

The Industrial Engineering Formula Reference

Every formula behind the interactive tools at saranstinking.github.io/saranraj-portfolio — the same math, in one place, so you can use it without opening a browser.

Supply Chain Management

Economic Order Quantity

$$Q^* = \sqrt{2DS / H}$$

D = annual demand, S = ordering cost/order, H = holding cost/unit/year

Safety Stock

$$SS = z \times \sigma_d \times \sqrt{L}$$

z = service-level factor, σ_d = demand std. dev., L = lead time

Reorder Point

$$ROP = \bar{d} \times L + SS$$

$\bar{d}$ = average daily demand, L = lead time in days

Bullwhip Ratio

$$Ratio = CV(orders)^2 / CV(demand)^2$$

CV = coefficient of variation; ratio > 1 signals amplification upstream

Quality Management

Process Capability

$$C_p = (USL - LSL) / (6 \times \sigma)$$

Measures spread against tolerance width, ignoring centering

Process Capability Index

$$C_{pk} = \min[(USL - \mu) / (3\sigma), (\mu - LSL) / (3\sigma)]$$

Cp - Cpk gap reveals a centering problem, not just a spread problem

Individuals Control Chart

$$UCL/LCL = \bar{X} \pm 2.66 \times MR_{\bar{bar}}$$

MR_{bar} = mean moving range between consecutive readings

Lean Six Sigma

FMEA Risk Priority Number

$$RPN = Severity \times Occurrence \times Detection$$

Each rated 1-10; RPN >= 200 typically flags immediate action

Takt Time

$$Takt = Available\ Time / Customer\ Demand$$

The pace every station must match or beat to meet demand

Line Balance Efficiency

$$Eff. = (Sum\ of\ Task\ Times) / (Stations \times Cycle\ Time)$$

Below ~75% signals a poorly balanced line worth re-grouping

Work System & Ergonomics

Overall Equipment Effectiveness

$$OEE = Availability \times Performance \times Quality$$

All three as decimals; multiplies, so one weak factor caps the whole score

NIOSH Lifting Equation

$$RWL = LC \times HM \times VM \times DM \times AM \times FM \times CM$$

Recommended Weight Limit; each multiplier scales 0-1 based on task geometry

RULA / REBA Posture Scoring

$$\text{Additive table-based score per body segment}$$

Upper arm, lower arm, wrist, neck, trunk, legs -> mapped to an action level

Cognitive Ergonomics & Human Factors

Fitts's Law (Index of Difficulty)

$$ID = \log_2(2D / W)$$

D = distance to target, W = target width; higher ID = harder/slower to hit

Signal Detection Theory

$$d' = z(\text{Hit Rate}) - z(\text{False Alarm Rate})$$

c = -0.5 x [z(Hit Rate) + z(False Alarm Rate)] gives response bias

AI & Machine Learning

Precision, Recall, F1

$$F1 = 2 \times (P \times R) / (P + R)$$

Harmonic mean of precision and recall; punishes imbalance between the two

Logistic Sigmoid

$$\sigma(z) = 1 / (1 + e^{-z})$$

Squashes any real input into a (0,1) probability-like output

Coefficient of Determination

$$R^2 = 1 - (SS_{res} / SS_{tot})$$

Share of variance in y explained by the fitted regression line

Management & Entrepreneurship

Break-Even Volume

$$BEV = Fixed\ Costs / (Price - Variable\ Cost)$$

Units needed per period before the venture turns a profit

Contribution Margin Ratio

$$CMR = (Price - Variable\ Cost) / Price$$

Below ~20% means break-even is highly sensitive to cost or price slippage

Organisational Behaviour - Original Framework

Team Throughput Index (Team Constraint Diagnostic)

$$TTI = 0.7 \times \min(\text{dimension scores}) + 0.3 \times \text{avg}(\text{dimension scores})$$

Throughput is set by the weakest dimension, not the average - adapted from Theory of Constraints.

