Report on Manufacturing System Design for Hassis Games

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Problem Definition

Hassis Games is a company which has recently started to produce traditional board games. Now, they only produce two games. Hassis Games has no facility to manufacturer these products. Hassis Games need help to assess the situation and determine the most effective production system based on the needs of Hassis Games. To determine most effective way of production they need to decide the number of machines in each department of production and its facility layout to minimize the cost and enhance its production.

Hassis games also is considering outsourcing their production of one of the games if the economics are feasible. Therefore, it is also required to design the facility for each board game assuming the other will be outsourced.

Assumptions

The report consists of analysis and conclusions based on the production cycle determined by the team members. The addition of machines in the departments in each layout is solely determined by the cycle time and inability to match the production demand by the single set of machines. Area of each department is calculated by the number of machines present in the department. After determining the quantity of machines within a cell, the area is tripled to determine the minimum size of the physical cell. This space is needed for other miscellaneous tools, storage, inventory, and space as well as for maneuvering space for employees, managers, and material handling systems. Each cell is kept rectangular to accommodate them adjacently.

We have analyzed all 3 layouts for individual and combined production of each board games. We have assumed that each layout requires 3 general staff (6 in total if both Atlantic City and Reward are produced in house) to perform changeovers, manage inventory, and transfer materials. The cost of one of these workers is $65,000/year. We have calculated their salary for 5 years and have given them a 3% increment in salary. We have assumed that each assembly station requires an assembly worker and each Grinding/Polishing machine requires a skilled worker for the task.

The layout contains of rectangular blocks. The assembly station is kept in the center of the spine layout to ease up the material flow for the assembly.

Analysis

In this section of the report, we have calculated the required parameters for individual and combined production. The analysis of each layout contributes in providing information regarding number of machines, area and number of personnel required for the particular cell. The section is divided into 3 layouts and each layout contains details regarding production by individual departments/cells & number of machines required to meet the required demand.

- Atlantic city Layout
- Reward Layout
- Combined Production Layout

Atlantic City Layout:

Department wise production:

❖ Player Board:

Ideal Production:
We are doing the lot streaming for each department.
Batch size Q= 250
Loading time = 10 minutes
Operations:
1: Drying time = 24 sec/sheet
2: Scoring = 5 sec/sheet
3: Folding = 5 sec/sheet

Applying the single unit lot streaming formula for 250 units.

$$M = \sum_{j=1}^{b-1} p_j + Q \cdot p_b + \sum_{j=b+1}^{M} p_j$$

It takes 1210 seconds ideally to produce one batch of Player board.
So, it takes **4.84 sec** to produce 1 unit ideally for this department.

Considering the operations failures into account:

Calculating the availability of machines for the Player board department:

$$A_{i,0} = \lim_{t\to\infty} \frac{E(uptime)}{E(uptime) + E(downtime)} = \frac{1/a_j}{1/a_i + b_i^{-1}} = \frac{1}{1 + a_i \cdot b_i^{-1}}$$

$$A_0 = \prod_{i=0}^{M} [1 + a_i \cdot b_i^{-1}]^{-1}$$

$A_{\text{Player Board Dept.}}$ = 0.96

Now, calculating the production time for the production while taking availability into account
After considering the availability, it takes **5 secs** to produce one unit.

Now,
Cycle time = Total Available duration/ Production
= 1950*60*60/130,000
= 54 sec

Now calculating the production time for each department following the same calculations:

No.	Department	Operations	Ideal Production time/Unit	Availability	Actual Production	Cycle time
1	**Player Board**	1: Drying time = 24 sec/sheet 2: Scoring = 5 sec/sheet 3: Folding = 5 sec/sheet	4.84 s	0.968	5 s	
2	**Player Card Cell**	1: Printing = 18 sec/game 2: Cutting = 10 sec/game 3: Stacking = 14 sec/game	21.35 s	0.968	22.05 s	
3	**Player Money**	Batch size Q= 100 Operations: 1: Melting = 20 minutes/batch 2: Cooling = 20 minutes/batch 3: Grinding/Polishing = 30 sec/token	22.64	0.968	23.38 s	**54 s**

4	**Metal tokens**	Batch size Q= 100 Operations: 1: Melting = 20 minutes/batch 2: Cooling = 20 minutes/batch 3: Grinding/Polishing = 30 sec/token	221.99 s	0.963	230.51 s	
5	**Box Cell**	Operations: 1: Printing: 24*2 = 48 sec/game 2: Scoring/ Folding/ Gluing = 20 sec/ game 3: Drying = 30 sec /game	50.2	0.968	51.8 s	

Here we can see that **Metal Tokens** department is exceeding our cycle time of 54 sec. We need to customize this department by adding machines to the bottleneck station.

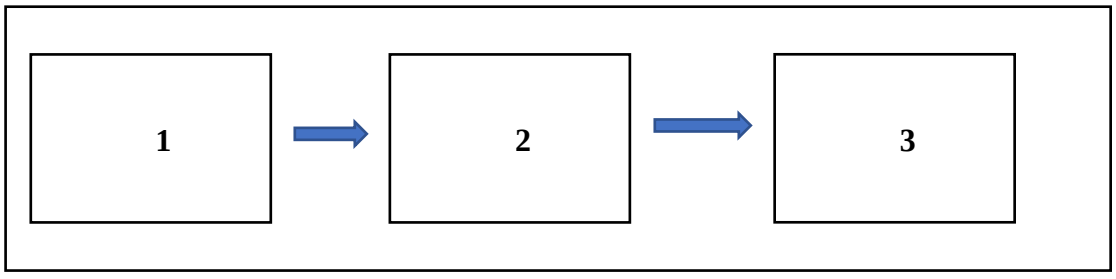
Customization for Metal Token Department:

As we have calculated the Metal Token department takes 230.51 secs to produce tokens for a single game; That exceeds our cycle time of 54s. We need to add the buffer to the system or we need to add extra machines to produce the required units in the given time constraint.

Now we will do the cost analysis for selecting the better system.

We will compare the cost of putting a buffer in the department and we will also compare it by putting extra set of machines in the department.

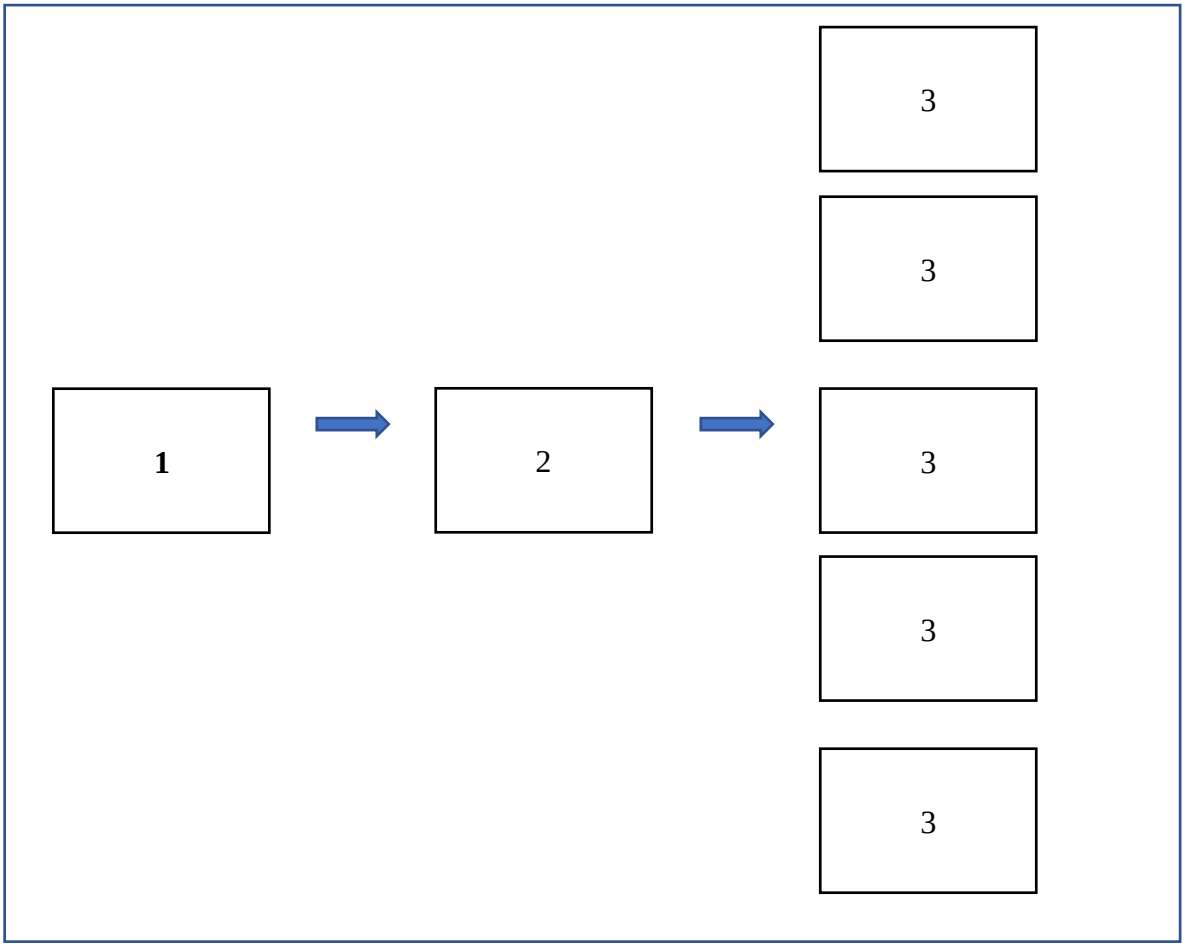
Normal structure using single set of machines:



1	2	3
Melting Machine	**Cooling Machine**	**Grinding/Polishing**
20 min/ batch	**20 min / batch**	**30 sec/token Standard Deviation: 3sec**
12 sec/game	**12 sec/game**	**$=30*600 + 2.33(3*600)^{1/2}$ =180.98 sec/game**

Here we can see that while having the single set of machines, our bottleneck station is exceeding our 54-sec time limit.

So, to accommodate the bottleneck production in 54 secs, we will include 5 Grinding/ Polishing machines in parallel.



1	2	3
Melting Machine	**Cooling Machine**	**Grinding/Polishing (5 machines)**
20 min/ batch	**20 min / batch**	**30 sec/token**

		Standard Deviation: 3sec
12 sec/game	**12 sec/game**	**$=30*600 + 2.33(3*600)^{1/2}$ =180.98 sec/game =180.98 / 5 =36.196 sec/game**
A_1=0.90	**A_2=0.90**	**A_3=0.99**

System Availability at Grinding/Polishing machine:
=0.90*0.90*0.99
=0.80
Bottleneck station timing for producing the tokens for one game:
=36.196/0.80
=45.245

Thus, after putting 5 sets of Machines we have reduced it to 45.245 secs.

So, our team recommends that it is better to use 5 machines for the Metal Token department to ensure the production in given cycle time frame.

Assembly:

Cycle time = Total Available duration/ Production
= 1950*60*60/130,000
= 54 sec
Applying RPW for the assembly process:

Task	Positional Weight	Rank
A	80	4
B	80	5
C	80	6
D	80	7
E	85	3
F	90	2
G	115	1
H	80	8
I	65	9
J	40	10

Station	Task
1	G, F
2	E, A, B
3	C, D, H
4	I
5	J

Layout for Atlantic city:

We will calculate the f value to proceed with the layout structure for the Atlantic city board game.

Departmental Flow:

Departments	Player Board	Player card	Metal Token	Box Cell	Player Money	Assembly
Player Board	0	0	0	0	0	250
Player card	0	0	0	0	0	150
Metal Token	0	0	0	0	0	100
Box Cell	0	0	0	0	0	250
Player Money	0	0	0	0	0	200
Assembly	0	0	0	0	0	0

F-values:

f	2.66
f_u	2.45
f_l	0.39
$f^{'}$	0.06

Here, we can see that **f** value is 2.66 and $\mathbf{f}^{'}$ is 0.06. We know that f values greater than 2 and $\mathbf{f}^{'}$ values closer to 0 have a few dominant flows and therefore these structures are easy to solve. So, we will follow the spine approach for the material flow.

Layout Structure for Atlantic City board game:

Atlantic City Cost Analysis:

Departments	Machines	Cost for Machines	Space Required for department	Cost for Space	Employees required for each department	Total cost/department
Player Board	Printer: 1 Scoring Knives Machine: 1 Folding Machine: 1	1.2 M + 0.512 M + 0.423 M **=2.135 M**	270 sq. ft	0.254 M	General Workers & Floor Supervisor: 3 * 1.03 M + 0.570 M **= 3.66 M**	2.389 M
Player Card Cell	Printer: 1 Cutter: 1 Card Sorter: 1	1.69 M + 0.619 M + 1.05 M **=3.339 M**	315 sq. ft	0.297 M		3.68 M
Player Money	Printer: 1 Cutter: 1 Paper Sorter: 1	1.23 M+ 0.308 M+ 1.29 M **=2.82 M**	510 sq. ft	0.480 M		3.28 M
Metal Tokens	Melting Vat: 1 Casting Area: 1 Grinding Station: 5	0.951 M + 1.19 M+ 5*0.105M **= 2.66 M**	500 sq. ft	0.471 M	Metal worker: 2.52 M	5.671 M
Box Cell	Printer: 1 Scoring Knives Machine: 1 Dryer: 1	0.904 M + 1.21 M+ 0.801M **= 2.9 M**	235 sq. ft.	0.221 M		3.121 M
Assembly	Assembly station: 5	=0.182*5 **=0.91 M**	150 sq. ft.	0.141 M	Assembly worker: **= 2.12 M**	5.691 M
Total Cost for Atlantic City						=23.163 + 3.66 + 0.373 **=27.19 M**

As we can see that it costs us **$27.19 M** for setting up the layout for producing Atlantic city board game for 5 years run. The cost includes facility space, purchase of machines and allotment of salary for the company personnel.

Cost for a single unit from this layout:

$$= \frac{27.19 * 10,00,000}{5*130000}$$

= **$41/ Board game.**

Reward Layout

❖ Department wise production

Cycle time = Total Available duration/ Production
= 1950*60*60/195,000
= 36 sec

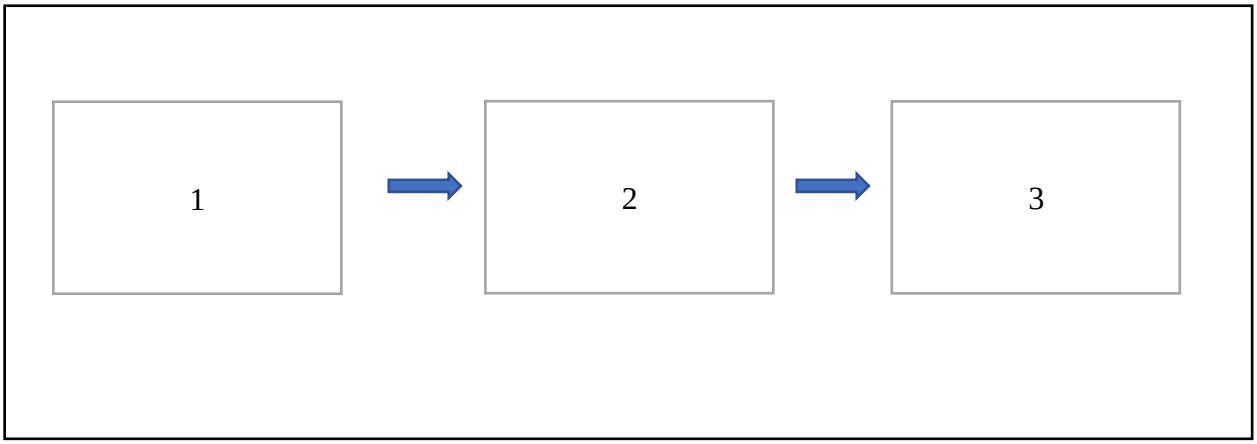
Now calculating the production time for each department.

No.	Department	Operations	Ideal Production time/Unit	Availability	Actual Production	Cycle time
1	**Player Board**	1: Drying time = 24 sec/sheet 2: Scoring = 5 sec/sheet 3: Folding = 5 sec/sheet	26.44 s	0.968	27.31 s	
2	**Player Card Cell**	1: Printing = 18 sec/game 2: Cutting = 10 sec/game 3: Stacking = 14 sec/game	21.36 s	0.968	22.066 s	
3	**Plastic tokens**	Batch size Q= 100 Operations: 1: Injection molding = 25 sec/mold 2: Cooling = 20 sec/ mold 3: Grinding =40*1.75 + $2.33*(0.2*40)^{1/2}$ =76.59/batch	N/A	0.96	N/A	**36 s**
4	**Box Cell**	Operations:	50.2	0.968	51.85 s	

		1: Printing: 24*2 = 48 sec/game 2: Scoring/ Folding/ Gluing = 20 sec/ game 3: Drying = 30 sec /game				

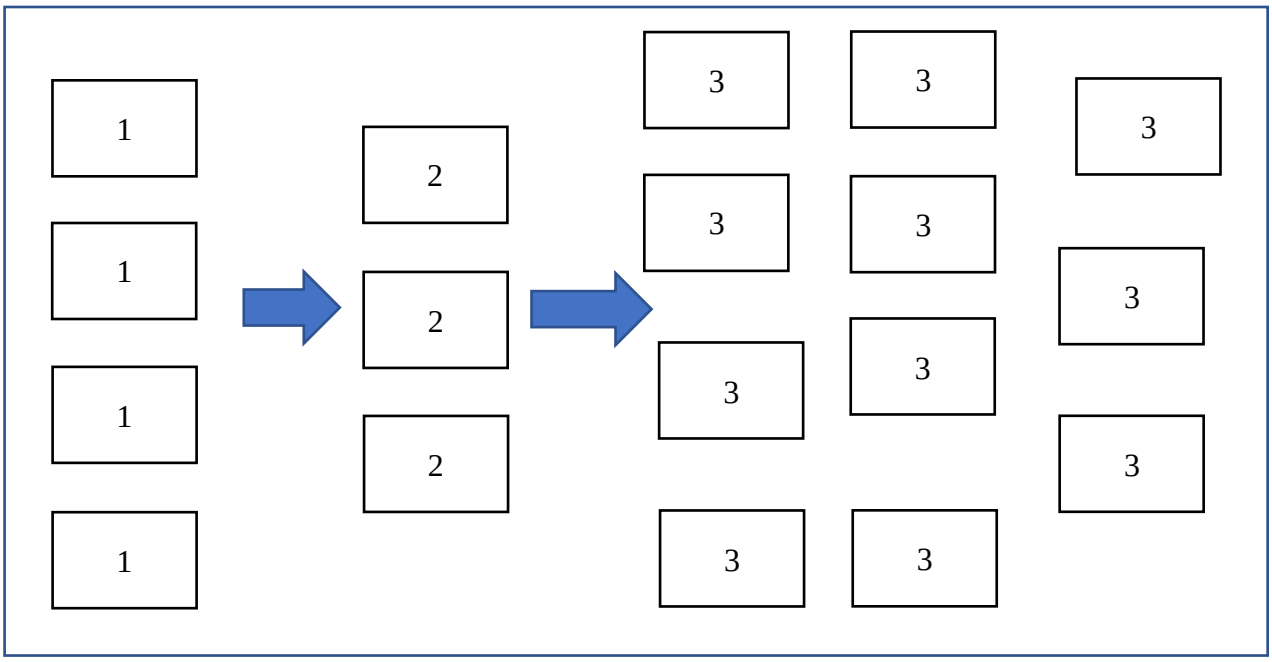
Here we can see that two department Plastic Tokens & Box Cell is exceeding our cycle time of 36 sec. We need to customize this department by adding machines to the bottleneck station.

Customization for Plastic Token Department:



1	2	3
Injection Molding	**Cooling Machine**	**Grinding**
125 sec/ game	**100 sec/game**	**382.95/game**

As we can see all of the machines takes more than 36 sec to produce one unit of game. So, we will add additional sets of machines for each of the functions



1	2	3
Injection Molding	**Cooling Machine**	**Grinding**
125 sec/ game	**100 sec/game**	**382.95/game**
Time after adding machines: 31.25 sec/game	**Time after adding machines: 33.33 sec/game**	**Time after adding machines: 34.81 sec/game**

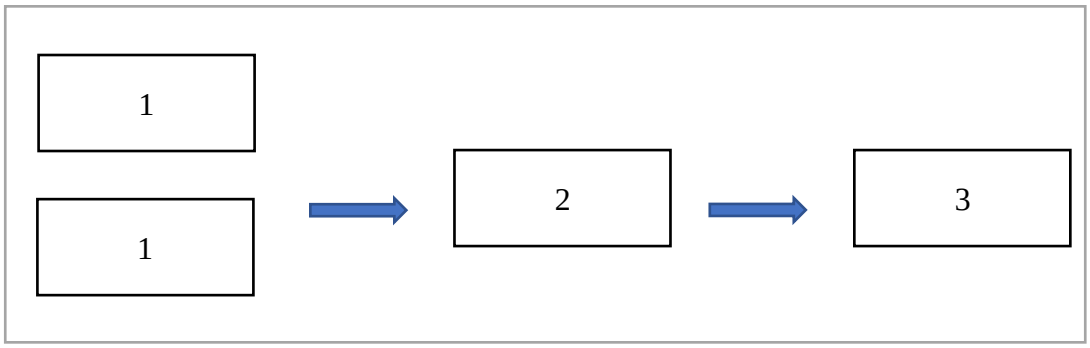
So, our team recommends that it is better to use 4 Injection Molding machines, 3 Cooling Machines & 11 grinding machines for the Metal Token department to ensure the production in given cycle time frame.

Customization for Box Cell Department:

1	2	3
Printing Machine	**Scoring/Folding/Gluing Machine**	**Drying Machine**
48 sec/game	**20 sec/game**	**30 sec/game**

Now after doing the lot streaming we have the throughput time for the Box-cell Department:
=48*250 + 50
=12050 sec

Per part production time:
=12050/250
=50.2 sec
It is more than our cycle time of 36 sec.
Now, after adding one more machine at the bottleneck station will make the throughput production time in 36 sec range.



1	2	3
Printing Machine	**Scoring/Folding/Gluing Machine**	**Drying Machine**
48 sec/game	**20 sec/game**	**30 sec/game**
After using 2 machines 24 sec/game	**20 sec/game**	**30 sec/game**
A_1=0.99	**A_2=0.98**	**A_3=0.98**

System availability at Grinding/Polishing machine:
=0.99*0.98*0.98
=0.95

Now, calculating the throughput time considering Drying machine station as bottleneck station.
=44+30*250
=7544 sec/ batch

Therefore,
=7544/250
=32.4 sec/part

Bottleneck station timing for producing a box one game:
=32.4/0.95
=34.1

So, our team recommends that it is better to use 2 machines for printing in the Box Cell department to meet the production cycle time constraint of 36s.

Assembly:

Cycle time = Total Available duration/ Production
= 1950*60*60/195,000
= 36 sec

Task Time	Positional Weight	Rank
A	84	6
B	93	1
C	93	2
D	93	3
E	93	4
F	93	5
H	71	7
I	45	8
J	40	9

Station	Task
1	B
2	C
3	D
4	E
5	F
6	A
7	H, I
8-1, 8-2	J1, J2

So, the assembling process for the Reward game will have 8 stations. As the task-J takes 40 seconds, we will divide that task into two tasks and assign a parallel station to accommodate the 40 second task.

Layout for Reward Board Game:

Departmental Flow:

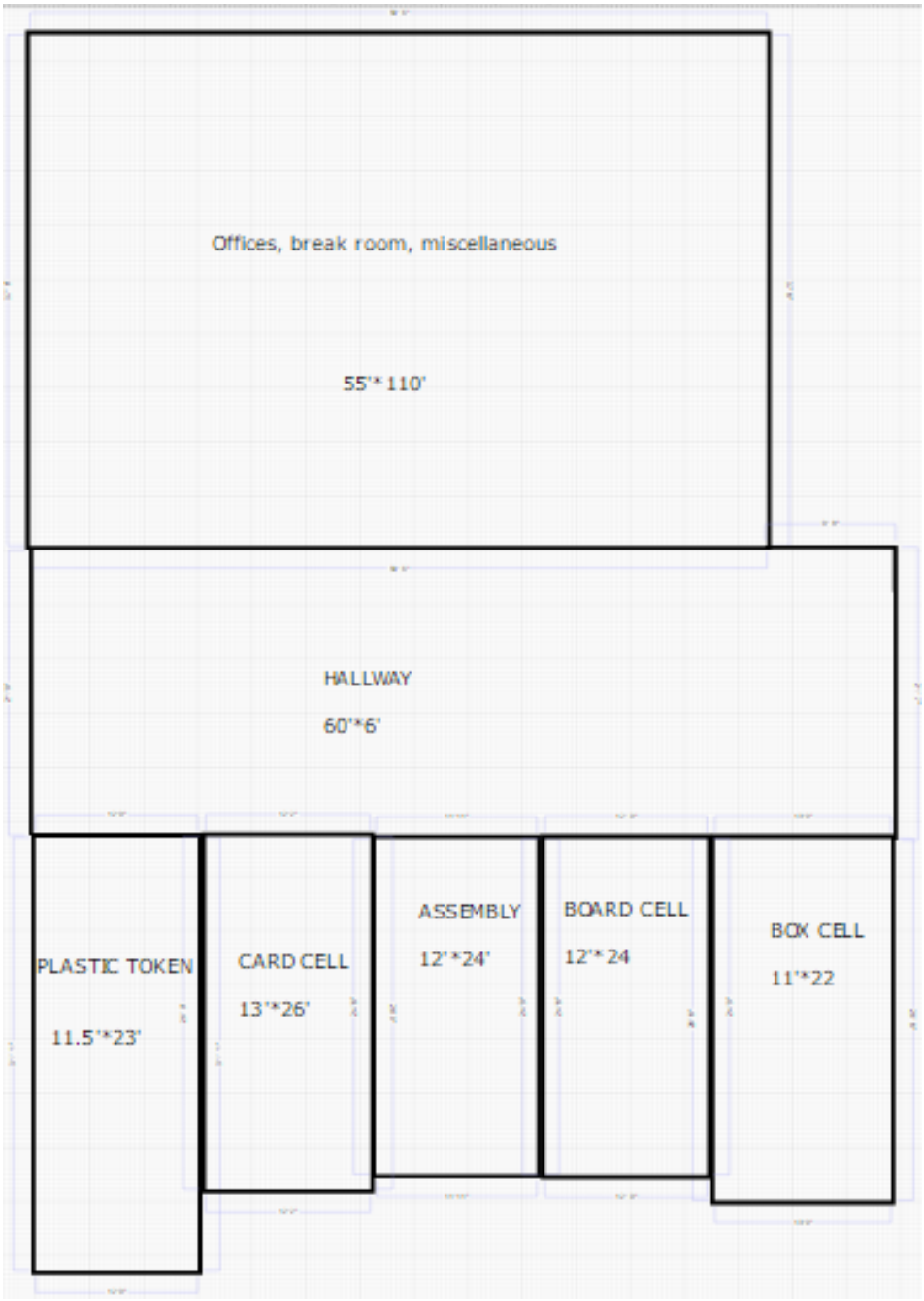
Departments	Player Board	Player card	Metal Token	Box Cell	Assembly
Player Board	0	0	0	0	250
Player card	0	0	0	0	150
Plastic Token	0	0	0	0	200
Box Cell	0	0	0	0	250
Assembly	0	0	0	0	0

F-values:

f	2.85
f_u	2.29
f_l	0.51
$f^{'}$	0.2

Here, we can see that **f** value is 2.85 and $\mathbf{f}^{'}$ is 0.2. We know that f values greater than 2 and $\mathbf{f}^{'}$ values closer to 0 have a few dominant flows and therefore these structures are easy to solve. So, we will follow the spine approach for the material flow as the values match the criteria.

Layout Structure for Reward Board Game:



Reward Cost Analysis:

Departments	Machines	Cost for Machines	Space Required for department	Cost for Space	Employees required for each department	Total cost/department
Player Board	Printer: 1 Scoring Knives Machine: 1 Folding Machine: 1	1.2 M + 0.512 M + 0.423 M **=2.135 M**	270 sq. ft	0.254 M	General Workers & Floor Supervisor: 3 * 1.03 M + 0.570 M = **3.66 M**	2.389 M
Player Card Cell	Printer: 1 Cutter: 1 Card Sorter: 1	1.69 M + 0.619 M + 1.05 M **=3.339 M**	315 sq. ft	0.297 M		3.68 M
Plastic Tokens	Injection Molding Machine: 5 Cooling Station: 3 Grinding/Separating Station: 11	**=11.418 M**	250 sq. ft	0.235 M	Plastic Token Worker: **3.79 M**	15.208 M
Box Cell	Printer: 2 Scoring Knives Machine: 1 Dryer: 1	**=3.189 M**	310 sq. ft.	0.292 M		3.481 M
Assembly	Assembly station: 9	**=1.63 M**	270 sq. ft.	0.254 M	Assembly worker: **3.82 M**	3.51 M
Total Cost for Reward						= 28.26 + 3.66 + 0.339 **=32.259 M**

It costs us **$32.259 M** for setting up the layout for producing Atlantic city board game for 5 years run. The cost includes facility space, purchase of machines and allotment of salary for the company personnel.

Cost for a single unit from this layout:

$$= \frac{32.259 * 10,00,000}{5*195000}$$

= **$33/ Board game**

Combined Production: Atlantic City & Reward

❖ Department wise production

Cycle time = Total Available duration/ Production
= 1950*60*60/195,000*130,000
= 21.6 sec

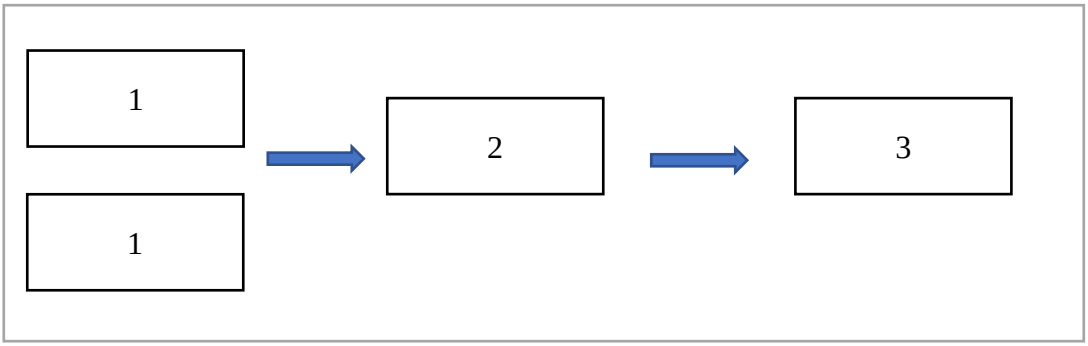
Now calculating the production time for each department.

No.	Department	Operations	Ideal Production time/Unit	Availability	Actual Production	Cycle time
1	**Player Board**	1: Drying time = 24 sec/sheet 2: Scoring = 5 sec/sheet 3: Folding = 5 sec/sheet	26.44 s	0.968	27.31 s	
2	**Player Card Cell**	1: Printing = 18 sec/game 2: Cutting = 10 sec/game 3: Stacking = 14 sec/game	21.36 s	0.968	22.066 s	
3	**Player Money**	Batch size Q= 100 Operations: 1: Melting = 20 minutes/batch 2: Cooling = 20 minutes/batch 3: Grinding/Polishing = 30 sec/token	22.64	0.968	23.38 s	**21.6 s**
4	**Metal tokens**	Batch size Q= 100 Operations: 1: Melting = 20 minutes/batch 2: Cooling = 20 minutes/batch	221.99 s	0.963	230.51 s	

		3: Grinding/Polishing = 30 sec/token				
5	**Plastic tokens**	Batch size Q= 100 Operations: 1: Injection molding = 25 sec/mold 2: Cooling = 20 sec/ mold 3: Grinding =40*1.75 + $2.33*(0.2*40)^{1/2}$ =76.59/batch	N/A	0.96	N/A	
6	**Box Cell**	Operations: 1: Printing: 24*2 = 48 sec/game 2: Scoring/ Folding/ Gluing = 20 sec/ game 3: Drying = 30 sec /game	50.2	0.968	51.85 s	

Here, we can see that Player board department is exceeding the production cycle time of **21.6 sec.** So, for the **player board department, the player card cell department and the Box cell department** we need to add extra machine for the bottleneck station. It requires the modification in the number of machines in the system.

Modification in the Player Board department:

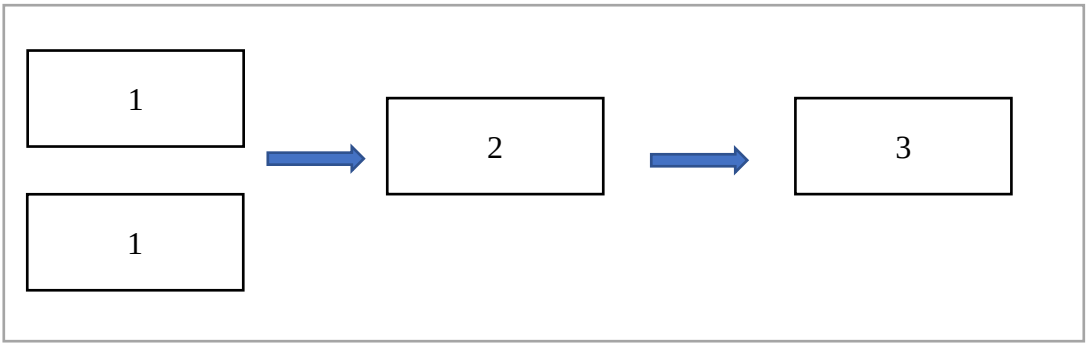


1	2	3
Printing Machine	Scoring Machine	Drying Machine
24 sec/game	5 sec/ game	5 sec/ game
After adding a second machine: 12 sec/game	5 sec/ game	5 sec/ game

Throughput time after adding the machine at the bottleneck station:
=Loading time/unit + Bottleneck station time
=2.4s + 12s
=14.4 sec
After adding the second machine at the bottleneck station we reduced the throughput time from **27.13 sec to 14.4 sec**.

Availability of the modified system: 0.95
Final Throughput time for the system:
=14.4s / 0.95
=15.15

Modification in the Player Card Cell department:

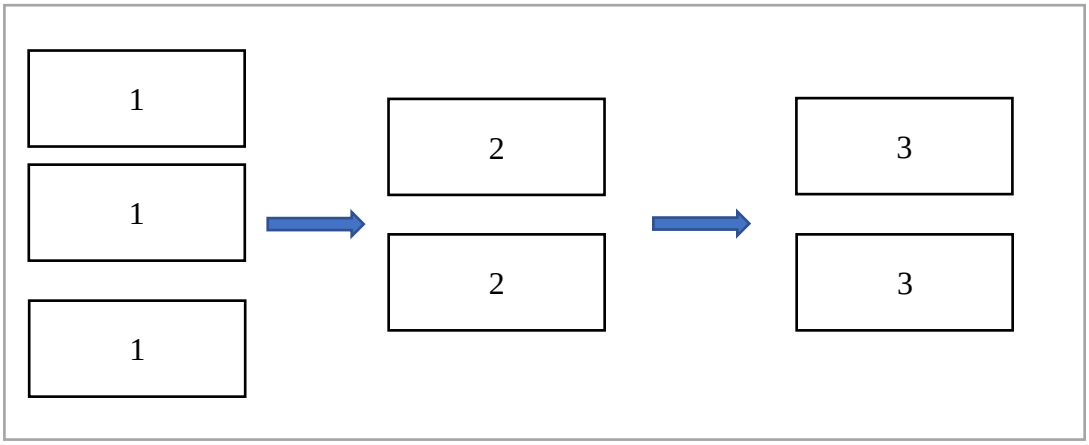


1	2	3
Printing Machine	Cutting Machine	Stacking
18 sec/game	10 sec/ game	14 sec/ game
After adding a second machine: 9 sec/game	10 sec/ game	14 sec/ game

Throughput time after adding the machine at the bottleneck station:
=Loading time/unit + Bottleneck station time
=14s + 3.2s
=17.2 sec
After adding the second machine at the bottleneck station we reduced the throughput time from **48. sec to 17.02 sec**.

Availability of the modified system: 0.95
Final Throughput time for the system:
=17.02 sec/ 0.95
=18.10 sec

Modification in the Box Cell department:



1	2	3
Printing Machine	Cutting Machine	Stacking
After 12 sec/game	10 sec/game	15 sec/game

Throughput time after adding the machine at the bottleneck station:
=Loading time/unit + Bottleneck station time
=15s + 2.4s
=17.4 sec
After adding the second machine at the bottleneck station we reduced the throughput time from **51.85 sec to 17.4 sec**.

Availability of the modified system: 0.95
Final Throughput time for the system:
=17.4 sec/ 0.95
=18.31 sec

Assembly:

In the combined structure, we will accommodate single assembly line with a flexible design to assemble the parts for both the games. To accommodate both production parts, we will try to use the Rank Positional Weight technique to accommodate every task in the given cycle time of **21.6 sec.**

Cycle time = Total Available duration/ Production
= 1950*60*60/195,000*130,000
= 21.6 sec

- **For assembling parts of Atlantic City:**

Task	Positional Weight	Rank
A	80	4
B	80	5
C	80	6
D	80	7
E	85	3
F	90	2
G	115	1
H	80	8
I	65	9
J	40	10

Station	**Task**
1	**G1, G2**
2	**F**
3	**E**
4	**A**
5	**B**
6	**C**
7	**D**
8	**H**
9	**I**
10	**J**

- **For assembling parts of Reward:**

Task Time	Positional Weight	Rank
A	84	6
B	93	1
C	93	2
D	93	3
E	93	4
F	93	5
H	71	7
I	45	8
J	40	9

Station	Task
1	B1, B2
2	C1, C2
3	D1, D2
4	E1, E2
5	F1, F2
6	A
7	H1, H2
8	I
9	J1, J2

Layout for the combined manufacturing:

Departmental Flow:

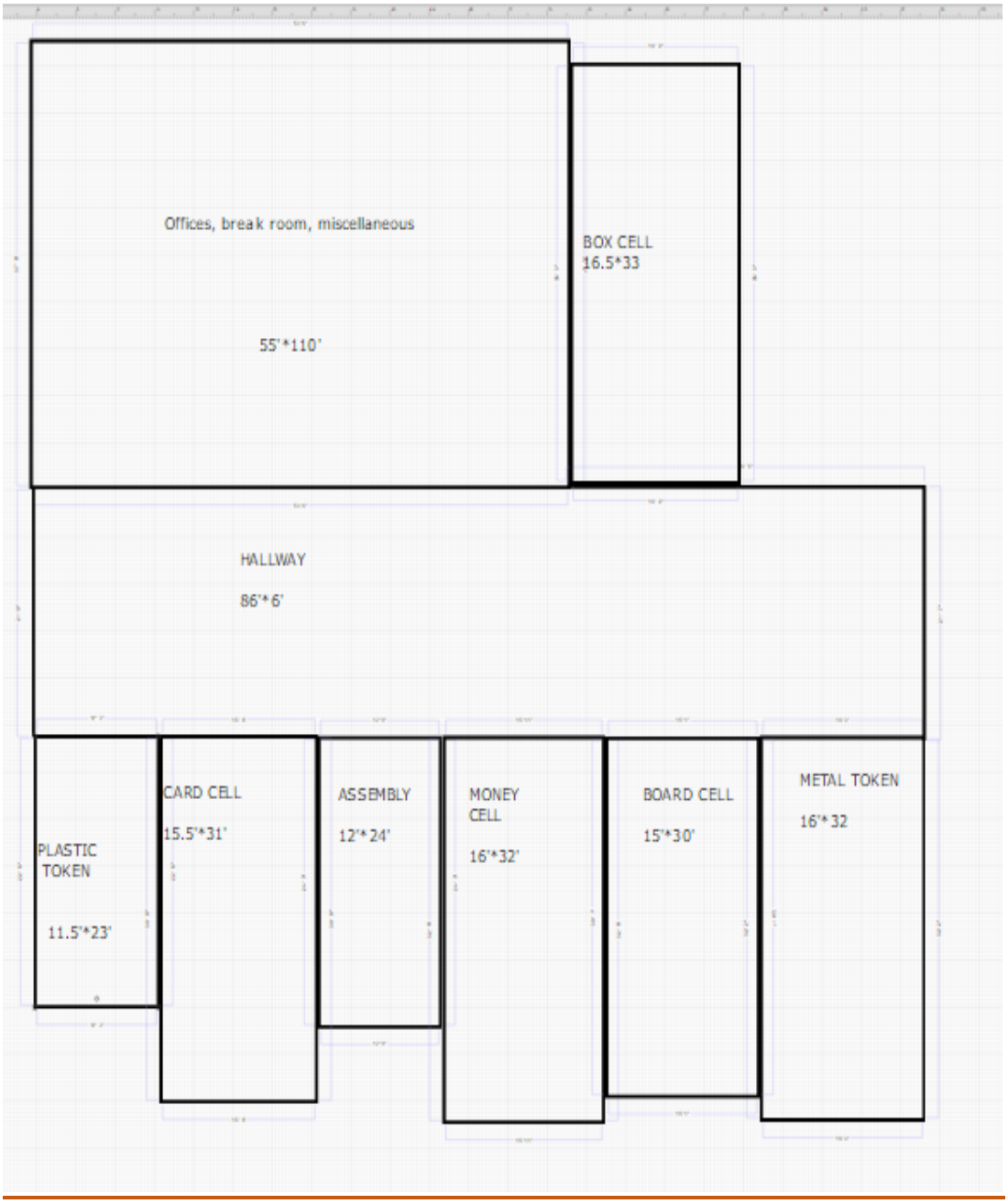
Departments	Player Board	Player card	Metal Token	Box Cell	Assembly
Player Board					250
Player card					150
Metal Token					100
Plastic Token					200
Box Cell					250
Player Money					250
Assembly					0

F-values:

f	3.0
f_u	3.33
f_l	0.41
f'	0.11

Here, we can see that **f** value is 3 and **f'** is 0.11. We know that f values greater than 2 and **f'** values closer to 0 have a few dominant flows and therefore these structures are easy to solve. So, we will follow the spine approach for the material flow as the values match the criteria.

Layout Structure for combined production:



Combined Production cost analysis:

Departments	Machines	Cost for Machines	Space Required for department	Cost for Space	Employees required for each department	Total cost/department
Player Board	Printer: 2 Scoring Knives Machine: 1 Folding Machine: 1	**=3.34 M**	420 sq. ft	0.396 M	General Workers & Floor Supervisor: 6 * 1.03 M + 0.570 M = **6.75 M**	3.73 M
Player Card Cell	Printer: 2 Cutter: 1 Card Sorter: 1	**=5.09 M**	465 sq. ft	0.438 M		5.5 M
Player Money	Printer: 1 Cutter: 1 Paper Sorter: 1	1.23 M+ 0.308 M+ 1.29 M **=2.82 M**	510 sq. ft	0.480 M		3.3 M
Metal Tokens	Melting Vat: 1 Casting Area: 1 Grinding Station: 5	0.951 M + 1.19 M+ 5*0.105 M **= 2.66 M**	500 sq. ft	0.471 M	Metal worker: **2.52 M**	5.651 M
Plastic Tokens	Injection Molding Machine: 5 Cooling Station: 3 Grinding/Separating Station: 11	**=11.418 M**	250 sq. ft	0.235 M	Plastic Token Worker: **3.79 M**	15.208 M
Box Cell	Printer: 3 Scoring Knives Machine: 2 Dryer: 2	**= 6.734 M**	545 sq. ft.	0.513 M		7.24 M
Assembly	Assembly station: 9	=0.182* 9 **=1.638 M**	270 sq. ft.	0.254 M	Assembly worker: $80,000/ year * 9 **= 3.82 M**	5.45 M

Total Cost for Combined Production	=46.341 + 6.75 + 0.486 **=53.57 M**

It costs us **$53.57 M** for setting up the layout for producing Atlantic city board game for 5 years run. The cost includes facility space, purchase of machines and allotment of salary for the company personnel.

Cost for a single unit from this layout:

$$= \frac{53.57 * 10,00,000}{5*(325000)}$$

= **$32.96/ Board game.**

Conclusion and recommendation

Based on the cost analysis shown above our team recommends following number of machines in given departments in each layout.

Reward Layout

Department	Machines
Player Board	Printer: 1 Scoring Knives Machine: 1 Folding Machine: 1
Player Card Cell	Printer: 1 Cutter: 1 Card Sorter: 1
Plastic Tokens	Injection Molding Machine: 5 Cooling Station: 3 Grinding/Separating Station: 11
Box Cell	Printer: 2 Scoring Knives Machine: 1 Dryer: 1
Assembly	Assembly station: 9
Cost/Board game-33$	

Atlantic city Layout

Department	Machines
Player Board	Printer: 1 Scoring Knives Machine: 1 Folding Machine: 1
Player Card Cell	Printer: 1 Cutter: 1 Card Sorter: 1
Player Money	Printer: 1 Cutter: 1 Paper Sorter: 1
Metal Tokens	Melting Vat: 1 Casting Area: 1 Grinding Station: 5
Box Cell	Printer: 1 Scoring Knives Machine: 1 Dryer: 1
Assembly	Assembly station: 5
Cost/Board game-41$	

Combined layout

Department	Machines
Player Board	Printer: 2 Scoring Knives Machine: 1 Folding Machine: 1
Player Card Cell	Printer: 2 Cutter: 1 Card Sorter: 1
Player Money	Printer: 1 Cutter: 1 Paper Sorter: 1
Metal Tokens	Melting Vat: 1 Casting Area: 1 Grinding Station: 5
Plastic Tokens	Injection Molding Machine: 5 Cooling Station: 3 Grinding/Separating Station: 11
Box Cell	Printer: 3 Scoring Knives Machine: 2 Dryer: 2
Assembly	Assembly station: 9
Cost/Board game-32.96$	

- As we can see that with the given cost analysis, Combined production layout provides the most efficient cost/ game that is **$32.96** per game.
- It is recommended that these two games should be produced together in a single layout and there is no need for outsourcing any of game as they can be produced economically in single layout.
- In any of department buffer is not required as it expensive. Providing a machine in parallel combination is better idea to save money.
- Lot streaming should be used to reduce the throughput time and to increase the efficiency.
- In each of department our team has recommended that the size of cell should in ratio 2:1 and has arranged the departments in such a way that length of hallway is minimum resulting in reduced area and cost. Metal token is kept in end of layout as per instruction to isolate it as much as possible.