

MSCI 432 COURSE NOTES
PRODUCTION AND SERVICE OPERATIONS
MANAGEMENT

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Table of Contents

1	<i>Operations Management and Demand Forecasting (I)</i>	1
1.1	Basic Premise of Supply and Demand	1
1.2	Operations as an Aggregate Function	1
1.2.1	What is Operations Management?	1
1.2.2	Why Study Operations Management?	1
1.2.3	Three Basic Functions	1
1.2.4	Types of OM Decisions	1
1.3	Operations as it Relates to the Firm	2
1.4	What Operations Managers Do	2
1.4.1	Defining the Role of the Operations Manager	2
1.4.2	The Operations Manager's Job	3
1.4.3	Establishing Priorities	3
1.5	The Importance of Collaboration	3
1.6	Concept of Value Added	3
1.7	Stakeholder Management	3
1.8	Demand Forecasting	3
1.9	Forecast Commonalities	4
1.10	Requirements for a Useful Forecast	4
1.11	How it is Done	4
1.12	Judgemental Approaches	4
1.13	Quantitative Approaches	4
1.14	Time Series Modeling	5
1.14.1	Data Behaviour	5
1.14.2	Methods	5

1 OPERATIONS MANAGEMENT AND DEMAND FORECASTING (I)

1.1 Basic Premise of Supply and Demand

- As consumers, we decide how much we want to buy and how much we are willing to pay
- Consumers hold the cash and as such are the ultimate decision makers
- This underlies OM as it goes to the heart of the environment in which firms operate

1.2 Operations as an Aggregate Function

1.2.1 What is Operations Management?

- OM is the management of activities and resources that create goods and provide services
- Companies use OM to improve efficiency and effectiveness

1.2.2 Why Study Operations Management?

- A large percentage of a company's expenses occur in the OM area
- A large number of all jobs are in the OM area
- Activities in all other areas are interrelated with OM activities

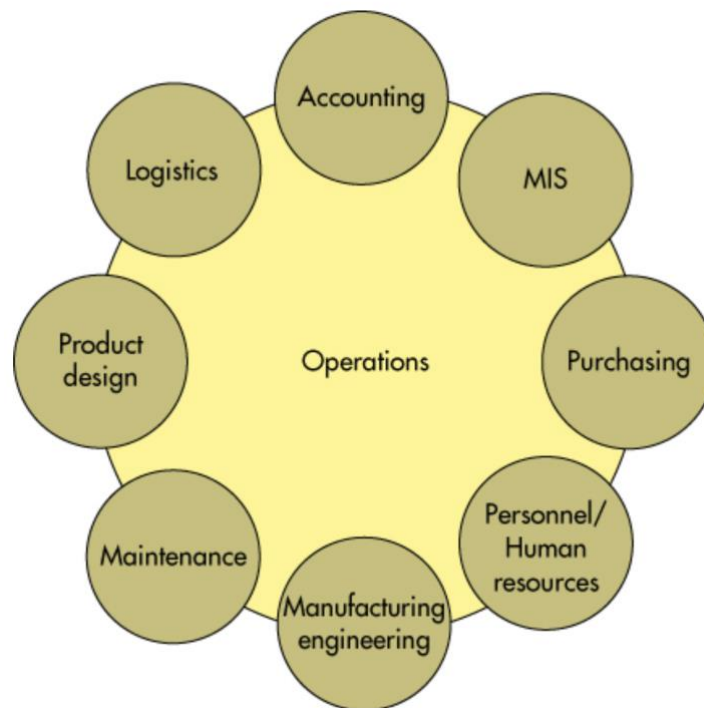
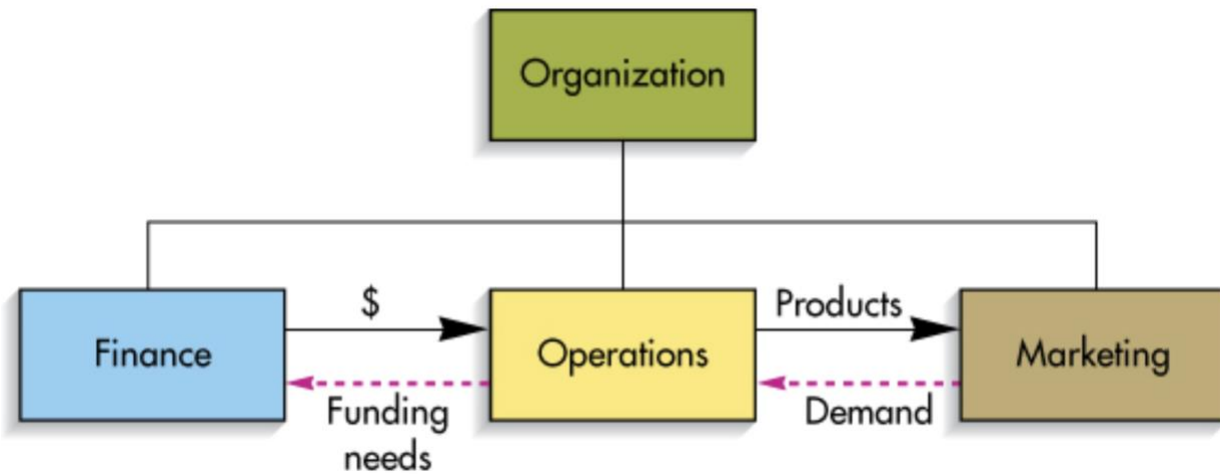
1.2.3 Three Basic Functions

1. Operations: Create goods and services
2. Finance: Provide funds and the economic analysis of investment proposals
3. Marketing: Assess customer wants and needs and communicate them to others

1.2.4 Types of OM Decisions

- Design (strategic) decisions that are medium to long term and deal with capital equipment and other physical assets (equipment needs, production capacity, etc.)
- Day-to-day operations involve the everyday decisions such as scheduling, packaging, quality control, and labour requirements

1.3 Operations as it Relates to the Firm



1.4 What Operations Managers Do

1.4.1 Defining the Role of the Operations Manager

- Core (manufacturing)
- Support (maintenance, accounting, HR, purchasing)
- Managerial (general administration)

1.4.2 The Operations Manager's Job

Management Process	Field of Responsibility
Planning	Capacity, location, make or buy
Organizing	Centralization, specialization, staffing
Controlling	Inventory, quality, motivation
Directing	Scheduling, incentive plans, work orders

1.4.3 Establishing Priorities

- Pareto Phenomenon: A few factors account for a high percentage of the occurrence of some event(s)
- 80/20 Rule: 80% of problems are caused by 20% of the activities

1.5 The Importance of Collaboration

- A clear and comprehensive systems-based approach for issues is in demand
- Coordination between marketing and operations is essential for success
- For example, changing a package form needs to account for inventory costs and order quantities, existing packaging inventories, new equipment needs, plant layout, etc.

1.6 Concept of Value Added

- Difference between the cost of goods and the value of outputs
- For services, the cost of services and the value placed on those services by individuals
- Value of output is determined by the prices that consumers are willing to pay for goods

1.7 Stakeholder Management

- “Any group or individual who can affect or is affected by the achievement of an organization’s objective” (Freeman, 1984)
- Stakeholders may include customers, employees, suppliers, financiers, etc.

1.8 Demand Forecasting

- Underlies strategic planning when it comes to plant or service design
- Essential for budgeting and determining capital requirements for both inputs and projects
- Dictates medium-term operations and affects short-term operations

1.9 Forecast Commonalities

1. Rely, to some extent, upon past demand and criteria identified as affecting that demand
2. Forecasts of aggregate demand for similar goods is more accurate than forecasts for individual items within a category
3. Increasing forecast horizons introduces greater uncertainty and reduced reliability

1.10 Requirements for a Useful Forecast

1. Forecast should be long enough to make it relevant
2. Limitations on accuracy must be clearly stated
3. Forecasting method should be reliable
4. Operations forecasts should be expressed in units

1.11 How it is Done

1. Determine why you are forecasting (who wants it and what will they use it for)
2. Assess and state the required levels of detail and accuracy
3. Establish a forecasting horizon
4. Gather historical data
5. Select a forecasting method
6. Complete the forecast
7. Monitor its accuracy

1.12 Judgemental Approaches

- Includes things such as hunches, personal opinions, non-quantitative observations
- Can be tainted by personal bias
- Developed as a non-quantitative analysis of historical data or analysis of subjective data

1.13 Quantitative Approaches

- Utilize hard data from the past (untainted from personal bias)
- Time series models (identifies patterns in data and projects these trends into the future)
- Associative models (describes demand in terms of independent causal variables)

1.14 Time Series Modeling

- A time-ordered sequence of observations taken at regular intervals over a period of time
- Assumes that future values of the series can be estimated from past values

1.14.1 Data Behaviour

- Average (level): Horizontal pattern
- Trend: Persistent upward or downward pattern
- Seasonality: Regular wavelike pattern that corresponds with some repeatable event
- Cycles: Lasts more than one year and looks at longer-term patterns
- Irregular Variations: One-time events that tend to skew the data
- Random Variations: Multitude of minor events that combine to affect the data

1.14.2 Methods

Naïve Method

- Assumes that the value of the data for the last period will be the value of the next period
- Can be applied to average, trend, and seasonal data

Period	Actual	Change	Naïve Forecast
$t - 1$	50		
t	53	+3	
$t + 1$			$53 + 3 = 56$

Averaging Methods

- Three types: moving average, weighted moving average, and exponential smoothing
- Requires stable data and can handle random variations but not irregular data points

Moving Average Method

- Average of recent observations are used as the basis for the current forecast
- Choice of the number of data points used for the calculation will affect the sensitivity of the average to the most recent data point

Period	Demand
1	42

2	40
3	43
4	40
5	41

$$F_6 = \frac{43 + 40 + 41}{3} = 41.33$$

$$F_7 = \frac{40 + 41 + 39}{3} = 40.00$$

Weighted Moving Average Method

- Assigns a heavier weight to more recent data points
- Sum of the weights must equal to one

$$F_6 = 0.40(41) + 0.30(40) + 0.20(43) + 0.10(40) = 41.0$$

$$F_7 = 0.40(39) + 0.30(41) + 0.20(40) + 0.10(43) = 40.2$$

Exponential Smoothing

- Current forecast that is based upon the previous period plus a portion of the difference between the actual outcome in the period and the quantity forecast for that period
- Notation: $F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$, where $0 < \alpha < 1$
- For example, if previous forecast was 42 units, previous actual demand was 40 units, and $\alpha = 0.10$, the new forecast would be:

$$F_t = 42 + 0.10(40 - 42) = 41.8$$

- Then, if the actual demand turned out to be 43, the next forecast would be:

$$F_{t+1} = 41.8 + 0.10(43 - 41.8) = 41.92$$