* + Aggregate Planning

# ****AGGREGATE PLANNING****

## Learning Objective:

To take the first steps in translating forecasts for demand into a production plan.

### ****Aggregate Planning:****

**Attempts to match the supply of and demand for a product or service by determining the appropriate quantities and timing of inputs, transformation, and outputs. Decisions made on production, staffing, inventory and backorder levels.**

**Characteristics of aggregate planning:**

* **Considers a "planning horizon" from about 3 to 18 months, with periodic updating**
* **Looks at aggregate product demand, stated in common terms**
* **Looks at aggregate resource quantities, stated in common terms**
* **Possible to influence both supply and demand by adjusting production rates, workforce levels, inventory levels, etc., but facilities cannot be expanded.**

**Production Plan (manufacturing aggregate plan):**

**A managerial statement of the period-by-period (*time-phased*) production rates, work-force levels, and inventory investment, given customer requirements and capacity limitations.**

**Staffing Plan (service aggregate plan):**

**A managerial statement of the period-by-period staff sizes and labour-related capacities, given customer requirements and capacity limitations.**

### ****Objectives of Aggregate Planning****

**Objective of aggregate planning frequently is to minimize total cost over the planning horizon.**

**Other objectives should be considered:**

* **maximize customer service**
* **minimize inventory investment**
* **minimize changes in workforce levels**
* **minimize changes in production rates**
* **maximize utilization of plant and equipment**

### ****Aggregate Planning Strategies****

***Active strategy:***

* **Attempts to handle fluctuations in demand by focusing on demand management**
* **Use pricing strategies and/or advertising and promotion**
* **Develop counter-cyclical products**
* **Request customers to backorder or advance-order**
* **Do not meet demand**

***Passive strategy (reactive strategy):***

* **Attempts to handle fluctuations in demand by focusing on supply and capacity management**
* **Vary size work force size by hiring or layoffs**
* **Vary utilization of labour and equipment through overtime or idle time**
* **Build or draw from inventory**
* **Subcontract production**
* **Negotiate cooperative arrangements with other firms**
* **Allow backlogs, back orders, and/or stockouts**

**Mixed strategy:**

* **Combines elements of both an active strategy and a passive (reactive) strategy**
* **Firms will usually use some combination of the two**

### ****Passive (reactive) Strategies in Aggregate Planning: Basic Approaches,****

### ****Chase approach****

**capacities (workforce levels, production schedules, output rates, etc.) are adjusted to match demand requirements over the planning horizon.**

**Advantages:**

* **anticipation inventory is not required, and investment in inventory is low**
* **labour utilization is kept high**

**Disadvantages:**

* **expense of adjusting output rates and/or workforce levels**
* **alienation of workforce**

**Level Approach**

**Capacities (workforce levels, production schedules, output rates, etc.) are kept constant over the planning horizon.**

**Advantages:**

* **stable output rates and workforce levels**

**Disadvantages:**

* **greater inventory investment is required**
* **increased overtime and idle time**
* **resource utilizations vary over time**

**Aggregate Planning Methods:** **Intuitive Methods**

**Intuitive methods use management intuition, experience, and rules-of-thumb, frequently accompanied by graphical and/or spreadsheet analysis.**

**Advantage:**

* **easy to use and explain**

**Disadvantage:**

* **many solutions are possible, most of which are not optimal**

**Aggregate Planning Example:**

**Suppose you have the following forecasts for demand to meet:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Month** | 1 | 2 | 3 | 4 | 5 | 6 |
| **Demand** | 1000 | 1200 | 1500 | 1900 | 1800 | 1600 |

**Relevant Costs:**

|  |  |
| --- | --- |
| **Regular production cost** | **BDT 35/unit** |
| **Lost sales** | **BDT100/unit** |
| **Inventory carrying costs** | **BDT10/unit/month** |
| **Subcontracting costs** | **BDT 60/unit** |
| **Hiring costs** | **BDT1500/worker** |
| **Firing costs** | **BDT3000/worker** |
| **Beginning workforce level** | **20 workers** |
| **Capacity per worker** | **50 units/month** |
| **Initial inventory level** | **700 units** |
| **Closing inventory level** | **100 units** |

**LEVEL PRODUCTION STRATEGY**

**Find the requirements for the period of the plan and produce the average amount needed per month to meet the plan.**

**First determine the average requirements per month:**

**Avg. requirements = total requirements - opening inv. + closing inv.**

**number of periods**

**Avg. requirements = (9000 - 700 + 100)/6 = 1400 units/period**

**Steps:**

1. **Enter the production data**
2. **Determine hire/fire to get to production level desired**
3. **Update inventory levels**
4. **Does the inventory run out - If it does recalculate average production needed and go to step 1**
5. **Calculate totals for each category**
6. **Calculate costs**

**LEVEL STRATEGY**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Period** | **1** | **2** | **3** | **4** | **5** | **6** | **Total** |
| **Req.** | **1000** | **1200** | **1500** | **1900** | **1800** | **1600** | **9000** |
| **Prod.** |   |   |   |   |   |   |   |
| **Inv.(700)** |   |   |   |   |   |   |   |
| **Hire** |   |   |   |   |   |   |   |
| **Fire** |   |   |   |   |   |   |   |
| **Sub.** |   |   |   |   |   |   |   |

**Costs:**

1. **Regular production costs:**
2. **Inventory carrying costs:**
3. **Hiring Costs:**

**TOTAL COSTS: \_\_\_\_\_\_\_\_\_**

**CHASE STRATEGY**

* **Produce exactly what is required every period.**
* **Hire and fire to adjust monthly production to monthly requirements.**
* **The first and last period production levels are adjusted to account for opening inventory and closing inventory requirements.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Period** | **1** | **2** | **3** | **4** | **5** | **6** | **Total** |
| **Req.** | **1000** | **1200** | **1500** | **1900** | **1800** | **1600** | **9000** |
| **Prod.** |   |   |   |   |   |   |   |
| **Inv.(700)** |   |   |   |   |   |   |   |
| **Hire** |   |   |   |   |   |   |   |
| **Fire** |   |   |   |   |   |   |   |
| **Sub.** |   |   |   |   |   |   |   |

**Costs:**

1. Regular production costs:
2. Inventory carrying costs:
3. Hiring Costs:
4. Firing Costs:

TOTAL COSTS : \_\_\_\_\_\_\_\_\_\_\_\_\_

**Intuitive (Mixed) Strategy**

- Trial and Error to find a good solution

- Use Excel to model the problem and test the impact of different solutions

- Build the model using proper structure with key variables at the top and a summary of key results immediately below.

**Finding Optimal Solutions Using Linear Programming**

- Aggregate planning problems can be solved optimally using linear programming (LP).

- Given the constraints on requirements, production capabilities, allowed workforce changes, overtime and subcontracting limits plus all relevant costs LP will find an optimal solution to the problem which minimizes total costs.

-Excel's Solver add-in will perform LP