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**QANT 610**

Assignment A4:

**Aggregate Planning**

**(Cornwell Glass Case Study)**

Submitted on 14th November 2012

Prepared by

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1. **Introduction:**

**Aggregate Planning** is the most essential part of Production and Operations Management (POM). If the demand for a company product was absolutely stable, there would be no need for aggregate planning. The company can develop a production process and a workforce level that would produce exactly the amount demanded every month in a repeating cycle while maintaining practically no inventory. However, this is seldom found to be true and the demand mix among the products keeps on fluctuating over the time.

This leads to the company to create production, inventory and the workforce plans far enough in advance to satisfy the anticipated demand in a cost effective manner. The plan comprises of deploying the amount of workforce in a regular and overtime period, changing inventory levels and/or subcontracting approach with their most effective use that produces the required output and reduces the cost of the production; achieving the maximum profit. The objective of aggregate planning is to meet forecasted demand while minimizing cost over the planning period.

Aggregate planning is the key to managing change in POM. The economical and optimal balance between the changing patterns of customer demand and the plans for providing production resources, define the successful aggregate planning. It is a model that combines forecasts and costs so that scheduling decisions can be made for the planning period.

Since the aggregate plan is based on satisfying expected intermediate term demands, it is necessary that accurate forecast of these demands shall be made. Due importance must be given to seasonal factor while arriving at forecasts. In addition, material prices, labor wages, subcontracting rates, holding cost as well as carrying costs which affect the optimal plan must be properly considered. Fully loaded facilities and minimizing overloading and under-loading reduce the overall cost. The aggregate planning can be achieved by applying capacity option as well as demand option. However, the mixed strategy combing the different options is the best way to achieve minimum cost.

In the given case, “Cornwell Glass”, a glass producer for automobile industry has its annual demand forecast prepared based on their sophisticated forecasting system that considers the demand pattern due to seasonal changes and long term trends. The case provides the variable costs which may influence the company while selecting the best strategy using aggregate planning process in order to administer the business at lowest possible cost.

1. **Different Aggregate Plans and analysis:**

In order to find the best fit production schedule for Cornwell Glass, following are the plans studied with their feasibility and cost comparison.

**Demand option** is considered as a level strategy in order to match the output rates to demand forecast for each period by adopting backordering during high-demand period.

* Use a constant workforce & produce similar quantities each time period
* Use inventories and backorders to absorb demand peaks & valleys

**Capacity option** is considered as a chase strategy by keeping the daily production uniform for better quality and productivity through varying workforce size by hiring and layoffs, also varying production rate through overtime or idle time. Moreover, subcontracting option has also been verified.

* Minimize finished good inventories by trying to keep pace with demand fluctuations
* Matches demand by varying either work force level or output rate

1. Varying production rate through overtime and subcontracting:
2. Varying workforce size by hiring or layoffs:

**Mixed Strategy or Hybrid Strategy:** (Level + Chase Strategy)

* Build up inventory ahead of rising demand and use backorders to level extreme peaks
* [Layoff](http://en.wikipedia.org/wiki/Layoff) workers during lulls
* Subcontract production or hire temporary workers to cover short-term peaks
* Reassign workers to preventive maintenance during lulls

**Data provided:**

* Annual demand forecast for the period of 2nd week of April through 1st week of April subsequent year.
* The maximum production capacity of the company = 1,900 pounds of glass per week and currently production is working at full capacity; i.e. 1,900 units.
* The current inventory is 73 units.
* The holding cost for glass is $.12 per pound per week.
* The cost of a late order is $20 per pound per week late.
* The overtime is limited to 250 pounds per week. The overtime costs $8 per pound more than glass manufactured during regular time (Assume the unit cost during regular time production = $10 per pound; therefore, the overtime cost equals $18).
* Subcontracting is limited to 2,000 pounds per week. Subcontracting cost is $2 more per pound than glass that is produced during overtime = $20.
* Hiring cost = $5.63 per pound
* Layoff cost = $15.73 per pound

The case has been analyzed using different planning options as specified above, to achieve the lowest total cost by decreasing the holding cost and avoiding loss of sale in order to meet the estimated demand. Attached herewith are the results obtained from the POM software for various options. Taken into account the backorder allowance outweighs the loss of sale, three key options are considered. Following are the options with their total cost:

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Aggregate plan** | **Total Cost** |
| 1 | Smooth production (Avg. net demand) | $849,077.10 |
| 2 | Chase current demand (Let workforce vary) | $104,575.10 |
| 3 | Constant regular time, then OT and subcontracting | $82,858.08 |

In plan No.1 (Smooth production - Avg. net demand), although at the end of week 52, the company can manage with zero inventories and zero backorders by using its own human resources in regular and overtime, the cost incurred due to shortage (backorder) is significant that reflects in high total cost amounting to **$849,077.10**.

In plan No.2 (Chase current demand - Let workforce vary), while chasing the demand, the regular time production is limited to the demand of that particular week in order to avoid any holding cost. Consequently, it leads to extra overtime and subcontracting cost in succeeding weeks. However, the total cost is substantially reduced to **$104,575.10** as compared to plan No.1.

In plan No. 3 (Constant regular time, then overtime and subcontracting), the production in regular time has kept constant to its maximum limit which adds the holding cost during initial weeks but later helps using that stock in the successive weeks; resulting the minimum usage of labor hours during overtime and subcontracting. In this plan, although there will be 614 inventories will remain unsold, considering its meager holding cost as compared to the minimum total cost of **$82,858.08** against two other plans, this is the most favorable option.

1. **Conclusion:**

I recommend that Cornwell Glass should adopt the plan No.3 as the optimal production plan that gives the lowest total cost amounting to $82,858.08. The company should use its own human resources in regular time and then consider additional production during overtime and subsequently, subcontracting it whenever deemed necessary in order to chase the demand. The particular strategy will maximize the profit with minimum input and cost.

It is clear from the above example how the aggregate planning plays pivotal role in achieving the company goal in cost-effective manner. Wrong selection of the plan may lead to wastage/improper use of resources, excess/shortage of inventory etc. The success of the organization is directly linked with how efficiently the medium range (approx. 3-12 months) planning is done.

**Works Cited:**

* Aggregate planning/ Wikipedia, the free encyclopedia

<http://en.wikipedia.org/wiki/Aggregate_planning#Hybrid_Strategies>

* Production Planning and Scheduling. MS-53. Vol.4

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