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INSTITUTE OF MANAGEMENT
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Supply Chain and Logistics Analytics

Project:

Green Mills Aggregate Production Planning

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1: Project Approach

The information relating to Green mill provided will be used to have an aggregate planning for the production as a part of the new strategy to acquire forest woods in Chile and have it shipped to their location.

The provided information will be used to check under Chase, Level or mixed strategy and see which is most efficient under certain assumptions.

1. Discovery

1.1: Objective

Green Hill wishes to acquire a forest wood providing firm in Chile which can provide them the required softwood and make them competitive.

Provided information in the case study will be used to test the aggregate production planning under the Chase, Level and Mixed strategy and identify which is more efficient.

In this approach we will make certain assumptions so as to facilitate the testing of the strategy.

1.3: Potential Data Sources: The data source referred in this project is a .pdf file which has the requisite information to make the aggregate production planning

1.4: Applications list:

i. MS Excel
ii. MS WORD

2. Given Information

Chile plan capacity: 3 million wooden boards

Total employees: 20

Cost of the regular employee: 150 per 1000 boards

Overtime cost: 200 per 1000 boards

Maximum overtime allowed: 25%

Work hours: 160 hours a day

1 person makes 50,000 boards during the month

Shipping cost: 50 per 1000 boards

Handling cost: 25 per 1000 boards

Shipping limit: 1.5 million a month

Hiring cost per employee: 1000

Lay off cost per employee: 500

2.1: CHASE STRATEGY:

Under this strategy employing of the work force is done basis the demand anticipated. It is assumed that the workforce are easily available and are also easily laid off.

All the above given information has been used to prepare for the aggregation.

Month	Demand In '000S	Units To Be Produced In Chile In '000	Emp Available	Normal Unit Prod Capacity '000S	Chile Plant Shipping Capacity	Actual Production To Be Done	Emp Required	Additional Emps Required	Time Required To Produce 1000 Units	Additional Units To Be Produced '000S	Time Reqd To Prod Additonal Units	Overtime Hours Available	Actual Overtimes Hours	Units Produced In Overtime	Additional Hours After Overtime	Additional Emps Required	Worforce Fired	Total Shipping Units	Units To Be Acquired From Us Spot Market	Cost From Us Market	Regular Cost	Overtime Costs	Hiring Cost	Firing Cost	Shipping Cost	Total Cost
Jan	1000	1,000	20	1,000	1500	1000	20	-	3.2	-	-	800		0		0	0	1000	-	-	150,000	-	-	-	50,000	200,000
Feb	1100	1,100	20	1,000	1500	1100	22	2	3.2	100	320	800	320	100		0	0	1100	-	-	165,000	20,000	-	-	55,000	240,000
Mar	1300	1,300	20	1,000	1500	1300	26	6	3.2	300	960	800	800	250	160	1	0	1300	-	-	195,000	50,000	1,000	-	65,000	311,000
Apr	1500	1,500	20	1,000	1500	1500	30	10	3.2	500	1,600	800	800	250	800	4	0	1500	-	-	225,000	50,000	4,000	-	75,000	354,000
May	1800	1,500	20	1,000	1500	1500	30	10	3.2	500	1,600	800	800	250	800	0	0	1500	300	120,000	225,000	50,000	-	-	75,000	470,000
Jun	2200	1,500	20	1,000	1500	1500	30	10	3.2	500	1,600	800	800	250	800	0	0	1500	700	280,000	225,000	50,000	-	-	75,000	630,000
Jul	2500	1,500	20	1,000	1500	1500	30	10	3.2	500	1,600	800	800	250	800	0	0	1500	1,000	400,000	225,000	50,000	-	-	75,000	750,000
Aug	2400	1,500	20	1,000	1500	1500	30	10	3.2	500	1,600	800	800	250	800	0	0	1500	900	360,000	225,000	50,000	-	-	75,000	710,000
Sep	2000	1,500	20	1,000	1500	1500	30	10	3.2	500	1,600	800	800	250	800	0	0	1500	500	200,000	225,000	50,000	-	-	75,000	550,000
Oct	1600	1,500	20	1,000	1500	1500	30	10	3.2	500	1,600	800	800	250	800	0	0	1500	100	40,000	225,000	50,000	-	-	75,000	390,000
Nov	1200	1,200	20	1,000	1500	1200	24	4	3.2	200	640	800	640	200	(160)	0	1	1200	-	-	180,000	40,000	-	500	60,000	280,500
Dec	800	800	20	1,000	1500	800	16	(4)	3.2	-	-	800	0	0	200	0	9	800	-	-	120,000	-	-	4,500	40,000	164,500
																5	10			1,400,000	2,385,000	460,000	5,000	5,000	795,000	5,050,000

Calculations are done considering the below

i. Shipping limitation will limit the production at the Chile plant to 1.5 million boards
ii. Balance demand will be obtained from the US SPOT market
iii. It is also assumed that all the existing workforce will make use of the available 25% of their capacity
iv. Additional staffing is taken into consideration after the overtime capacity is exhausted
v. There are no handling costs as the production units are equal to demand
vi. Workforce is easily available for hiring and for lay off

Considering all this the total of the aggregation of production works to ~$5.05 million under this strategy

2.2: LEVEL STRATEGY:

Under the level strategy a uniform production is done irrespective of the demands and additional demand is catered through spot market buying.

All the information given in section 2 have been used to make the aggregation

Month	Demand In '0005	Levelled Production Capacity If Chile	Inventory	Additional Units To Be Acquired From Us Market	Actual Emps Available	Unit Production Capacity For 20	Hours For 1000 Units	Overtime Hours Available	Emps Needs For Prodn	Units Produced During Overtime	Emp Effort For Ovetime	Balance To Be Hired	Hired	Fired	Regular Cost	Overtime Cost	Shipping Cost	Hiring Cost	Firing Cost	Holding Cost	Us Market Cost	Total Cost
Jan	1000	1,500	500	0	20	1000	3.2	800	30	250	5	5	5	0	225,000	50000	75000	5000	0	12,500	0	367,500
Feb	1100	1,500	900	0	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	22,500	0	372,500
Mar	1300	1,500	1,100	0	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	27,500	0	377,500
Apr	1500	1,500	1,100	0	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	27,500	0	377,500
May	1800	1,500	800	0	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	20,000	0	370,000
Jun	2200	1,500	100	0	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	2,500	0	352,500
Jul	2500	1,500		900	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	-	360000	710,000
Aug	2400	1,500		900	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	-	360000	710,000
Sep	2000	1,500		500	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	-	200000	550,000
Oct	1600	1,500		100	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	-	40000	390,000
Nov	1200	1,500	300	0	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	7,500	0	357,500
Dec	800	1,500	1,000	0	20	1000	3.2	800	30	250	5	5	0	0	225,000	50000	75000	0	0	25,000	0	375,000
													5	0	2,700,000	600,000	900,000	5,000	-	145,000	960,000	5,310,000

Calculations are done considering and assuming the below

i. The stable production volumes are the average volumes of the 12 months of predicted data.
ii. However the capacity is restricted to 1.5 million boards which is the shipping limits of Chile
iii. Balance requirement is acquired from the US Spot Market
iv. It is also assumed that all the existing workforce will make use of the available 25% of their capacity
v. Additional staffing is taken into consideration after the overtime capacity is exhausted
vi. Since there is no backtracking of the order, additional inventory created are considered for the handling costs
vii. Where ever the demand has reduced the workforce has been laid off

Considering all the above the aggregation cost under level strategy is ~$5.31 million

2.2: MIXED STRATEGY:

As the name suggests this strategy is a combined strategy of Chase and Level. In this strategy certain portion of the workforce is fixed and later are hired or fired basis the demand.

Production quantities can also be fixed to a minimum.

Demand	Month	Demand	Minimum production	Inventory	Additional units to be acquired from US market	Minimum Emp	Output of min emp	Overtime allowable in hrs	hrs taken to produce 1000 units	Units produced in overtime	Total units produced by existing emps	Bal units for new emps to be hired	Emps required	Workforce hired	Workforec fired	Regular cost	Overtime Cost	Hiring Cost	Firing cost	Shipping Cost	US Spot market cost	Handling cost	Overall cost
1000	Jan	1000	1300	300	0	26	1300000	1040	3.2	325	1300	0	0	0	0	195,000	65,000	-	0	75,000	-	7,500	342,500
1100	Feb	1100	1300	500	0	26	1300000	1040	3.2	325	1300	0	0	0	0	195,000	65,000	-	0	75,000	-	12,500	347,500
1300	Mar	1300	1300	500	0	26	1300000	1040	3.2	325	1300	0	0	0	0	195,000	65,000	-	0	75,000	-	12,500	347,500
1500	Apr	1500	1300	300	0	26	1300000	1040	3.2	325	1300	0	0	0	0	195,000	65,000	-	0	75,000	-	7,500	342,500
1800	May	1800	1300	-	300	26	1300000	1040	3.2	325	1300	200	4	4	0	195,000	65,000	4,000	0	75,000	120,000	-	459,000
2200	Jun	2200	1300	-	700	26	1300000	1040	3.2	325	1300	200	0	0	0	195,000	65,000	-	0	75,000	280,000	-	615,000
2500	Jul	2500	1300	-	1000	26	1300000	1040	3.2	325	1300	200	0	0	0	195,000	65,000	-	0	75,000	400,000	-	735,000
2400	Aug	2400	1300	-	900	26	1300000	1040	3.2	325	1300	200	0	0	0	195,000	65,000	-	0	75,000	360,000	-	695,000
2000	Sep	2000	1300	-	500	26	1300000	1040	3.2	325	1300	200	0	0	0	195,000	65,000	-	0	75,000	200,000	-	535,000
1600	Oct	1600	1300	-	100	26	1300000	1040	3.2	325	1300	200	0	0	0	195,000	65,000	-	0	75,000	40,000	-	375,000
1200	Nov	1200	1300	100	0	26	1300000	1040	3.2	325	1300	0	0	0	0	195,000	65,000	-	0	75,000	-	2,500	337,500
800	Dec	800	1300	600	0	26	1300000	1040	3.2	325	1300	0	0	0	0	195,000	65,000	-	0	75,000	-	15,000	350,000
																2,340,000	780,000	4,000	-	900,000	1,400,000	57,500	5,481,500

Calculations are done considering and assuming the below. There no specific assumptions provided in the problem and thus the below are made for the problem solving purpose.

i. Production volumes are fixed at 1.3 million units
ii. Employees are fixed at 26 at any given time of the year
iii. Capacity is restricted to 1.5 million boards which is the shipping limits of Chile
iv. Balance requirement is acquired from the US Spot Market
v. It is also assumed that all the existing workforce will make use of the available 25% of their capacity
vi. Additional staffing is taken into consideration after the overtime capacity is exhausted

Considering all the above the aggregation cost under level strategy is ~$5.482 million

3: Comparison of the 3 strategy and concluding on a single strategy

Below table summarizes the total costs month on month for all the 3 strategies

Month	Chase method	Level method	Mixed cost
Jan	200,000.0	367,500.0	342,500.0
Feb	240,000.0	372,500.0	347,500.0
Mar	311,000.0	377,500.0	347,500.0
Apr	354,000.0	377,500.0	342,500.0
May	470,000.0	370,000.0	459,000.0
Jun	630,000.0	352,500.0	615,000.0
Jul	750,000.0	710,000.0	735,000.0
Aug	710,000.0	710,000.0	695,000.0
Sep	550,000.0	550,000.0	535,000.0
Oct	390,000.0	390,000.0	375,000.0
Nov	280,500.0	357,500.0	337,500.0
Dec	164,500.0	375,000.0	350,000.0
Total	**5,050,000.0**	**5,310,000.0**	**5,481,500.0**

With the above table it can be seen that the total under the Chase strategy is least and it can be considered and evaluated further.

3: Sensitive Analysis

3.1 When the hiring costs increase by 25% the below table can be arrived as a summarized.

Month	Chase method	Level method	Mixed method
Jan	200,000.0	368,750.0	342,500.0
Feb	240,000.0	372,500.0	347,500.0
Mar	311,250.0	377,500.0	347,500.0
Apr	355,000.0	377,500.0	342,500.0
May	470,000.0	370,000.0	460,000.0
Jun	630,000.0	352,500.0	615,000.0
Jul	750,000.0	710,000.0	735,000.0
Aug	710,000.0	710,000.0	695,000.0
Sep	550,000.0	550,000.0	535,000.0
Oct	390,000.0	390,000.0	375,000.0
Nov	280,500.0	357,500.0	337,500.0
Dec	164,500.0	375,000.0	350,000.0
Total	**5,051,250.0**	**5,311,250.0**	**5,482,500.0**

If the overall cost has a strong dependency on a specific cost or costs the overall costs fluctuate more than the normal change in the independent variable.

In case of the Chase method there is no holding cost and thus it will not be impacted in the changes and the other 2 models it can be seen as an impact

3.2 When the Inventory costs increase by 25% the below table can be arrived as a summarized

Month	Chase method	Level method	Mixed method
Jan	200,000.0	370,625.0	344,375.0
Feb	240,000.0	378,125.0	350,625.0
Mar	311,000.0	384,375.0	350,625.0
Apr	354,000.0	384,375.0	344,375.0
May	470,000.0	375,000.0	459,000.0
Jun	630,000.0	353,125.0	615,000.0
Jul	750,000.0	710,000.0	735,000.0
Aug	710,000.0	710,000.0	695,000.0
Sep	550,000.0	550,000.0	535,000.0
Oct	390,000.0	390,000.0	375,000.0
Nov	280,500.0	359,375.0	338,125.0
Dec	164,500.0	381,250.0	353,750.0
Total	**5,050,000.0**	**5,346,250.0**	**5,495,875.0**

If the overall cost has a strong dependency on a specific cost or costs the overall costs fluctuate more than the normal change in the independent variable.

In case of the Chase method there is no holding cost and thus it will not be impacted in the changes and the other 2 models it can be seen as an impact

3.3 Conclusion:

Various methods are available for evaluation and they can be taken into consideration post which the methods will be tested with relaxations of the assumptions and impact on the model.

Just testing the model above will not be treated in isolation and independent of the entire flow of the business.