



Ahram
Canadian
University

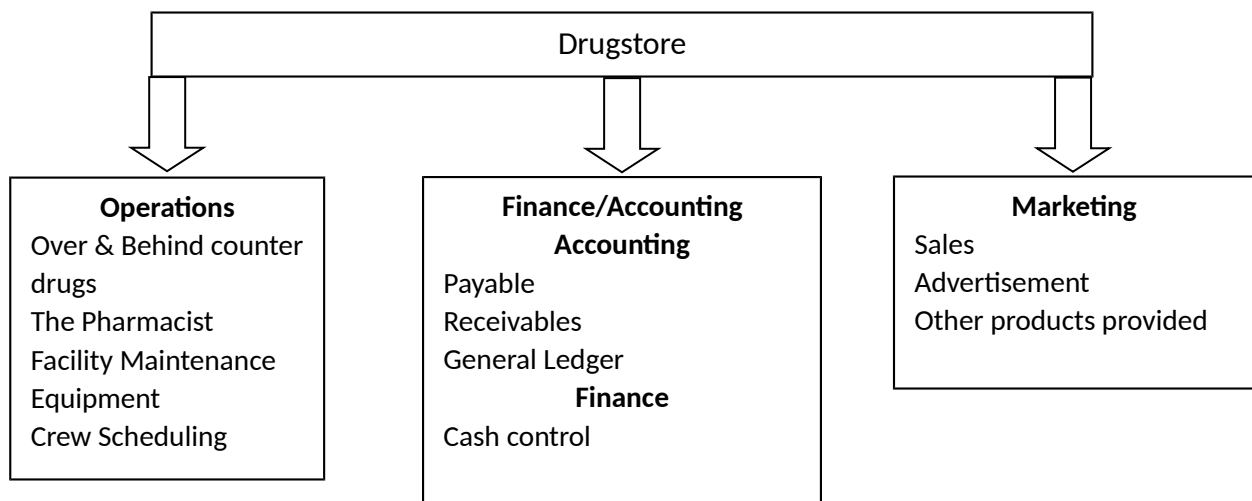
Production and Operation Management
Assignment 1

Name: Hazem Mohamed Ahmed
ID: 21510303

Chapter 1

QUESTIONS

1. Why should one study operations management?
 - a. OM is one of three major functions of any organization, we want to study how people organize themselves for productive enterprise We want (and need) to know how goods and services are produced. We want to understand what operations managers do. OM is such a costly part of an organization
2. Identify four people who have contributed to the theory and techniques of operations management.
 - a. Eli Whitney
 - b. Frederick W. Taylor
 - c. Frank & Lillian Gilberth
 - d. Henry Ford
3. Briefly describe the contributions of the four individuals identified in the preceding question.
 - a. Eli Whitney- Invented the Cotton Gin and standardized part to exact specifications.
 - b. Federick W. Taylor- Known as the father of scientific management and did motion and time studies.
 - c. Frank & Lillian Gilberth- They were an engineer team.
 - d. Henry Ford- created the moving assembly line.
4. Figure 1.1 outlines the operations, finance/accounting, and marketing functions of three organizations. Prepare a chart like Figure 1.1 outlining the same functions for one of the following:



5. Answer Question 4 for some other organization, perhaps and organization you have worked.
6. What are the three basic functions of a firm?
 - a. Marketing
 - b. Production/operations
 - c. Finance/ Accounting.
7. Name the 10 decision areas of operations management.
 - a. Design of foods and services
 - b. managing quality
 - c. process and capacity design
 - d. location strategy
 - e. layout strategy
 - f. human resources and job design
 - g. supply-chain management
 - h. inventory, MRP, JIT
 - i. scheduling
 - j. maintenance
8. Name four areas that are significant to improving labor productivity.
 - a. Basic education, diet of the labor force, social overhead that makes labor available, and maintaining and expanding the skills necessary for changing technology and knowledge, as well for teamwork and motivation.
9. The U.S. and indeed much of the world, has been described as a "Knowledge society." How does this affect productivity measurement and the comparison of productivity between the U.S. and other countries?
 - a. Productivity is harder to measure when the task becomes more intellectual. A knowledge society implies that work is more intellectual and therefore harder to measure. Because the U.S. and many other countries are increasingly "Knowledge" societies, productivity is harder to measure.
10. What are the measurements problems that occur when one attempts to measure productivity?
 - a. Productivity is difficult to measure because precise units of measure may be lacking, quality may not be consistent, and exogenous variables may change.
11. Mass customization and rapid product development were identified as current trends in modern manufacturing operations. What is the relationship, if any, between these trends? Can you cite any examples?
 - a. Mass customization is the flexibility to produce in order to meet specific customer demands, without sacrificing the low cost of a product-oriented process. Rapid product development is a source of competitive advantage. Both rely on agility within the organization.

12. What are the five reasons productivity is difficult to improve in the service sector?
- Typically, labor intensive, frequently focused on unique individual attributes or desires, often an intellectual task performed by professionals, often difficult to mechanize, often difficult to evaluate for quality.
13. Describe some the actions taken by Taco Bell to increase productivity that have resulted in Taco Bell's ability to serve "twice the volume with half the labor."
- Taco Bell designed meals that were easy to prepare; with actual cooking and food preparation done elsewhere; automation to save preparation time; reduced floor space; manager training to increase span of control.

PROBLEMS

1.1) Lori Cook produces final exam Care Packages for resale by her sorority. She is currently working a total of 5 hours per day to produce 100 care packages.

- $100/5 = 20$ packet/hr
- $133/5 = 26.6$ packet/hr
- $(26.6-20)/20 = 33\%$

1.4) Carbondale Casting produces cast bronze valves on a 12-person assembly line. On a recent day, 160 valves were produced during a 44-hour shift.

- $160/8 * 10 = 2$ v/hr
- $180/8 * 10 = 2.25$ v/hr
- $2.25-2/2 = 12.5\%$

1.6) In December, General Motors produced 6,600 customized vans at its plant in Detroit. The labor productivity at this plant is known to have been 0.10 vans per labor-hour during that month. 300 laborers were employed at the plant that month

- Productivity = Units produced / Labor-hours used
 $0.10 = 6,600 \text{ units} / \text{Labor-hours used}$
 $6,600 / 0.10 = \text{Labor-hours used}$
 $66,000 = \text{Labor-hours used}$
 Average hours worked per laborer = $66,000 / 300$
 Average hours worked per laborer = 220 hours
- Productivity = Units produced / Labor-hours used
 $0.11 = 6,600 \text{ units} / \text{Labor-hours used}$
 $6,600 / 0.11 = \text{Labor-hours used}$
 $60,000 = \text{Labor-hours used}$
 Average hours worked per laborer = $60,000 / 300$
 Average hours worked per laborer = 200 hours

1.7) George Kyparisis makes bearing balls in his Miami plant. With recent increases in his costs, he has a newfound interest in efficiency. George is interested in determining the productivity of his organization. He would like to know if his organization is maintaining the manufacturing average of a 3% increase in productivity. He has the following data representing a month from last year and an equivalent month this year.

Answer:

	Last Year	Now	Unit Cost
Units Produced	1200	1200	-
Labor Hours	280	255	10
Resin	50	45	6
Capital Investment	10000	11000	0.01
Energy	2900	2750	0.6
Productivity	0.2429	0.2620	
Growth	0.2620-0.2429/0.2429		=7.86%

1.11) Kleen Karpet cleaned 65 rugs in October, consuming the following resources: Labor: 520 hours at \$13 per hour Solvent: 100 gallons at \$5 per gallon Machine rental: 20 days at \$50 per day

a. Productivity = Units Produced / Input Used
 $= 65 / 520 = 0.125$ rugs/hour
 $= 65 / (520 * 13) = 0.0096$ rugs/\$

b. Productivity = Units Produced / Input Used
 $= 65 / (520 * 13 + 100 * 5 + 20 * 50) = 7.87$ rugs/1000\$

1.14) Lake Charles Seafood makes 500 wooden packing boxes for fresh seafood per day, working in two 10-hour shifts. Due to increased demand, plant managers have decided to operate three 8-hour shifts instead. The plant is now able to produce 650 boxes per day.

a. before = $650 / 2 * 10 = 25$ w/hr
 after = $500 / 3 * 8 = 27.08$ w/hr

b. $27.08 - 25 / 25 = 8.3\%$

c. New productivity = $700 / 24 = 29.16$ w/hr

Chapter 4

QUESTIONS

1. What is a qualitative forecasting model, and when is it appropriate?

Qualitative forecasting model - forecasts that incorporate such factors as the decision maker's intuition, emotions, personal experiences, and value system. Judgmental models are useful when subjective factors are important. When quantitative data are difficult to obtain, qualitative models are appropriate.

2. Identify and briefly describe the two general forecasting approaches.

One is quantitative analysis; the other is qualitative approach. Quantitative forecasts use a variety of mathematical models that rely on historical data and/or associative variables to forecast demand. Subjective or qualitative forecasts incorporate such factors as the decision maker's intuition, emotions, personal experiences, and value system in reaching a forecast. Some firms use one approach and some use the other. In practice, a combination of the two is usually most effective.

3. Identify the three forecasting time horizons. State an approximate duration for each.

Short-range forecast: This forecast has a time span of up to 1 year but is generally less than 3 months. It is used for planning purchasing, job scheduling, workforce levels, job assignments, and production levels.

Medium-range forecast: A medium-range, or intermediate, forecast generally spans from 3 months to 3 years. It is useful in sales planning, production planning and budgeting, cash budgeting, and analysis of various operating plans.

Long-range forecast: Generally 3 years or more in time span, long-range forecasts are used in planning new products, capital expenditures, facility location or expansion, and research and development

4. Briefly describe the steps used to develop a forecasting system.
 - a. Determine the use of the forecast.
 - b. Select what is to be forecasted.
 - c. Determine the time horizon of the forecast: short (1-30 days), medium (1 month - 1 year), or long horizon (more than 1 year)?
 - d. Select the forecasting model or models to be used.
 - e. Gather the required data to make the forecast.
 - f. Validate the forecast.
 - g. Make and implement the results.
5. A skeptical manager asks what medium-range forecasts can be used for. Give the manager three possible uses/purposes.

Any three of: sales planning, production planning and budgeting, cash budgeting, analyzing various operating plans.

6. Explain why such forecasting devices as moving averages, weighted moving averages, and exponential smoothing are not well suited for data series that have trends.
There is no mechanism for growth in these models; they are built exclusively from historical demand values. Such methods will always lag trends
7. What is the basic difference between a weighted moving average and exponential smoothing?
Exponential smoothing is a weighted moving average where all previous values are weighted with a set of weights that decline exponentially.
8. What three methods are used to determine the accuracy of any given forecasting method? How would you determine whether time-series regression or exponential smoothing is better in a specific application?
MAD, MSE and MAPE are common measures of forecast accuracy. To find more accurate forecasting model, forecast with each tool for several periods where the demand outcome is known, and calculate MSE, MAPE or MAD for each. The smaller error indicates the better forecast.
9. Briefly describe the Delphi technique.
A group process that allows experts from different places to make forecasts. This process includes three groups of people: decision makers, staff/personnel, and respondents. The decision-making group is made up of 5-10 experts who will make the actual forecast. The staff/personnel assist the decision makers by handling the questionnaires/surveys that are completed by the respondents. The respondents are a group of people whose judgments are valued and are being sought. The forecast is made from the inputs provided by the respondents to the decision makers.
10. What is the primary difference between a time-series model and an associative model?

Time-Series Models make predictions based on the assumption that the future is a function of the past while Associative Models incorporate variables or factors that might influence the quantity being forecast.
11. Define Time Series?
A model that employs the use of historical data to make a forecast.
12. What effect does the value of the smoothing constant have on the weight given to the past forecast and the past observed value?
The closer the smoothing constant is to 1, the more weight is added to recent data. When the smoothing constant is closer to 0, the past data carries more weight.
13. Explain the value of seasonal indices in forecasting. How are seasonal patterns different from cyclical patterns?

Seasonal indices enable forecasters to adjust for fluctuating seasonal demand. Seasonal patterns can occur in weeks, months, quarters, etc. but cyclical patterns occur over several years.

14. Which forecasting technique can place the most emphasis on recent values? How does it do this?

Exponential Smoothing

Form of weighted moving average

Weights decline exponentially

Most recent data weighted most

The concept is not complex. The latest estimate of demand is equal to the old forecast adjusted by a fraction of the difference between the last period's actual demand and last period's

Forecast

15. ??

16. What is the purpose of a tracking signal?

A tracking signal is a measurement of how well a forecast is predicting actual values.

17. ??

18. What is the different between a dependent and an independent variable?

Independent variable (x) is said to explain variations in the dependent variable (y) Independent variables - The values that can be changed in a given model or equation. They provide the "input" which is modified by the model to change the "output." Dependent variables - The values that result from the independent variables.

19. Give examples of industries that are affected by seasonality. Why would these businesses want to filter out seasonality?

Nearly every industry has seasonality. The seasonality must be filtered out for good medium-range planning (of production and inventory) and performance evaluation.

20. Give examples of industries in which demand forecasting is dependent on the demand for other products.

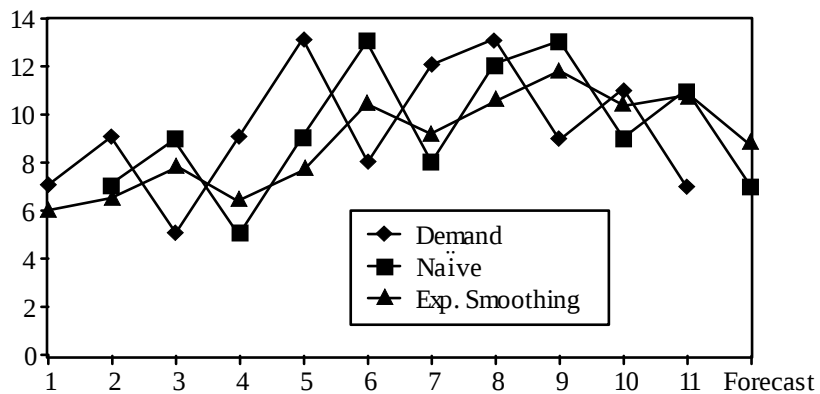
There are many examples. Demand for raw materials and component parts such as steel or tires is a function of demand for goods such as automobiles.

21. What happens to the ability to forecast for periods further into the future?

Obviously, as we go farther into the future, it becomes more difficult to make forecasts, and we must diminish our reliance on the forecasts.

PROBLEMS

4.3 Year	1	2	3	4	5	6	7	8	9	10	11	Forecast
Demand	7	9.0	5.0	9.0	13.0	8.0	12.0	13.0	9.0	11.0	7.0	
Naïve		7.0	9.0	5.0	9.0	13.0	8.0	12.0	13.0	9.0	11.0	7.0
Exp. Smoothing	6	6.5	7.8	6.4	7.7	10.3	9.2	10.6	11.8	10.4	10.7	8.8



Naïve tracks the ups and downs best but lags the data by one period. Thus, it gives quite large errors. Exponential smoothing is much better because it smoothens the data and does not have as much variation.

- 4.4 (a) $F_{\text{July}} = F_{\text{June}} + 0.2(\text{Forecasting error}) = 42 + 0.2(40 - 42) = 41.6$
- (b) $F_{\text{August}} = F_{\text{July}} + 0.2(\text{Forecasting error}) = 41.6 + 0.2(45 - 41.6) = 42.3$
- (c) Because the banking industry has a great deal of seasonality in its processing requirements

- 4.9 (a) 3-month moving average:

Month	Sales	Three-Month	
		Moving Average	Absolute Deviation
January	11		
February	14		
March	16		
April	10	$(11 + 14 + 16) / 3 = 13.67$	3.67
May	15	$(14 + 16 + 10) / 3 = 13.33$	1.67
June	17	$(16 + 10 + 15) / 3 = 13.67$	3.33
July	11	$(10 + 15 + 17) / 3 = 14.00$	3.00
August	14	$(15 + 17 + 11) / 3 = 14.33$	0.33
September	17	$(17 + 11 + 14) / 3 = 14.00$	3.00
October	12	$(11 + 14 + 17) / 3 = 14.00$	2.00
November	14	$(14 + 17 + 12) / 3 = 14.33$	0.33
December	16	$(17 + 12 + 14) / 3 = 14.33$	1.67
January	11	$(12 + 14 + 16) / 3 = 14.00$	3.00
February		$(14 + 16 + 11) / 3 = 13.67$	

$$\Sigma = 22.00$$

$$MAD = 2.20$$

(b) 3-month weighted moving average

Month	Sales	Three- Month Moving Average Weights = 1, 2, 3	Absolute Deviation
January	11		

February	14		
March	16		
April	10	$(1 \times 11 + 2 \times 14 + 3 \times 16) / 6 = 14.50$	4.50
May	15	$(1 \times 14 + 2 \times 16 + 3 \times 10) / 6 = 12.67$	2.33
June	17	$(1 \times 16 + 2 \times 10 + 3 \times 15) / 6 = 13.50$	3.50
July	11	$(1 \times 10 + 2 \times 15 + 3 \times 17) / 6 = 15.17$	4.17
August	14	$(1 \times 15 + 2 \times 17 + 3 \times 11) / 6 = 13.67$	0.33
September	17	$(1 \times 17 + 2 \times 11 + 3 \times 14) / 6 = 13.50$	3.50
October	12	$(1 \times 11 + 2 \times 14 + 3 \times 17) / 6 = 15.00$	3.00
November	14	$(1 \times 14 + 2 \times 17 + 3 \times 12) / 6 = 14.00$	0.00
December	16	$(1 \times 17 + 2 \times 12 + 3 \times 14) / 6 = 13.83$	2.17
January	11	$(1 \times 12 + 2 \times 14 + 3 \times 16) / 6 = 14.67$	3.67
February		$(1 \times 14 + 2 \times 16 + 3 \times 11) / 6 = 13.17$	

$$\Sigma = 27.17$$

$$MAD = 2.72$$

- (c) Based on a Mean Absolute Deviation criterion, the 3-month moving average with $MAD = 2.2$ is to be preferred over the 3-month weighted moving average with $MAD = 2.72$.
- (d) Other factors that might be included in a more complex model are interest rates and cycle or seasonal factors.

a) Use exponential smoothing, first with a smoothing constant of .6 and then with one of .9, to develop forecasts for years 2 through 6.

Exponential Smoothing $\alpha = 0.6$

Year	A	$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$	F_t	Error
1	45	41 (given in question)	41	4.0
2	50	$41.0 + 0.6(45 - 41)$	43.4	6.6
3	52	$43.4 + 0.6(50 - 43.4)$	47.4	4.6
4	56	$47.4 + 0.6(52 - 47.4)$	50.2	5.8
5	58	$50.2 + 0.6(56 - 50.2)$	53.7	4.3
6	?	$53.7 + 0.6(58 - 53.7)$	56.3	
				$\Sigma = 25.3$

$MAD = 25.3 / 5 = 5.06$

b) Use a 3-year moving average to forecast demand in years 4, 5, and 6.

3-Year Moving Average

Year	A	3-Year Moving Average	Error
1	45		
2	50		
3	52		
4	56	$(45 + 50 + 52) / 3 = 49$	7
5	58	$(50 + 52 + 56) / 3 = 52.7$	5.3
6	?	$(52 + 56 + 58) / 3 = 55.3$	
			$\Sigma = 12.3$

$MAD = 12.3 / 2 = 6.2$

4.23 (a)

Week	Actual Miles	Forecast	Error	RSFE	Σ Error	Cum. MAD	Tracking Signal
1	17	17.00	0.00	-	0.00	0	
2	21	17.00	4.00	4.00	4.00	2	2.0
3	19	17.80	1.20	5.20	5.20	1.73	3.0
4	23	18.04	4.96	10.16	10.16	2.54	4.0
5	18	19.03	-1.03	9.13	11.19	2.24	4.1
6	16	18.83	-2.83	6.30	14.02	2.34	2.7
7	20	18.26	1.74	8.04	15.76	2.25	3.6
8	18	18.61	-0.61	7.43	16.37	2.05	3.6
9	22	18.49	3.51	10.94	19.88	2.21	5.0
10	20	19.19	0.81	11.75	20.69	2.07	5.7

11	15	19.35	-4.35	7.40	25.04	2.28	3.2
12	22	18.48	3.52	10.92	28.56	2.38	4.6

- (b) The $MAD = 28.56/12 = 2.38$
- (c) The *RSFE* and tracking signals appear to be consistently positive, and at week 10, the tracking signal exceeds 5 *MADs*.

4.39

X = car registrations

Y = sales tax collection

Y (sales tax collections)	X (new car registrations)	XY	x^2	y^2
1	10	10	100	1
1.4	12	16.8	144	1.96
1.9	15	28.5	225	3.61
2	16	32	256	4
1.8	14	25.2	196	3.24
2.1	17	35.7	289	4.41
2.3	20	46	400	5.29
12.5	104	194.2	1610	23.51

$$b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$$

$$b = \frac{194.2 - 7 \times (14.86 \times 1.786)}{1610 - 7 \times (14.86^2)}$$

$$= \frac{194.2 - 7 \times 26.53}{1,610 - 7 \times 220.81}$$

$$= \frac{194.2 - 185.71}{1,610 - 1,545.67}$$

$$= \frac{8.42}{64.33}$$

$$= 0.131$$

4.49

x = Contracts released

y = Sales of PEC

Substitute the data according to the given formula:

X	Y	XY	X ²	Y ²
153	8	1224	23409	64
172	10	1720	29584	100
197	15	2955	38809	225
178	9	1602	31684	81
185	12	2220	34225	144
199	13	2587	39601	169
205	12	2460	42025	144
226	16	3616	51076	256
1515	95	18384	290413	1183

To find $b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$

$$\text{To find } b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$$

Need to find \bar{x} and \bar{y} .

To find \bar{x} :

$$\bar{x} = \frac{\sum x}{n}$$

Where, $\sum x = 1,515$ and n is 8.

$$\begin{aligned}\bar{x} &= \frac{1,515}{8} \\ &= 189.375\end{aligned}$$

To find \bar{y} :

$$\bar{y} = \frac{\sum y}{n}$$

Where, $\sum y$ is 95 and n is 8.

$$\begin{aligned}\bar{y} &= \frac{95}{8} \\ &= 11.875\end{aligned}$$

Then, substitute 18,384 for $\sum xy$, 189.375 & 11.875 for $\bar{x}\bar{y}$, 8 is n :

$$\begin{aligned}b &= \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2} \\ b &= \frac{18,384 - 8(189.375 \times 11.875)}{290,413 - 8 \times 189.375^2} \\ &= \frac{18,384 - 17,990.625}{290,413 - 286,903.125} \\ &= \frac{393.775}{3,509.875} \\ &= 0.1122\end{aligned}$$