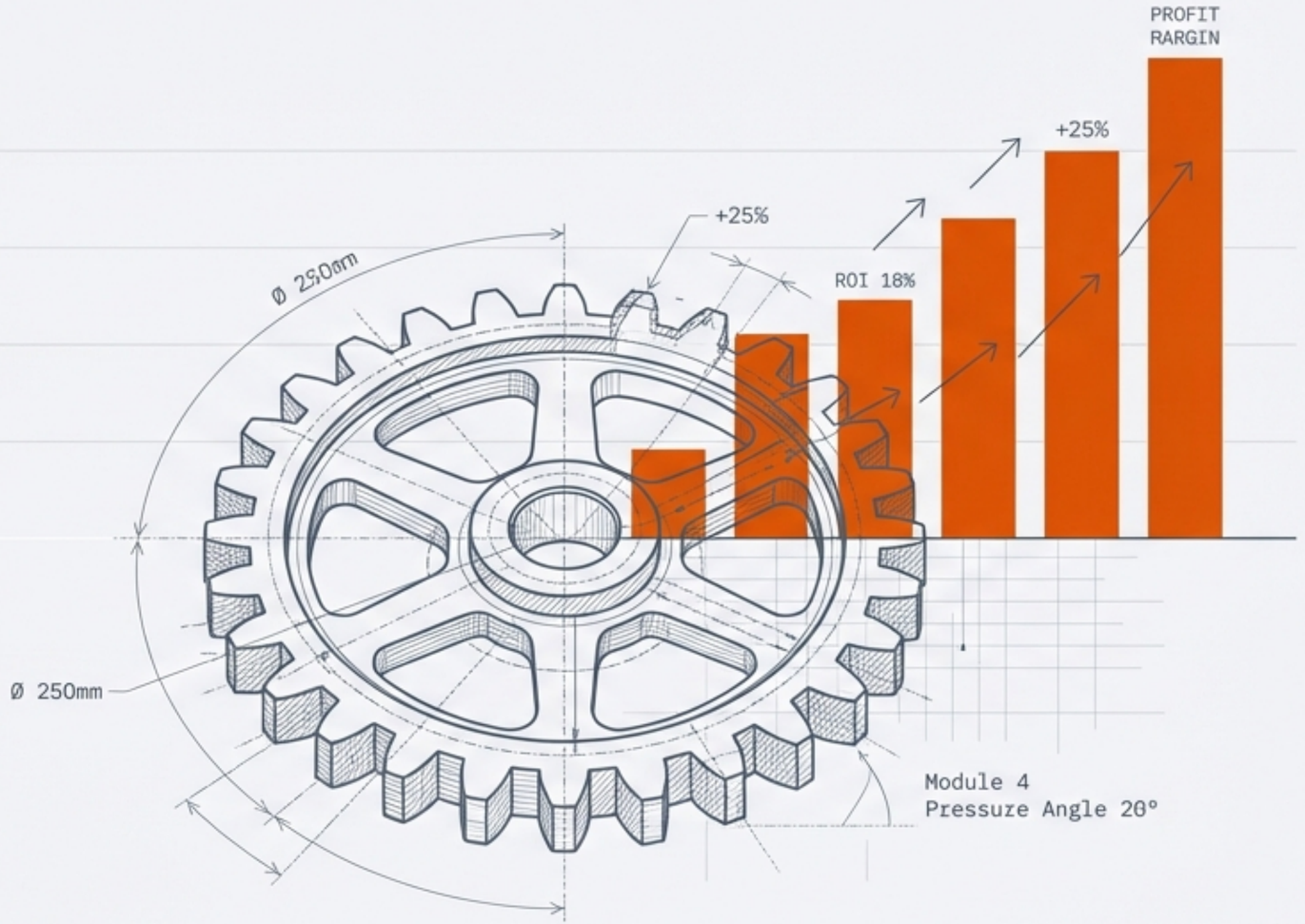
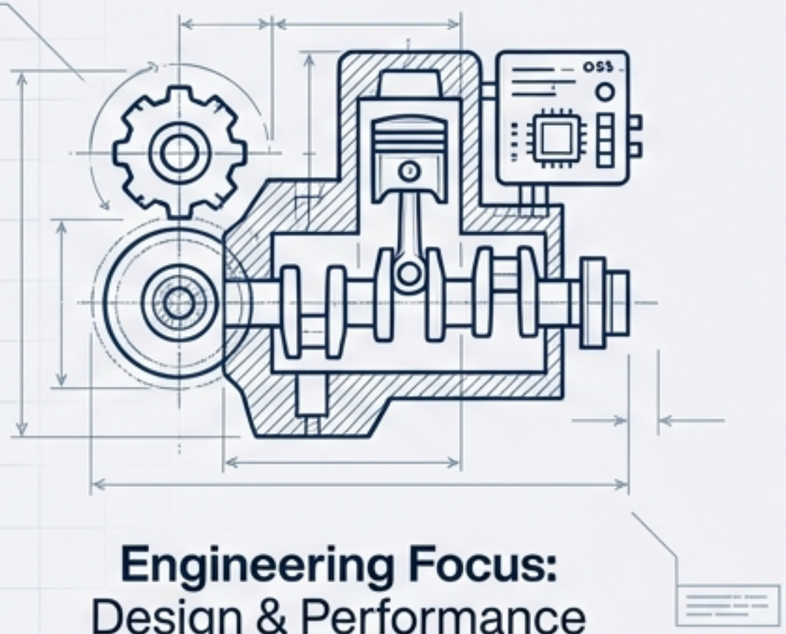


Engineering Economics for Managers: From Technical Feasibility to Economic Efficiency

A guide to principles, market dynamics, and production strategies.

The Bridge Between Engineering Design and Economic Value



Engineering Focus:
Design & Performance

SPEC: 2000 RPM
TOLERANCE: +/-0.005mm
MATERIAL: Ti-6Al-4V

RGI: 18.5%
RISK FACTOR: MODERATE
SUSTAINABILITY SCORE: A-
NPV: $2.5M

Managerial Focus:
Cost, Benefit, Risk, Sustainability

Engineering Economics is a specialized branch applying economic principles and analytical tools to decision-making. Its goal is selecting the "most economically efficient alternative" among technically feasible options.

Context: Originating in the Industrial Revolution. Formalized by Eugene L. Grant, "Principles of Engineering Economy" (1942).

REF: EE-HIST-V1.0

The Six Core Principles of Decision Making

REF: EE-HIST-V1.0

Scarcity

Resources are limited; therefore, choices are unavoidable.

Alternatives

Every decision implies multiple options; if there is no alternative, there is no decision.

Time Value of Money

Money has a time dimension—₹1 today is worth more than ₹1 tomorrow.

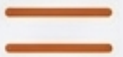
SPEC: PRINCIPLES

Marginal Analysis

Continue investment only if Additional Benefit ≥ Additional Cost.

Risk & Uncertainty

Future outcomes are never guaranteed; analysis must account for this.



Economic Equivalence

Different cash flows must be compared on a common time basis for accuracy.

SPEC: PRINCIPLES

Nature, Scope, and Economic Perspectives

Nature of the Discipline

- Decision-oriented
- Quantitative
- Applied
- Dynamic

Key Applications

Capital investment, Equipment replacement, Cost reduction, Project appraisal (NPV, IRR).

Aspect	Microeconomics	Macroeconomics
Scope	Individual units	Economy as a whole
Focus	Demand, supply, pricing	GDP, inflation, employment
Approach	Bottom-up	Top-down
Time	Short run	Long run

REF: ECON-PERSPECTIVES-V1.2

Theory of Demand: Understanding the Consumer

Demand = Desire + Ability to Pay + Willingness to Pay

Desire alone is not demand.

Demand Function

$$Dx = f(Px, Y, T, Pr, N, E)$$

- Price
- Income
- Tastes
- Prices of related goods
- Number of consumers
- Expectations

SPEC: DEFINITIONS

Distinction: “Demand” is the entire relationship. “Quantity Demanded” is a specific amount at a specific price.

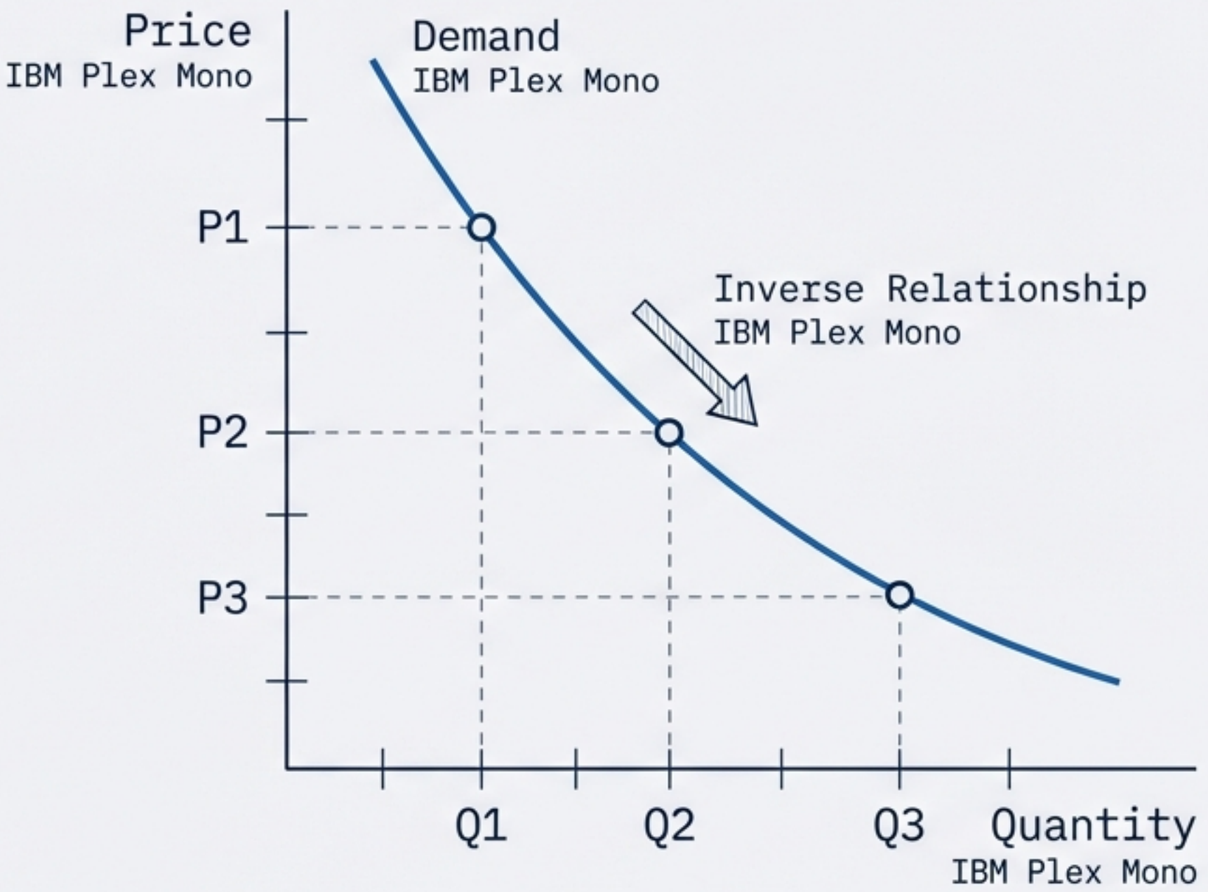
REF: DEMAND-THEORY-V1.3

The Law of Demand

The Law:
Ceteris paribus, when price rises, quantity demanded falls. An inverse relationship.

The Logic:

1. Substitution Effect: Consumers shift to cheaper alternatives.
2. Income Effect: Lower price increases real purchasing power.



REF: LAW-OF-DEMAND-V1.4

Price Elasticity and Market Exceptions

Price Elasticity of Demand (PED)

$$\% \text{ Change in } Q \; / \; \% \text{ Change in } P$$

- Elastic (>1): High sensitivity
- Unitary (=1): Proportional
- Inelastic (<1): Low sensitivity

Exceptions (When the Law Breaks)

Giffen Goods
(Inferior goods)

Demand rises when price rises. Consumers buy more of an inferior good as its price increases due to the income effect.

Veblen Goods
(Prestige/Status)

Demand rises when price rises. High price signifies status and exclusivity, attracting buyers.

Speculative Goods
(Future price rise expected)

Demand rises when price rises. Buyers purchase now expecting further price increases to sell for profit.

Necessities & Ignorance Effect

Demand remains relatively stable despite price changes. Lack of market information can also lead to exceptions.

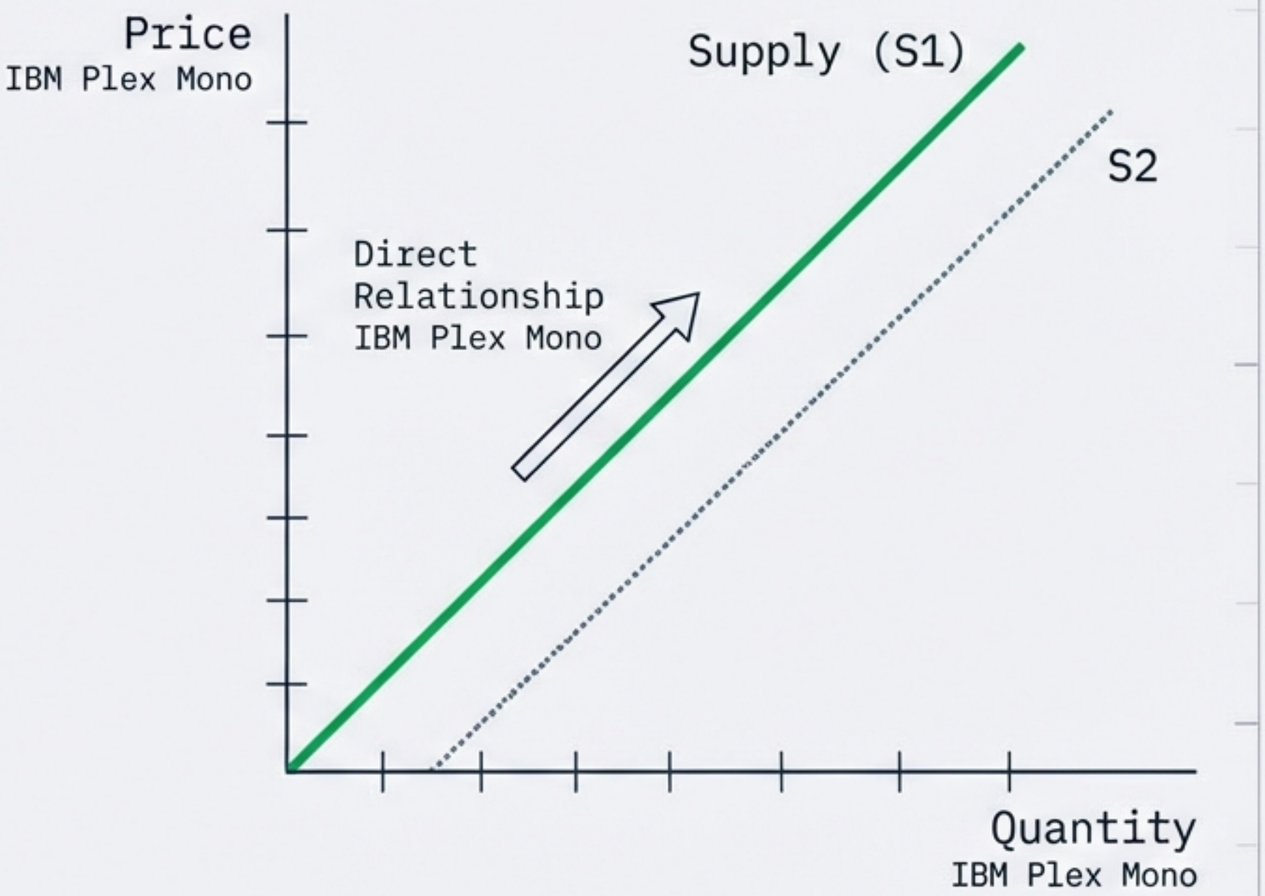
REF: ELASTICITY-EXCEPTIONS-V1.5

Theory of Supply: The Producer's Perspective

The Law:
Other things constant, quantity supplied increases with price.

The Logic:

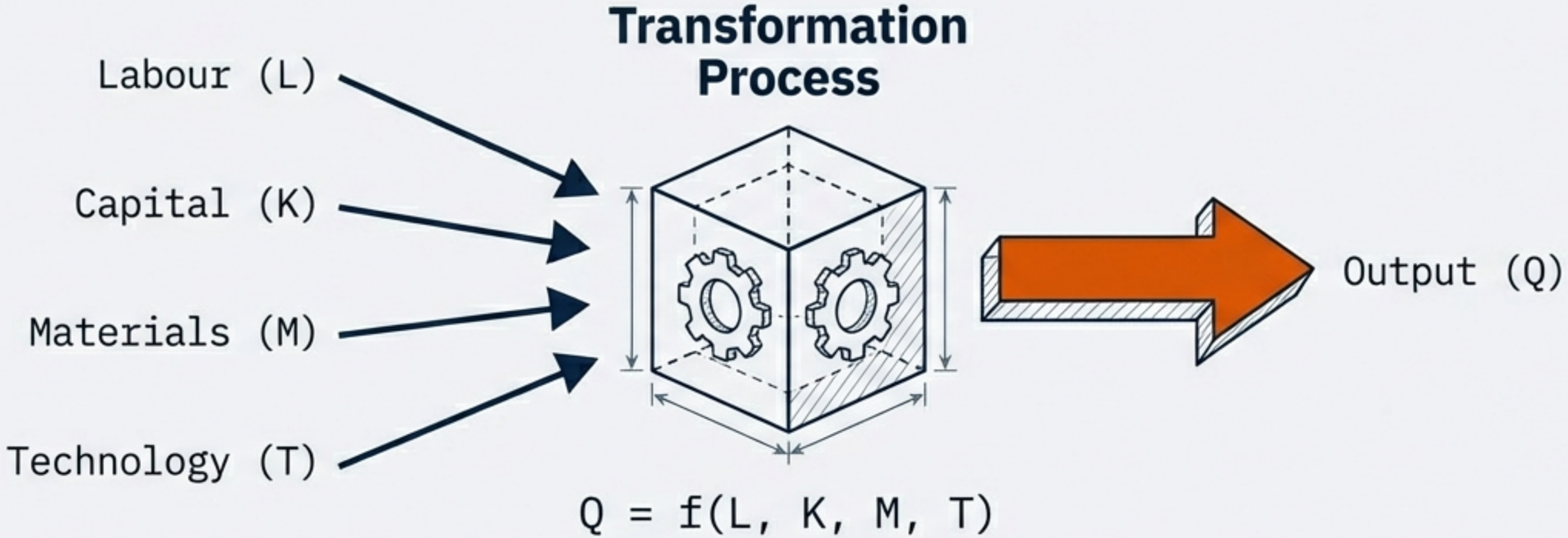
1. Higher prices = Higher profits = Market entry and expansion.



REF: THEORY-OF-SUPPLY-V2.0

Market Equilibrium

The Production Function: Inputs to Outputs



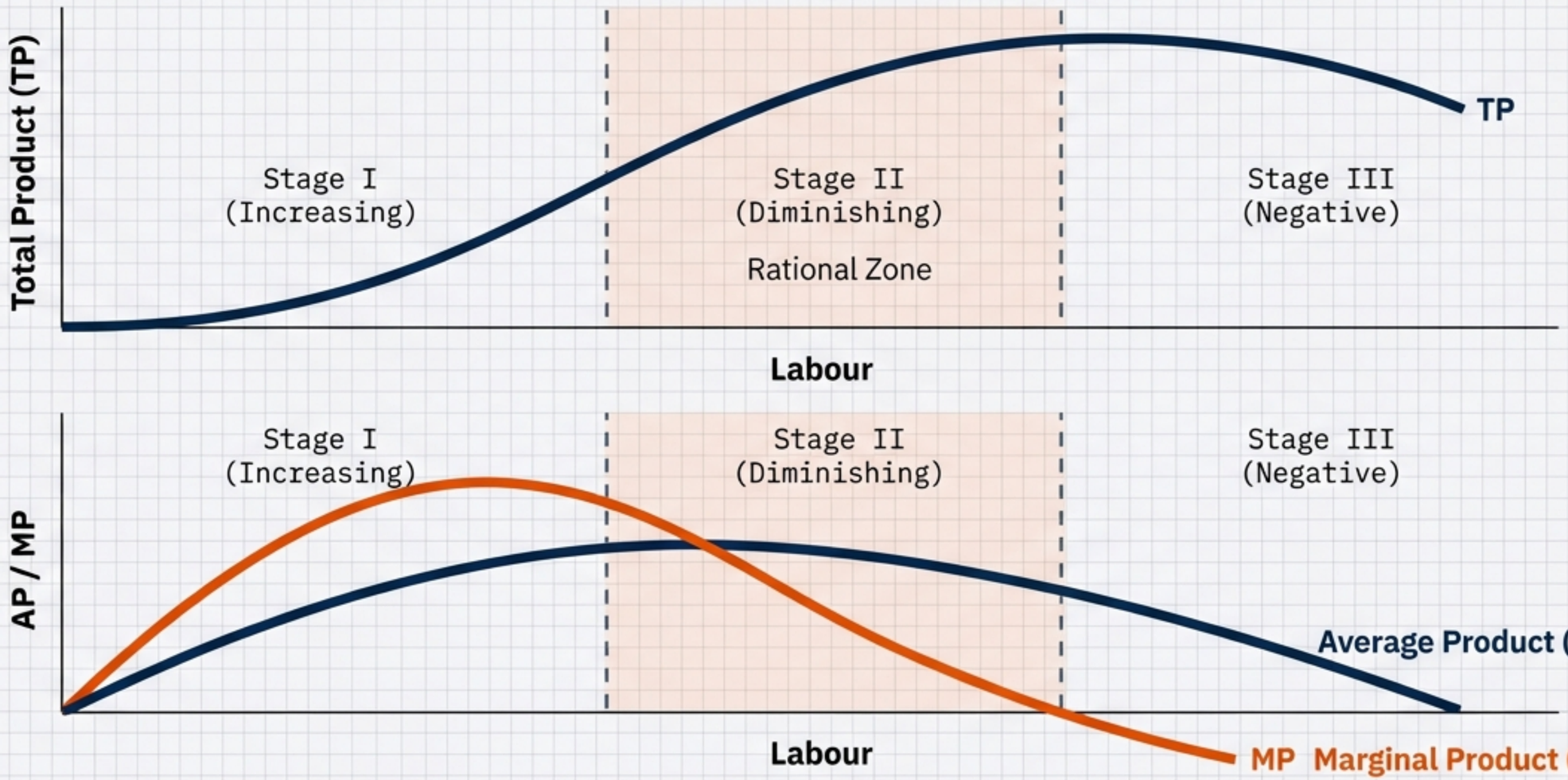
Short Run:

- At least one factor fixed (Capital), others variable.

Long Run:

- All factors variable; scale changes.

Short Run Analysis: Law of Variable Proportions

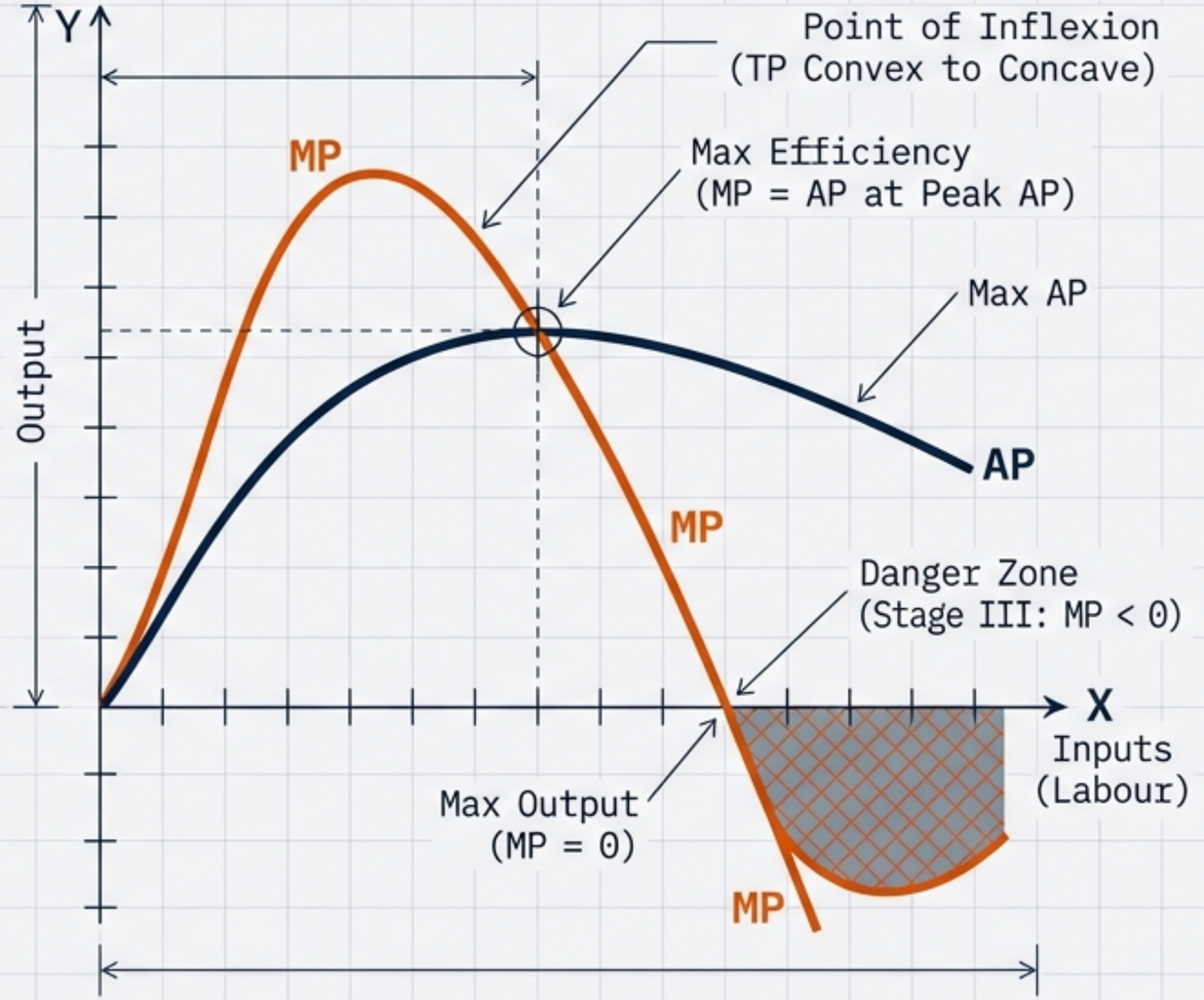


Analyzing the Efficiency Curves

Key Inflection Points:

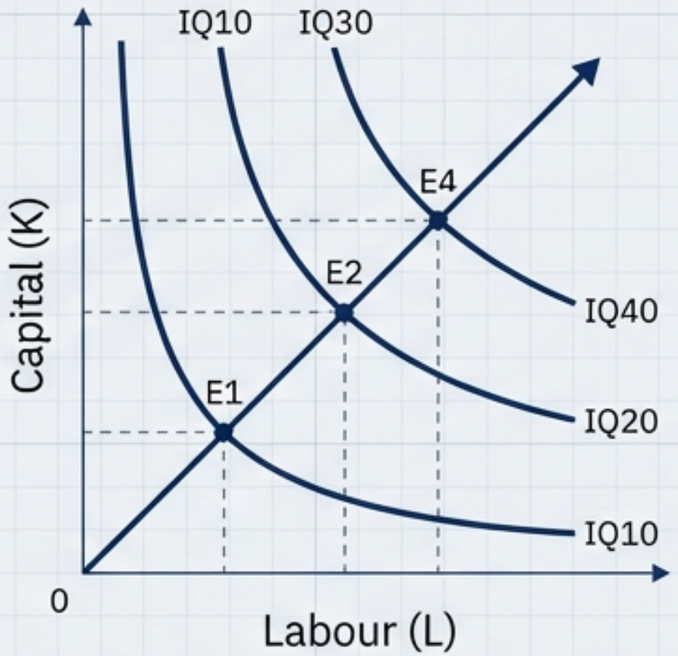
1. **Point of Inflexion:** TP curve shifts from convex to concave.
2. **Max Efficiency:** Marginal Product (MP) intersects Average Product (AP) at AP's peak.
3. **Max Output:** Marginal Product (MP) = 0. Total Product (TP) is maximized here.
4. **The Danger Zone (Stage III):** MP becomes negative. Total output falls.

Takeaway: Stop adding inputs before MP becomes negative.

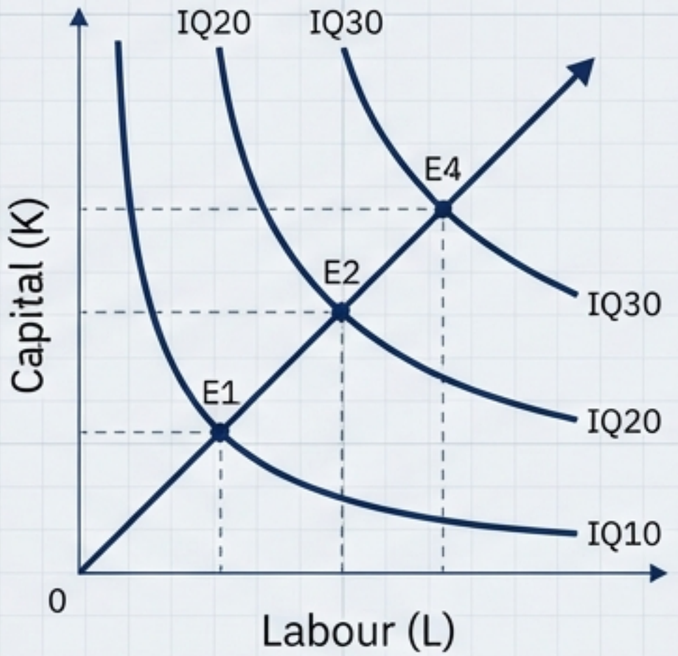


Long Run Analysis: Returns to Scale

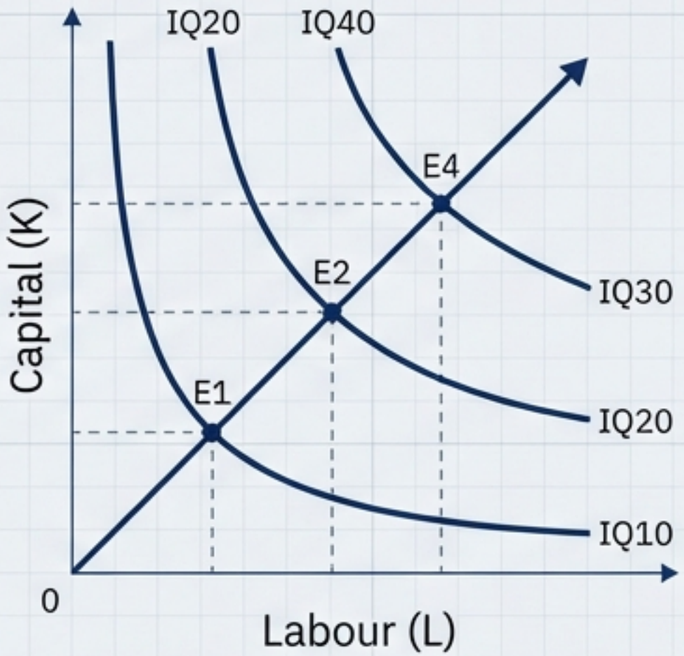
Increasing Returns (IRS)



Constant Returns (CRS)



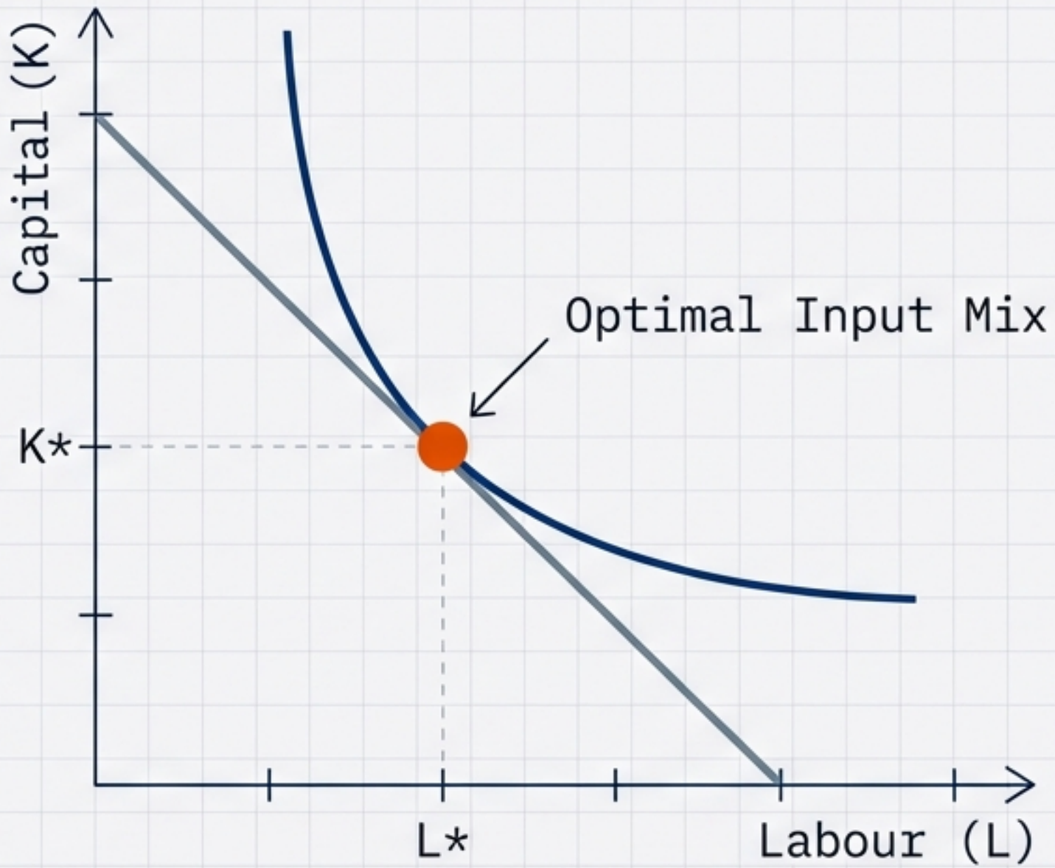
Decreasing Returns (DRS)



REF: LONG-RUN-ANALYSIS-RETURNS-TO-SCALE-V1.0

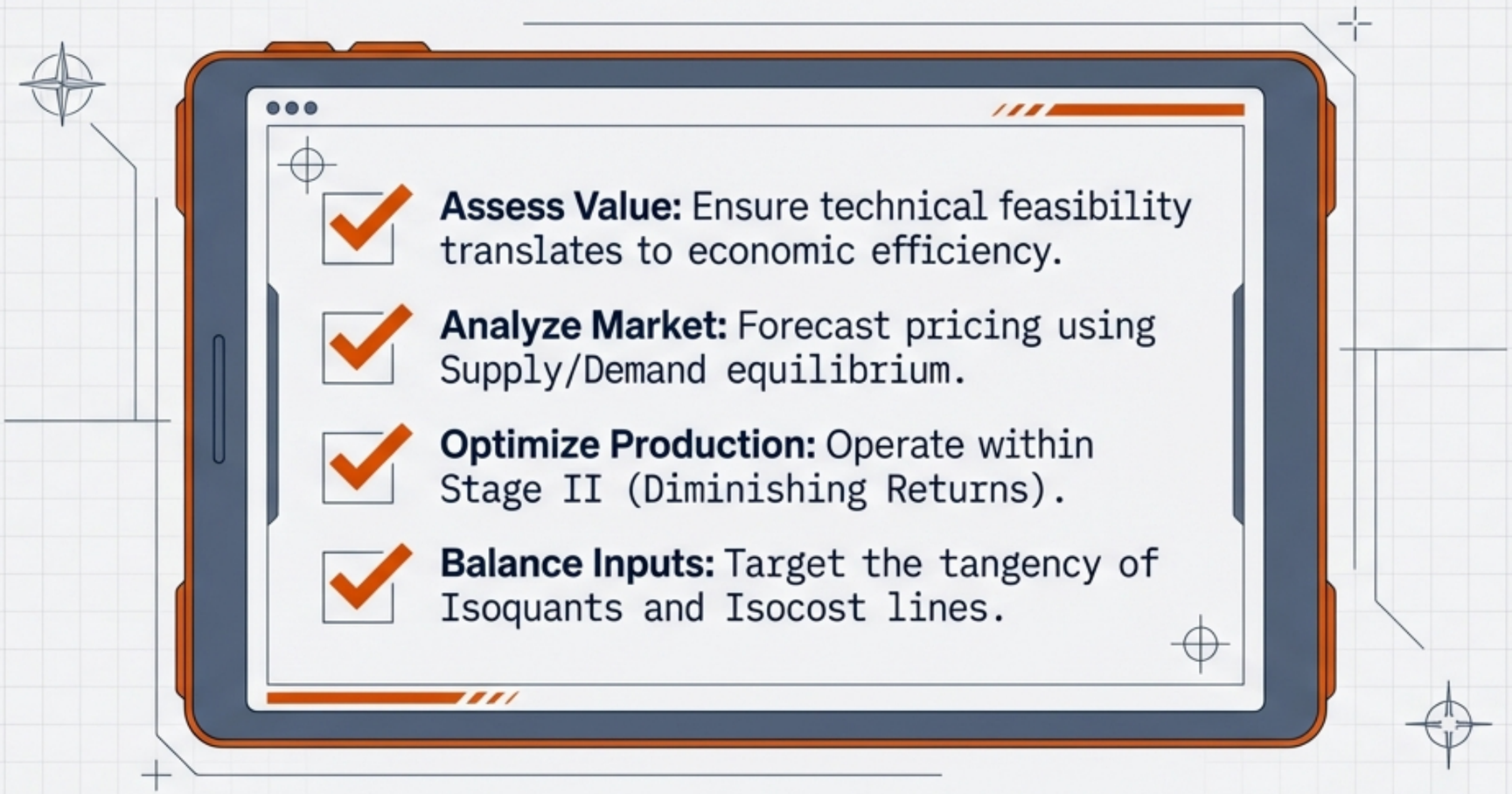
Optimization: Isoquants and Isocosts

- **Isoquant:** Curve showing combinations of inputs producing EQUAL output.
- **Isocost:** Line representing the BUDGET constraint.
- **Optimization Rule:** Efficiency is achieved at the point of tangency.



REF: OPTIMIZATION-ISOQUANTS-ISOCOSTS-V1.0

The Engineer’s Economic Checklist



Engineering Economics is the bridge between a working design and a successful business.