

Case Study: RM-SYM-003

Category: Risk Management

Sub-Pillar: Structural Yield Multiplier (SYM)

Enterprise Focus: AB Fastener Sdn. Bhd. (SME)

Cost Centre: Thrufeed Thread-Rolling Section

Protagonists: Mr. Johnson (CEO), Ms. Kartina (Plant Manager)

1. Operational Context & Executive Dilemma

Background

AB Fastener Sdn. Bhd. is an established mid-sized Malaysian manufacturer specializing in standard and high-tensile fasteners for industrial applications. Among its primary revenue drivers is the Thrufeed Thread-Rolling Section, where steel wire blanks undergo high-speed cold-forming between opposing hardened steel dies to produce precision-threaded bolts.

The plant operates on a standard shift architecture, tracking performance via three core operational metrics:

1. **AEC (Asset Execution Capacity):** Line utilization and dynamic machine run-time capacity.
2. **EEU (Energy Efficiency Utilization):** Conversion efficiency of utility input into mechanical torque.
3. **SYM (Structural Yield Multiplier):** The overall physical material yield factor measuring conforming, top-tier finished units produced against total raw material blanks fed into the machine.

The Dilemma

During a routine Monday morning executive briefing, CEO Mr. Johnson reviewed last week's consolidated shop-floor reports. While machine capacity utilization (AEC) and power efficiency (EEU) remained within acceptable baseline parameters, the weekly average Structural Yield Multiplier (SYM) for the Thrufeed Thread-Rolling Section had plummeted to an alarming 65.0%—well below the plant target threshold of 90.0%.

Ms. Kartina, who had been appointed Plant Manager just two months prior, found herself in an uncomfortable position. Without deep historical context or immediate root-cause telemetry at her fingertips during the review, her initial explanations were hesitant and unconvincing. Recognizing the immediate threat to profit margins and her operational credibility, Ms. Kartina knew she needed to move swiftly from a defensive posture to empirical leadership.

2. Managerial Action Plan & Immediate 72-Hour Response

To address the executive crisis, Ms. Kartina executed a structured 3-step turnaround strategy:

- **Step 1: Immediate Executive Reframing** Request a 48-hour Gemba diagnostic window with CEO Mr. Johnson.
- **Step 2: 3-Vector Shop-Floor Gemba Diagnostic** Isolate material, tooling, and feed track losses; derive SYM mathematically.
- **Step 3: Empirical Recovery Proposal & Engineering Controls** Present immediate 7-day containment and long-term telemetry upgrades.

Step 1: Reframing the CEO Briefing

Rather than offering speculative answers, Ms. Kartina addressed Mr. Johnson directly:

"Mr. Johnson, you are entirely correct to highlight the 65.0% SYM average. While stable AEC and EEU show our asset run capacity and power efficiency are intact, a 35.0% yield loss in cold-forming direct inventory is unacceptably high. Give me 48 hours to execute a shop-floor Gemba audit with the lead operators. I will present a root-cause breakdown along with immediate corrective engineering controls by Thursday morning."

3. Mathematical Formulation & Diagnostic Breakdown

Because capacity utilization and energy parameters (AEC/EEU) remained normal, machine run time and energy were actively being supplied to the equipment, but were being converted into scrap material and non-conforming units rather than finished goods.

A. Mathematical Formulation of SYM

The Structural Yield Multiplier (SYM) fundamentally measures the ratio of first-pass, defect-free conforming output relative to the gross total raw units fed into the production line:

$$\text{SYM} = (\text{First-Pass Defect-Free Quality Quantity}) / (\text{Gross Total Units Produced (Raw Feed)}) = \text{N}(\text{conforming}) / \text{N}(\text{gross})$$

To perform granular shop-floor diagnostics, SYM is decomposed into the multiplicative product of three sequential stage yield factors:

$$\text{SYM} = \text{Y}(\text{material}) \times \text{Y}(\text{tooling}) \times \text{Y}(\text{feed})$$

Where:

- **Y(material) (Upstream Material Yield Ratio):** Percentage of raw blanks meeting dimensional pitch and diameter tolerances prior to forming.
- **Y(tooling) (Thread Die Alignment & Precision Ratio):** Percentage of units formed without pitch mismatch, flaking, or crest stripping.
- **Y(feed) (Mechanical Feed & Registration Efficiency Ratio):** Percentage of units successfully processed without double-feeding, track jams, or positioning slippage.

B. Fabricated Weekly Production Dataset

Over a weekly production input run of 100,000 raw wire blanks (N(gross) = 100,000):

Diagnostic Loss Vector	Yield Ratio Factor	Weekly Average (%)	Conforming Pass Rate	Primary Root Cause Identified
A. Material Blank Dimension Drift	Y(material)	88.0%	88,000 blanks pass	Wire draw diameter variations from supplier batch
B. Thread Die Wear & Misalignment	Y(tooling)	85.0%	74,800 units pass	Worn thread roll dies causing pitch distortion & flaking
C. Micro-Jamming & Setup Rejection	Y(feed)	87.0%	65,079 units pass	Vibratory bowl track misfeeds and double-blank loading

C. Step-by-Step Computation

1. Multiplicative Yield Factor Calculation:

$SYM = Y(\text{material}) \times Y(\text{tooling}) \times Y(\text{feed})$
 $SYM = 0.880 \times 0.850 \times 0.870 = 0.65076 \approx 65.0\%$

2. First-Pass Direct Yield Verification:

$N(\text{conforming}) = 100,000 \times 0.880 \times 0.850 \times 0.870 = 65,079 \text{ units}$
 $SYM = N(\text{conforming}) / N(\text{gross}) = 65,079 / 100,000 = 65.079\% \approx 65.0\%$

Diagnostic Summary: Out of 100,000 raw steel blanks fed into the section, only 65,079 conforming bolts passed quality control on the first pass, resulting in 34,921 unit scrap loss (35.0% total yield loss) despite 100% nominal machine execution capacity.

4. Engineering Solutions & Remediation Plan

To permanently resolve the yield drop and restore SYM above benchmark levels, Ms. Kartina presented a two-phased remediation plan:

Short-Term Corrective Actions (Immediate 7-Day Fixes)

- 1. **Pre-Feed Go/No-Go Gauging:** Implement physical Go/No-Go plug gauges at the inlet hopper to screen incoming raw blank dimensions before loading into the production run.
- 2. **Mandatory Die Alignment Protocol:** Establish a shift-change die recalibration and bolt torque checklist every 8 hours.

Long-Term Engineering Upgrades (Telemetry Integration)

- 1. **In-Line Laser Micrometer Node:** Install an optical laser micrometer at the thread-rolling exit track for real-time pitch diameter measurement, automatically diverting out-of-spec units before batch contamination.
- 2. **Real-Time SPC Visual Board:** Implement a shop-floor Statistical Process Control (SPC) display tracking hourly SYM, AEC, and EEU metrics concurrently to flag yield drift immediately.

5. Post-Implementation Metric Impact & Targeted Goals

Metric	Baseline (Last Week)	Target (Post-Remediation)	Improvement Vector
Upstream Material Yield (Y(material))	88.0%	97.0%	Incoming blank pre-screening &

Metric	Baseline (Last Week)	Target (Post-Remediation)	Improvement Vector
			supplier specification lockdown
Tooling & Die Precision Yield (Y(tooling))	85.0%	96.0%	Mandatory shift die alignment & scheduled replacement
Mechanical Feed Yield (Y(feed))	87.0%	98.0%	Vibratory bowl track calibration & jam sensor retrofit
Structural Yield Multiplier (SYM)	65.0%	91.2%	+26.2% point recovery (Productivity restoration)
Scrap / Reject Rate	35.0%	<8.8%	Reduction of raw scrap and rework overhead
Execution & Energy Performance (AEC / EEU)	Baseline Normal	Maintained Normal	Maintained asset utilization stability with zero adverse impact