Instituto de Ciencias Básicas e Ingeniería
Área Académica de Ingeniería

Licenciatura en Ingeniería Industrial

Asignatura: Logística y Cadena de Suministro

Unidad 4
Tema: Planeación agregada (Parte I)

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Periodo de elaboración: Agosto/2017
Periodo de actualización: Noviembre/2017

Tema
Planeación agregada

Resumen:
Se presentan los métodos tradicionales en que una firma puede realizar su planeación agregada con el fin de establecer el tamaño de fuerza laboral y un plan de producción

Palabras Clave: Método de persecución, Fuerza laboral constante, Programación lineal

Topic:

Aggregate Planning

Abstract:

We present the three principal methods to plan gross work force levels and set firm-wide production plans

Keywords: Constant work force, Chase Strategy

Aggregate Planning

Introduction to Aggregate Planning

Concept is predicated on the idea of an "*aggregate unit*" of production. May be actual units, or may be measured in weight (tons of steel), volume (gallons of gasoline), time (worker-hours), or dollars of sales. Can even be a fictitious quantity.

Overview of the Problem

Suppose that D_1, D_2, . . . , D_T are the forecasts of demand for aggregate units over the planning horizon (T periods.) The problem is to determine both work force levels (W_t) and production levels (P_t) to minimize total costs over the T period planning horizon.

Important Issues

- *Smoothing.* Refers to the costs and disruptions that result from making changes from one period to the next.
- *Bottleneck Planning*. Problem of meeting peak demand because of capacity restrictions.
- *Planning Horizon*. Assumed given (T), but what is "right" value? Rolling horizons and end of horizon effect are both important issues.
- *Treatment of Demand*. Assume demand is known. Ignores uncertainty to focus on the predictable/systematic variations in demand, such as seasonality.

Relevant Costs

- *Smoothing Costs*
  - changing size of the work force
  - changing number of units produced
- *Holding Costs*
  - primary component: opportunity cost of investment
- *Shortage Costs*
  - Cost of demand exceeding stock on hand. Why should shortages be an issue if demand is known?
- *Other Costs:* payroll, overtime, subcontracting.

Aggregate Units

The method is based on notion of aggregate units. They may be

- Actual units of production
- Weight (tons of steel)
- Volume (gallons of gasoline)
- Dollars (Value of sales)
- Fictitious aggregate units

Example of fictitious aggregate units. Example 3.1)

One plant produced 6 models of washing machines:

Model	# hrs.	Price	% sales
A 5532	4.2	285	32
K 4242	4.9	345	21
L 9898	5.1	395	17
L 3800	5.2	425	14
M 2624	5.4	525	10
M 3880	5.8	725	06

Question: How do we define an aggregate unit here?

Example continued

- Notice: Price is not necessarily proportional to worker hours (i.e., cost): why?
- One method for defining an aggregate unit: requires: .32(4.2) + .21(4.9) + . . . + .06(5.8) = 4.8644 worker hours. Forecasts for demand for aggregate units can be obtained by taking a weighted average (using the same weights) of individual item forecasts.

Prototype Aggregate Planning Example

The washing machine plant is interested in determining work force and production levels for the next 8 months. Forecasted demands for Jan-Aug. are: 420, 280, 460, 190, 310, 145, 110, 125. Starting inventory at the end of December is 200 and the firm would like to have 100 units on hand at the end of August. Find monthly production levels.

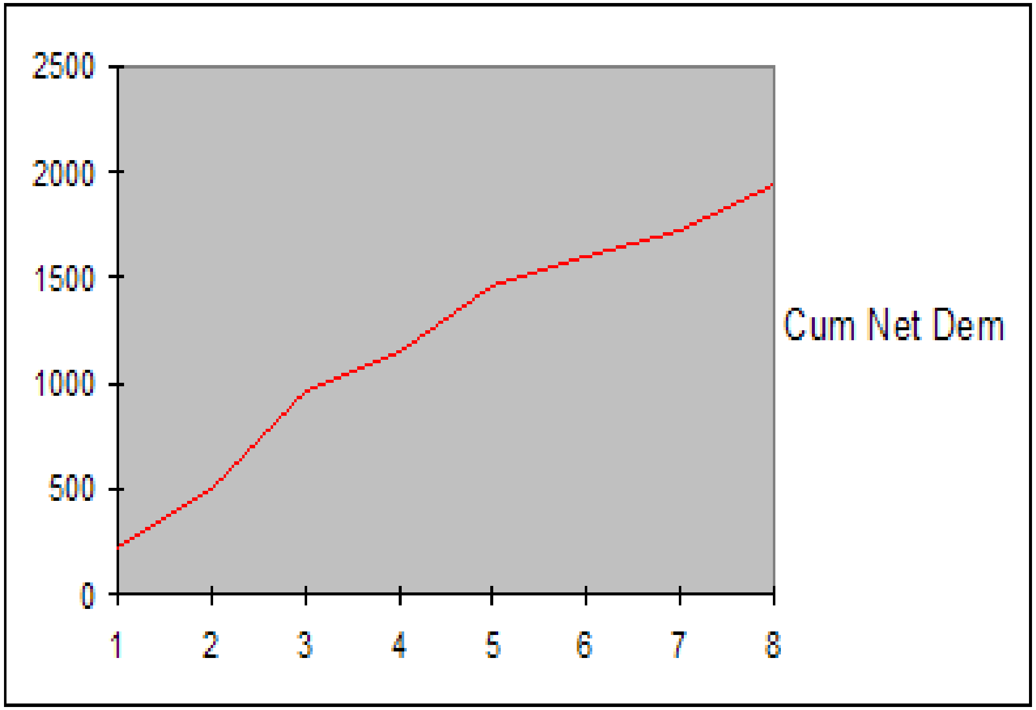
Step 1: Determine "net" demand.

(subtract starting inv. from per. 1 forecast and add ending inv. to per. 8 forecast.)

Month	Net Predicted Demand	Cum. Net Demand
1(Jan)	220	220
2(Feb)	280	500
3(Mar)	460	960
4(Apr)	190	1150
5(May)	310	1460
6(June)	145	1605
7(July)	110	1715
8(Aug)	225	1940

Step 2. Graph Cumulative Net Demand to Find Plans Graphically

1	220
2	500
3	960
4	1150
5	1460
6	1605
7	1715
8	1940

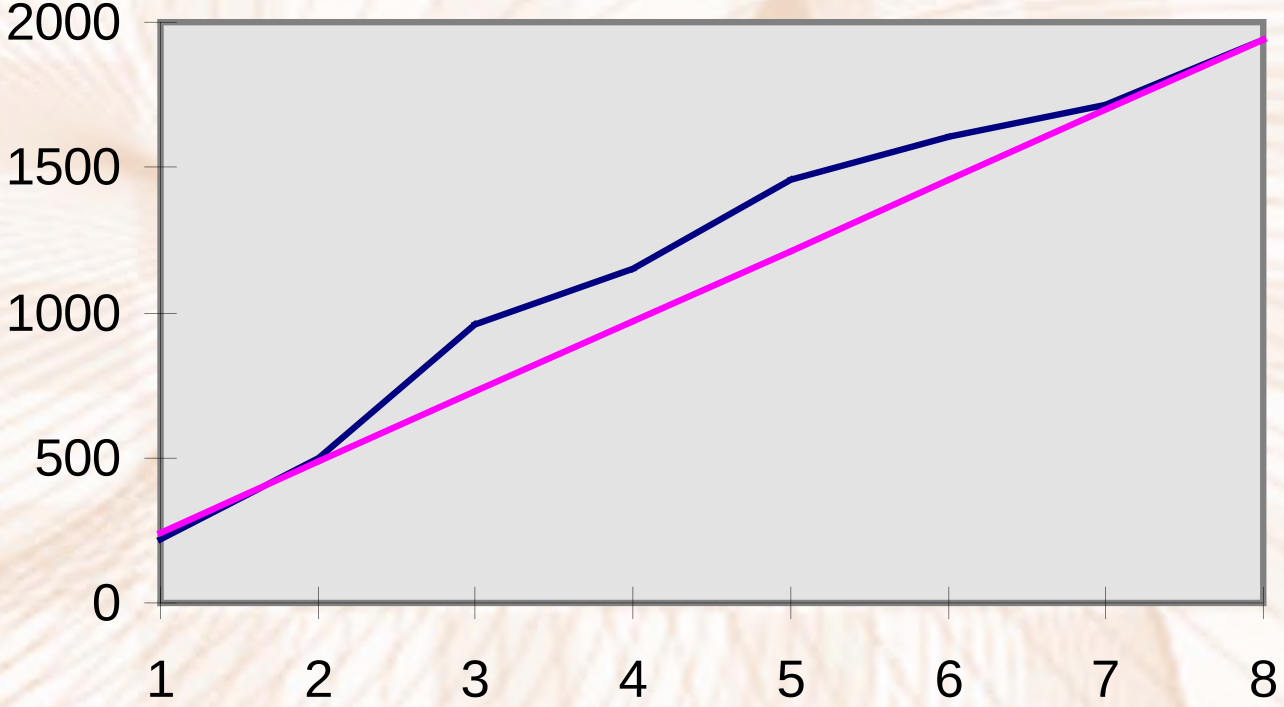


Constant Work Force Plan

Suppose that we are interested in determining a production plan that doesn't change the size of the workforce over the planning horizon. How would we do that?

One method: In previous picture, draw a straight line from origin to 1940 units in month 8: The slope of the line is the number of units to produce each month.

Constant Workforce Plan (zero ending inv)

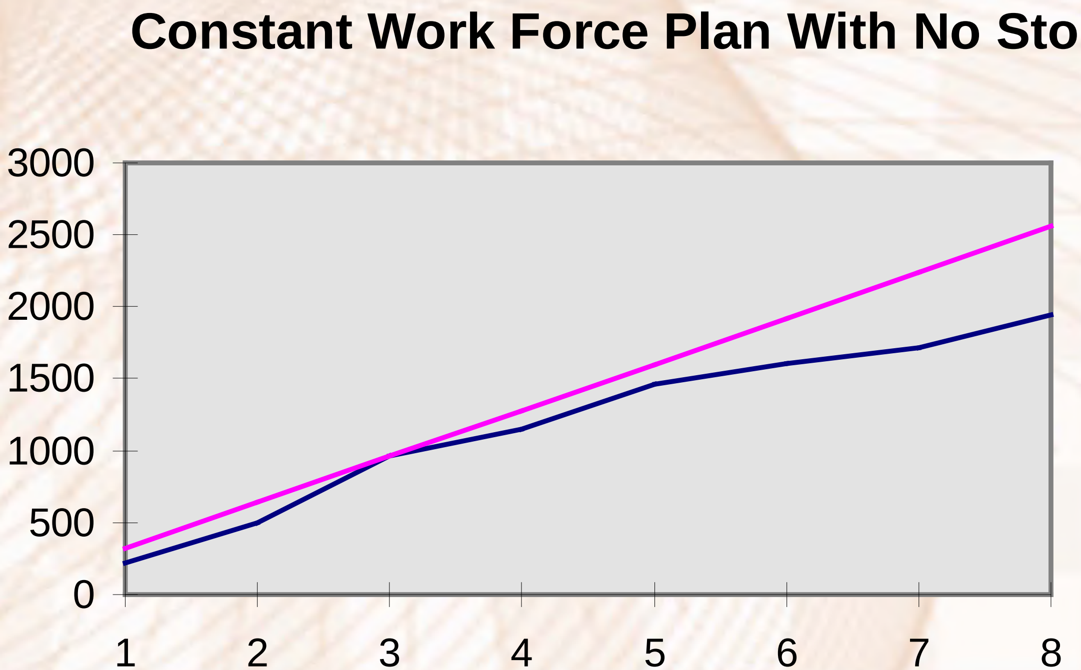


Monthly Production = 1940/8 = 242.2 or rounded to 243/month.

But: there are stockouts.

How can we have a constant work force plan with no stockouts?

Answer: using the graph, find the straight line that goes through the origin and lies completely above the cumulative net demand curve:



From the previous graph, we see that cum. net demand curve is crossed at period 3, so that monthly production is 960/3 = 320. Ending inventory each month is found from:

Month	Cum. Net. Dem.	Cum. Prod.	Invent.
1(Jan)	220	320	100
2(Feb)	500	640	140
3(Mar)	960	960	0
4(Apr.)	1150	1280	130
5(May)	1460	1600	140
6(June)	1605	1920	315
7(July)	1715	2240	525
8(Aug)	1940	2560	620

But - may not be realistic for several reasons:

- It may not be possible to achieve the production level of 320 unit/mo with an integer number of workers
- Since all months do not have the same number of workdays, a constant production level may not translate to the same number of workers each month.

To overcome these shortcomings:

- Assume number of workdays per month is given
- K factor given (or computed) where

K = # of aggregate units produced by one worker in one day

Finding K

- Suppose that we are told that over a period of 40 days, the plant had 38 workers who produced 520 units. It follows that:

- K= 520/(38*40) = .3421

  = average number of units produced by one worker in one day.

Computing Constant Work Force

Assume we are given the following # working days per month: 22, 16, 23, 20, 21, 17, 18, 10. March is still critical month. Cum. net demand thru March = 960. Cum # working days = 22+16+23 = 61. Find 960/61 = 15.7377 units/day implies 15.7377/.3421 = 46 workers required.

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Por su atención …

Gracias

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Material desarrollado en la Academia de Ingeniería Industrial