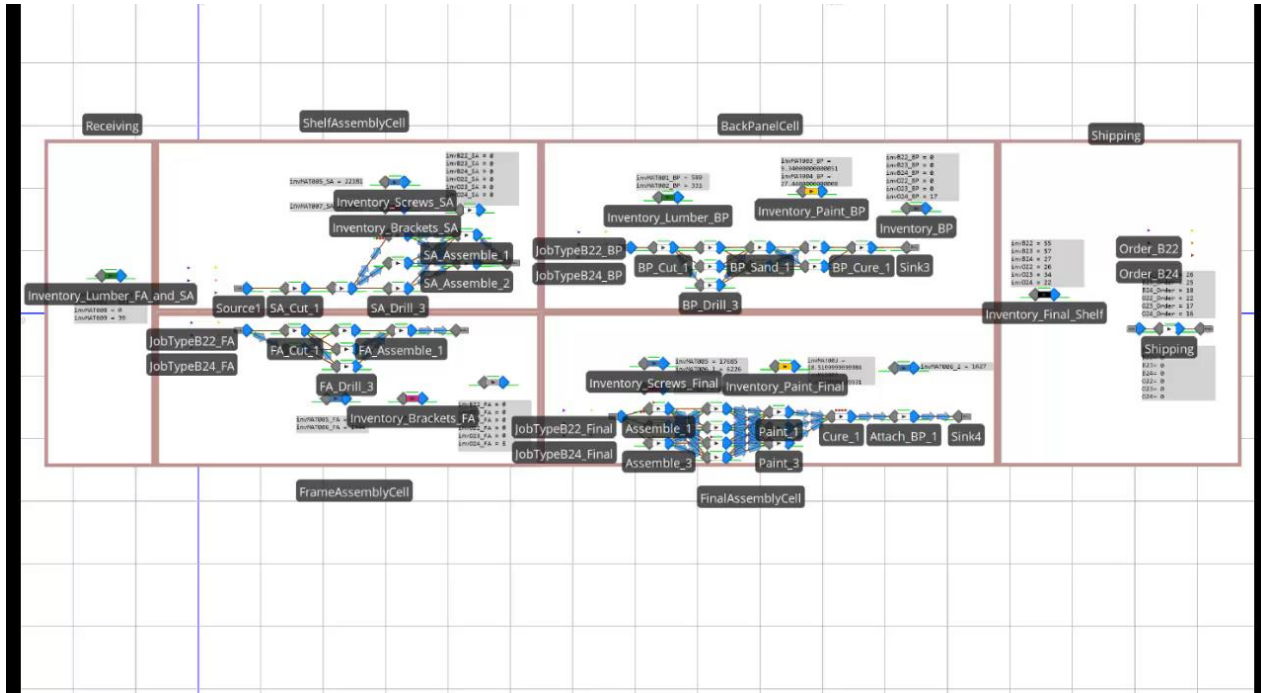
Current Simulation Model

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

DDMRP Model

So however, the consultant has suggested to utilize Demand Driven Material Requirements Planning as an alternative solution.

#1

Lead time = 46 hour = 1.92 days

#2

Buffer capacity = ∞

Server
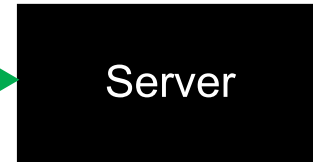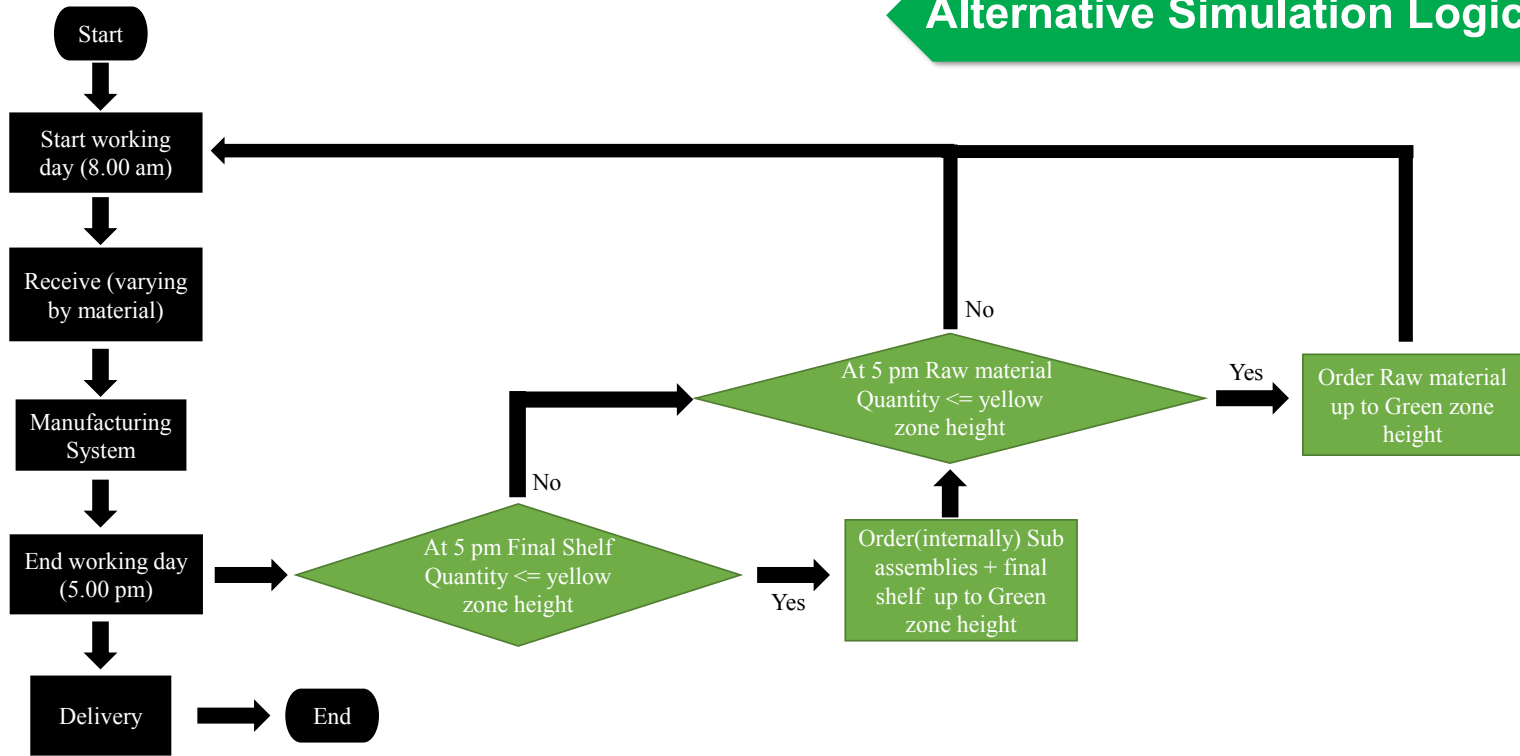
First, the lead time of the final shelf in the DDMRP model is given to be equal to the unit production time of traditional MRP which is
Before the DDMRP simulation model was created, several additional assumptions had been made.
approximately 46 hours or 1.92 days.

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

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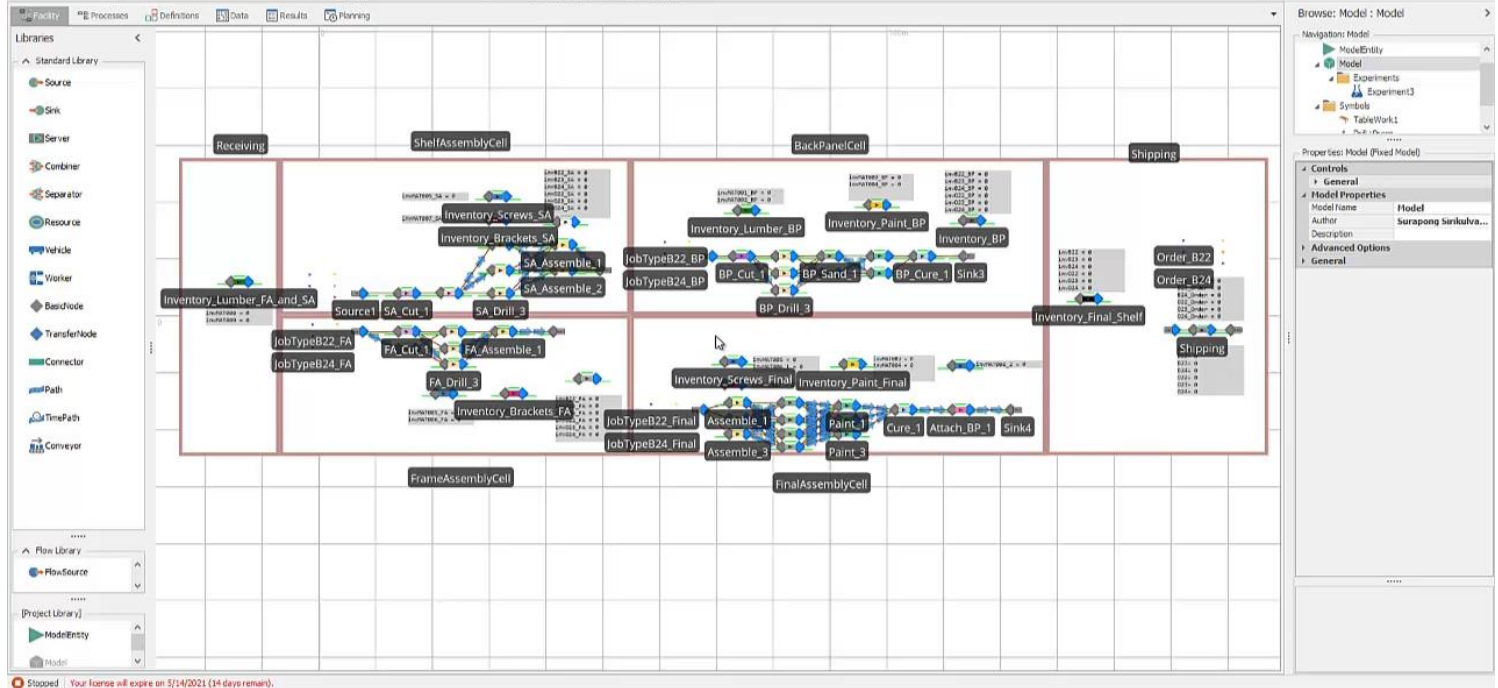
This model can be simply modified into DDMRP model by changing the reorder point After modifying the current MRP model, the DDMRP simulation is displayed as the following. and order-up-to-level of the current policy according to the concern of DDMRP.

Design of experiment

Guidelines for LTF and VF

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

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

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

Given six KPIs as given in the matrix table, decide the KPIs that to be weighted as their priority weight for optimizing the LTF and VF, to which value targets the level 6 to level variability fidelity (VF), should be obtained. The following matrix table illustrates the comparisons of importance for each KPI with factor LTF level 6 to level variability fidelity (VF), should be obtained the following table. which value targets 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 ∵ 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	$(\bar{x} + 1S, \infty)$	$(\bar{x} + 0.5S, \bar{x} + 1S)$	$(\bar{x} - 0.5S, \bar{x} + 0.5S)$	$(\bar{x} - 1S, \bar{x} - 0.5S)$	$[0, \bar{x} - 1S)$

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

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

=
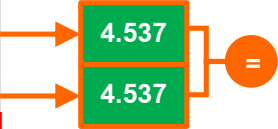
Highest weight rank

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

After however, if both of these results are compared each with KPI and daily denoted the which is the average weights only among both KPI average Consequently, the Optimal (0.5, 0.5) is chosen to be the optimal value to the following model. As a result, The Optimal value or 1.5 is chosen to be the optimal value to both KPI average unmet daily demand of (LTF, VF) at (0.5, 0.5) is less than those of (LTF, VF) at (0.75, 0).
Weight score equals to 4.537.

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, the results of this model are shown as the LTF and VF at 0.5 for all buffers,

Results Comparison of Simulation Models

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,

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%	+7.00%
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%	-76%
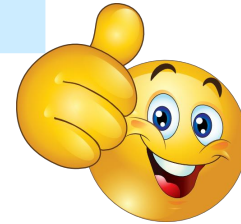
although the inventory cost of DDMRP is higher, the other KPIs in DDMRP perform much better,

meeting most of the factory's objectives.

Results Comparison of Simulation Models

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

Results Comparison of Simulation Models

Project success from buffer plots

Buffer Chart: invB24

Legend: Red, On Hand, Yellow, Green
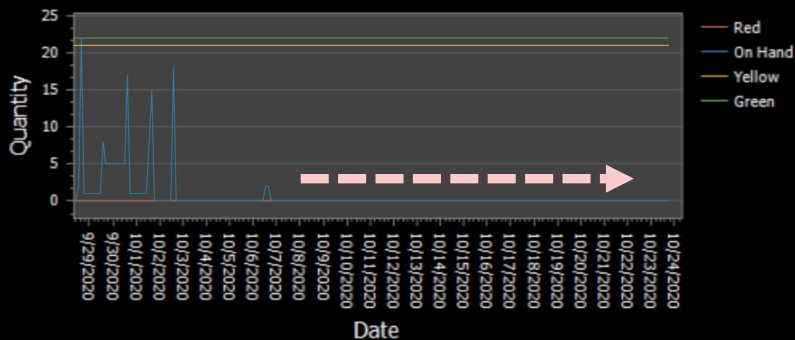
Stockout in long term!!!
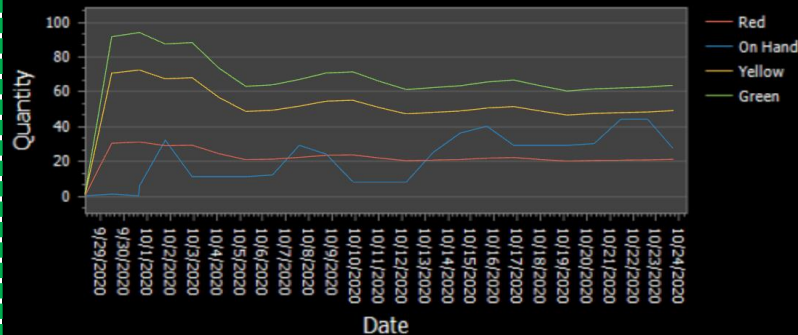
**Decrease of stockouts**

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

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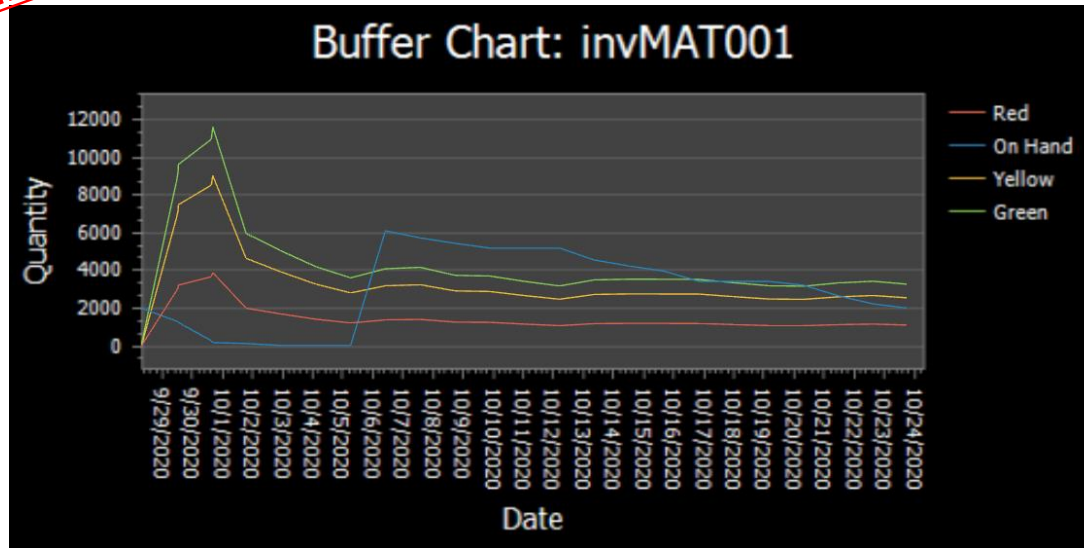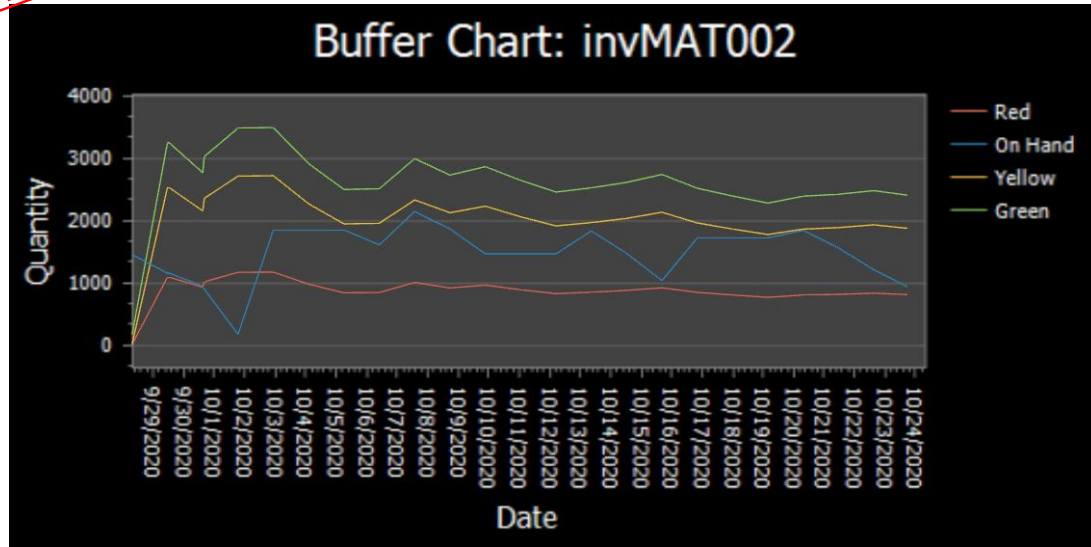
According to the alternative model, five buffers in MAT DDMRP model which has the highest inventory are

According to the buffers in the alternative model,

Top 5 highest inventory cost: invMAT001 > invMAT002
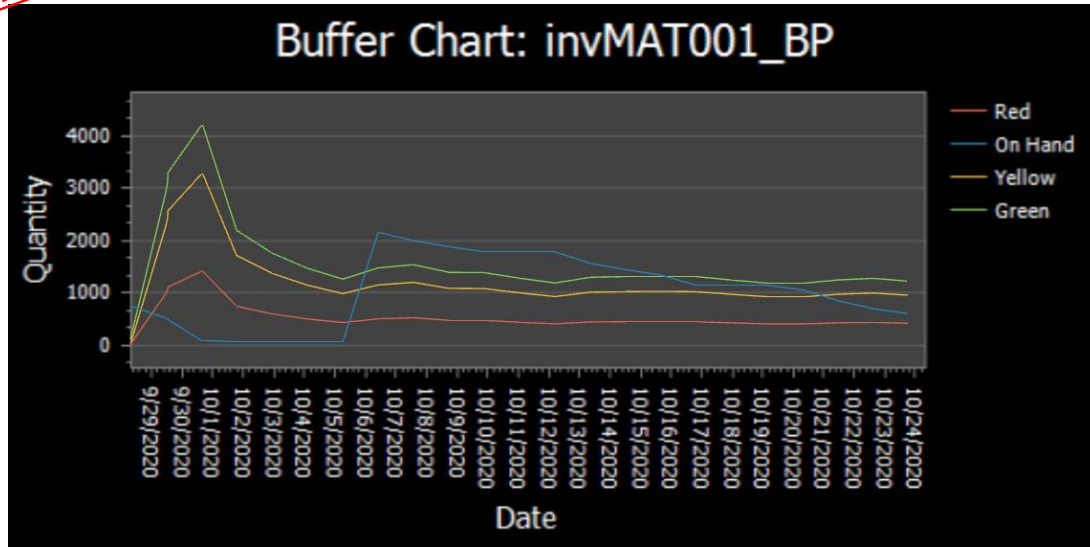
2ⁿᵈ highest inventory cost

Buffer Chart: invMAT002

invMAT002

According to the buffers in the alternative model,

Top 5 highest inventory cost: invMAT001 > invMAT002 > invMAT001_BP

3ʳᵈ highest inventory cost
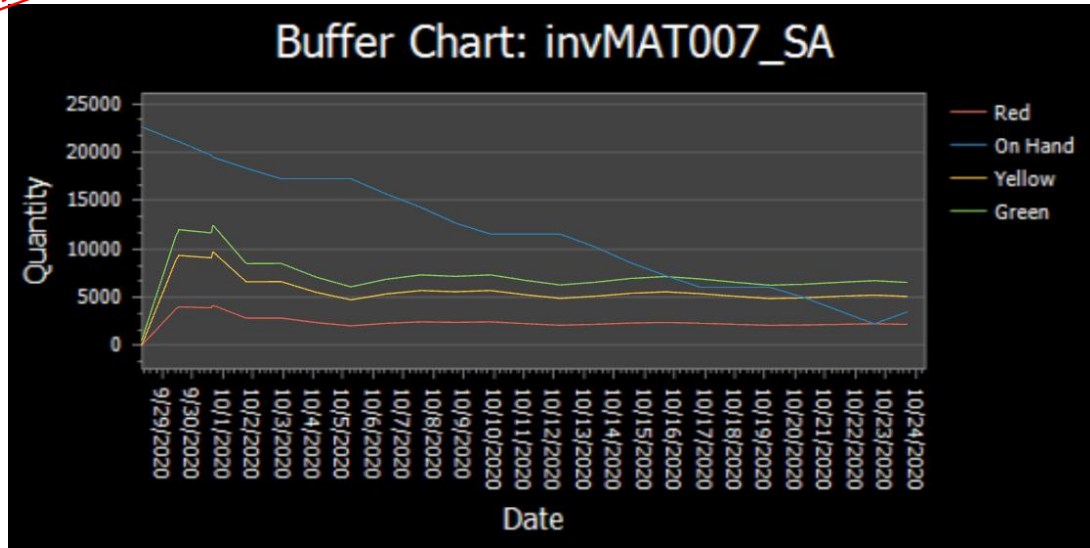

Buffer Chart: invMAT001_BP

invMAT001_BP

According to the buffers in the alternative model,

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

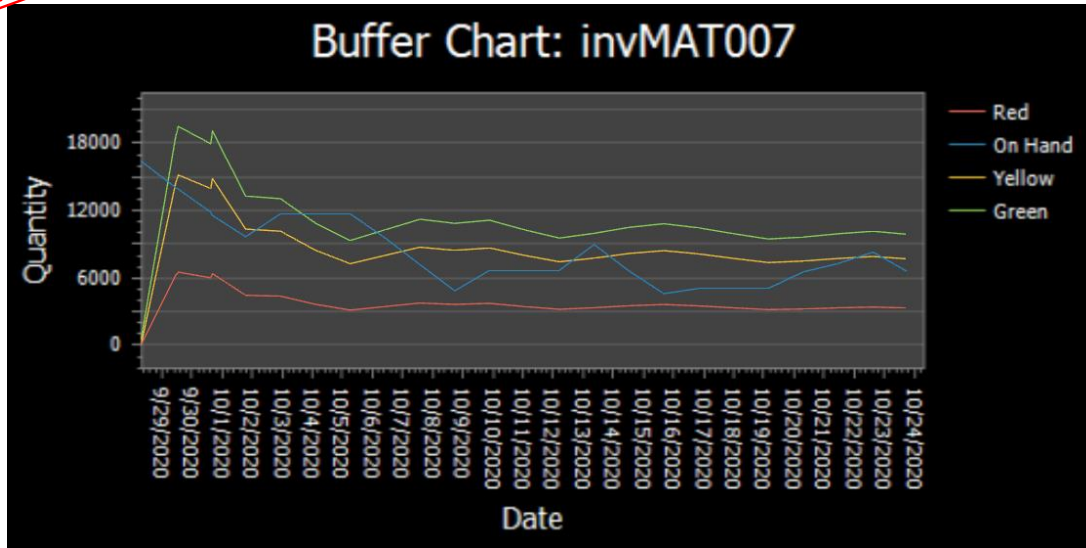4th highest inventory cost

Buffer Chart: invMAT007_SA

invMAT007_SA

According to the buffers in the alternative model,

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

5th highest inventory cost

Buffer Chart: invMAT007

invMAT007

Results Comparison of Simulation Models

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.

Current Model **Vs.** Alternative Model
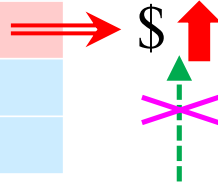
The smaller increment is,

the more possible the true optimal value can be obtained.

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

LTF
Description

OptQuest for Simio - Parameters

Include in Optimizati...	Yes
Minimum Value	0
Maximum Value	1
Increment	0.25

0.25 → 0.10 → 0.05 ⋯

$ ⬆

? Is (LTF,VF) optimal?

LEAN

Minimize: Inventory

New simulation model ← 6σ

NVAN

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

Another obvious to design the sets of LTF and VF for each buffer with combination of lean six sigma in order to minimize the waste in As result, compare with the better alternative by using the calculated expected DBR process should most of the interesting KPIs. Briefly, compared with the attractive MARR, as with the calculated expected DBR cost simultaneously most of the most interesting KPIs. excess inventory which is optimal value added activity but necessary (NVAN).