HABER

DATA BEFORE AI

A Practical Case Study in Paper Mill Data Foundation Building

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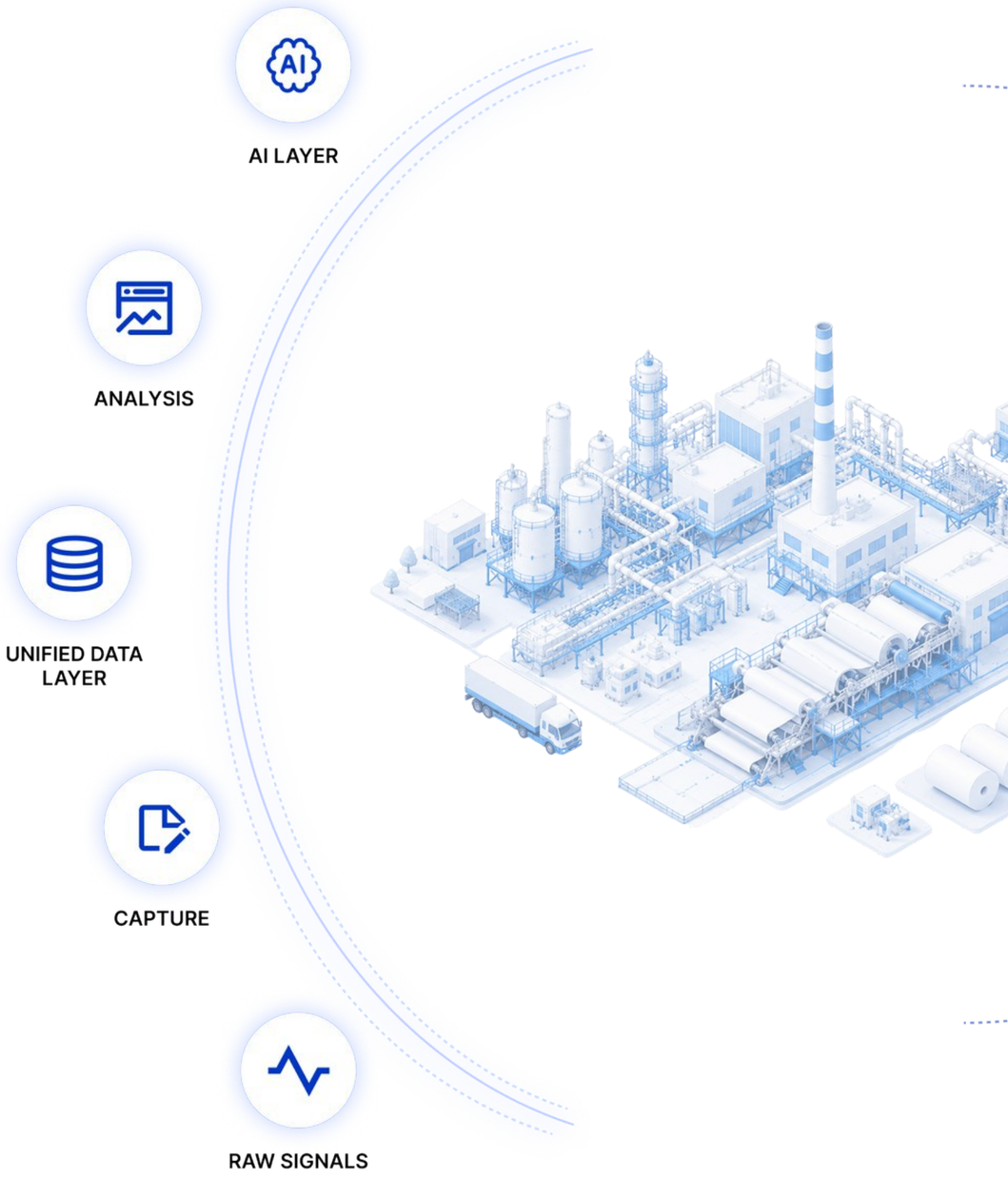


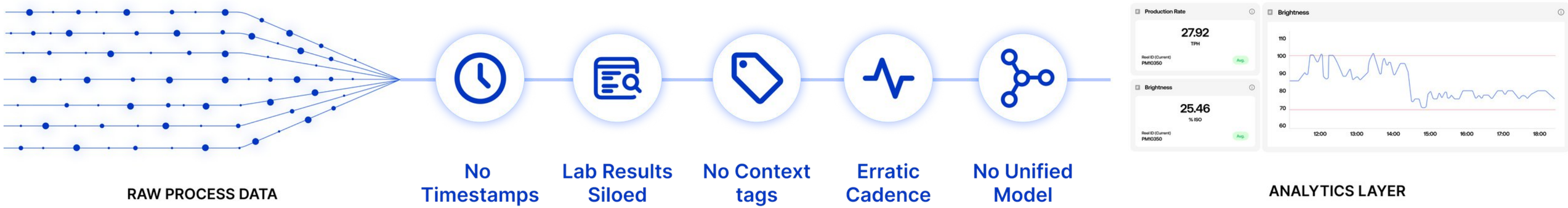
Addressing the Data Gaps That Limit Analysis

85%

AI projects fail due to poor quality or lack of relevant data

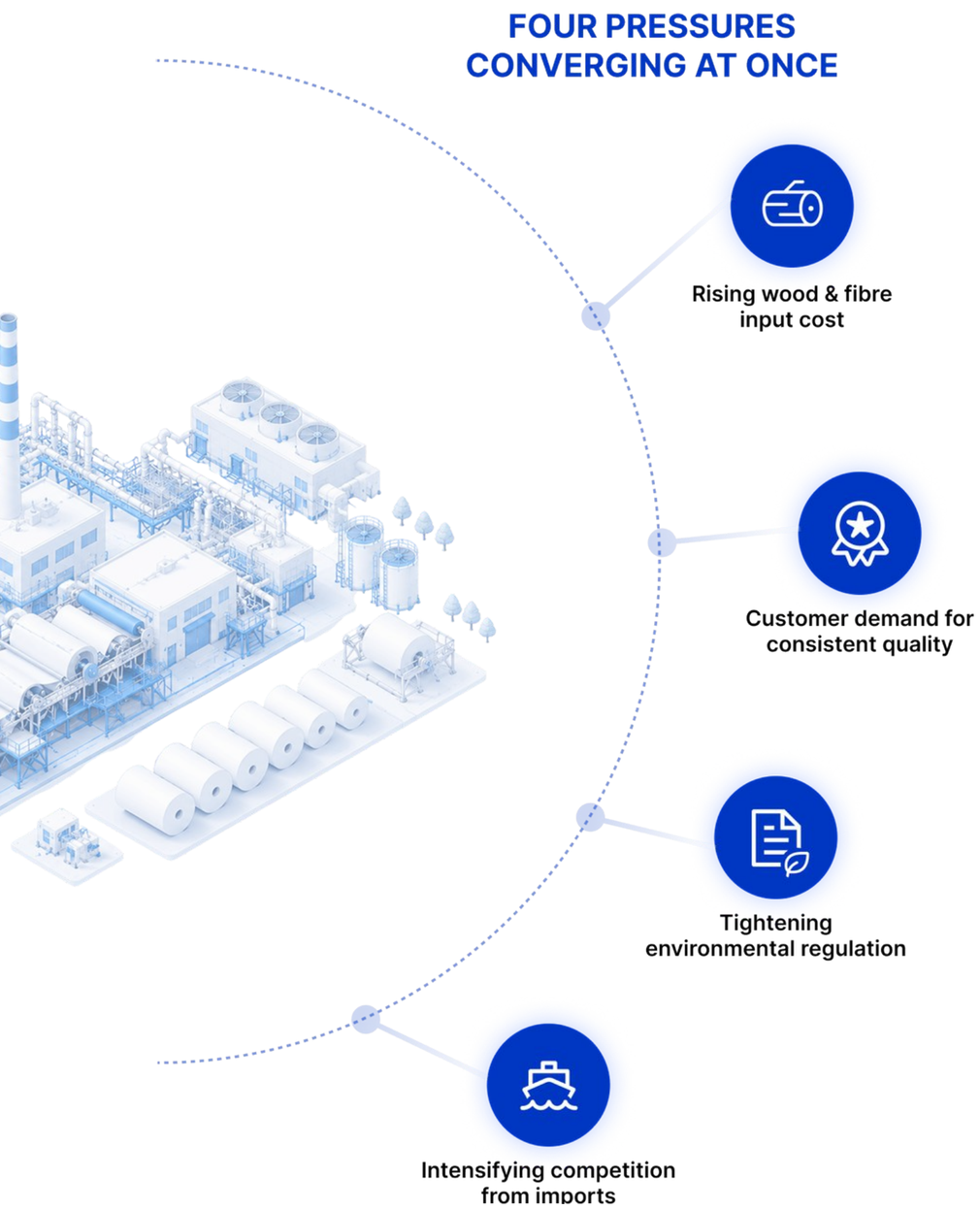
As per Gartner reports

Addressing the Data Gaps That Limit Analysis



Close these five gaps and this everyday question finally has an answer:

“What conditions drove our 50 best Kappa - Viscosity batches last quarter?”



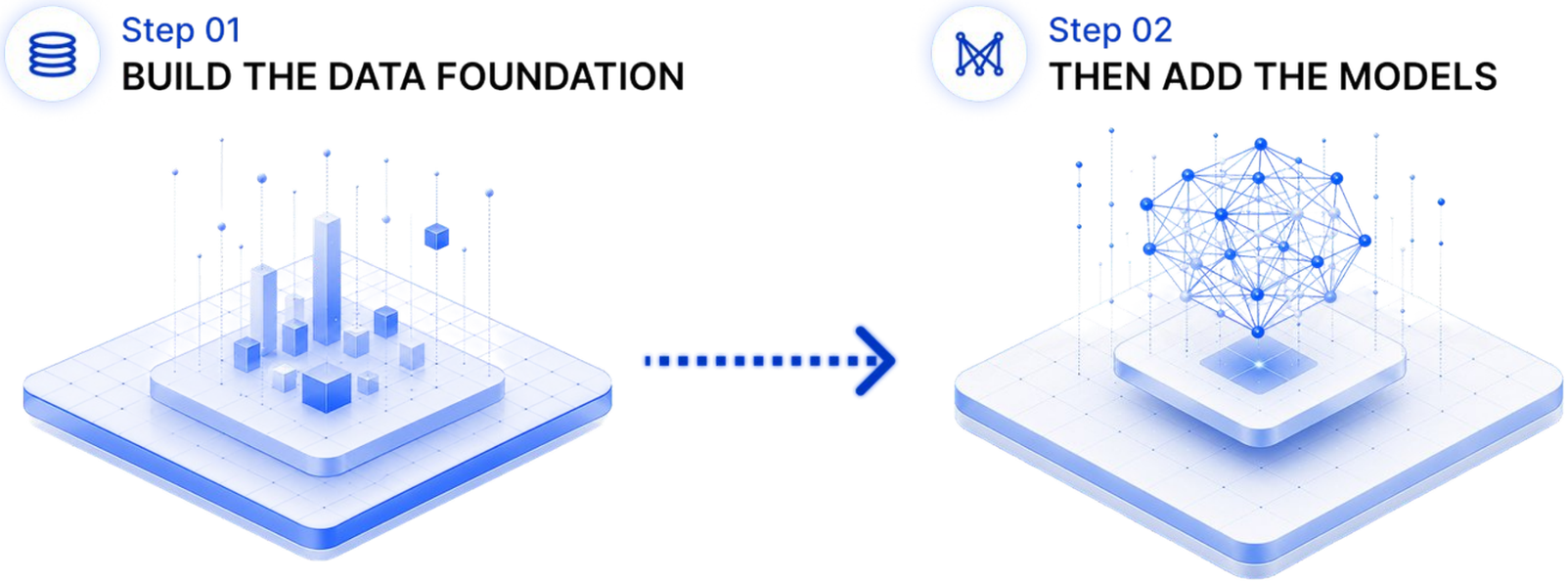
Industry Pressures and the Opportunity in Data

The algorithms get the attention - and rightly so, but the lasting value begins with data.

A foundation every mill can build today..

Data Foundation

The order matters - starting with clean, contextualised data often allows even a simple model to outperform a more sophisticated one trained on poor-quality data.



Data discipline isn't the precursor to the real work - it is the real work, and it's work any mill can start today.

Why Data Foundations Matter More in the Indian Context

Fibre Input

Agricultural residues, recycled fibre, mixed hardwood–softwood - each with different moisture and demand.

Equipment

Older equipment, limited instrumentation - manual capture is mission-critical, not optional.

Impact of Recipe

Same recipe, different results on different furnishes - context must travel with every reading.

For Indian mills, process complexity is the strongest argument FOR structured data capture - not a reason to defer it. The more variable your process, the more valuable the data foundation.

The Haber Data Foundation Framework

01

Define Critical Variables

Scope few variables that drive Kappa, Viscosity, brightness, reject rate.

02

Standardise Measurement Frequency

Fix how often each variable is measured — and by whom.

03

Digital Capture at Source

Capture digitally, at the point of measurement, with a real timestamp.

04

Contextualise Every Measurement

Tag each reading with grade, furnish, shift and dosages.

05

Integrate into a Unified Data Layer

Join manual, lab and historian data into one schema.

Case Study: Golden Batch Analysis — Problem, Scope & Objective

THE BUSINESS PROBLEM

The mill's primary challenge was achieving **consistent pulp quality**, as Viscosity varied significantly even when Kappa remained within target.

SCOPE OF ANALYSIS — GOLDEN BATCH STUDY

4,000
Digester Batches

6
Digesters

8
Months of Production

14–16 · 220–260 s
joint Kappa · Viscosity targets

Sulphite
acidic pulping

Case Study: Golden Batch Analysis — Problem, Scope & Objective

DELIVERABLES

Identify golden batches from the historical dataset

Define the operating envelope recipe for each digester

Recommend how to raise golden-batch consistency

Variables That Matter

Step 1 - Define Critical Variables

1,000+ VARIABLES

Every parameter in the historian, logbooks, manual records, shift reports

PROCESS DISCOVERY WORKSHOPS

With the process engineering team

- Kappa
- Viscosity
- Chip Moisture
- SO_2 Dosage
- Cook Temperature
- Time at Max Temp

QUALITY-CRITICAL VARIABLES

Confirmed with the process team

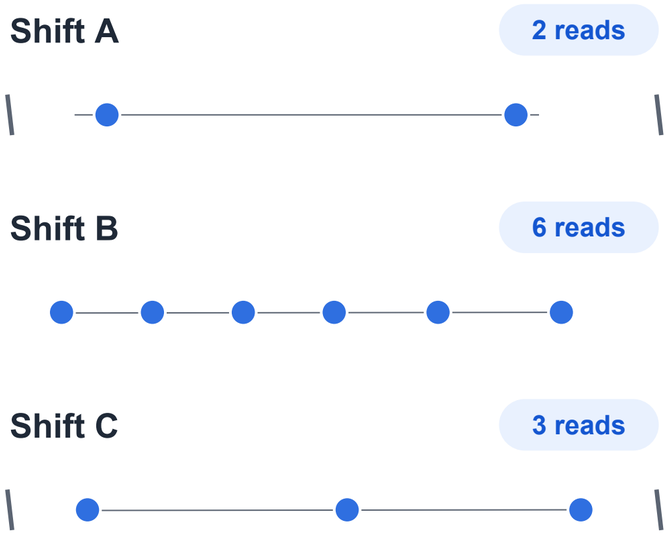
One SOP, Every Shift

Step 2 - Standardise measurement frequency

MISSING BATCH CONTEXT

BATCH TICKET	B-2214
DIGESTER	4
SHIFT	B
GRADE	*missing*
FURNISH	*missing*
OPERATOR	*missing*

INCONSISTENT MEASUREMENT FREQUENCY



INCONSISTENT RECORDING FORMAT

OPERATOR NOTE

Kappa - 14.5

KAPPA NUMBER

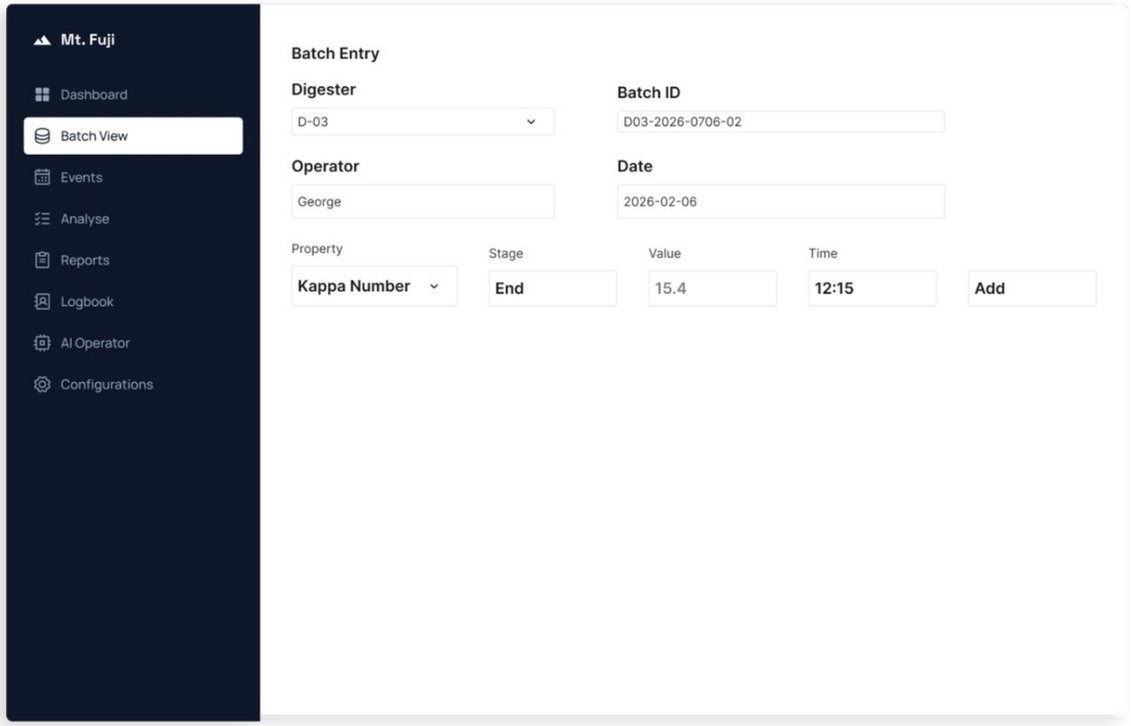
14.5

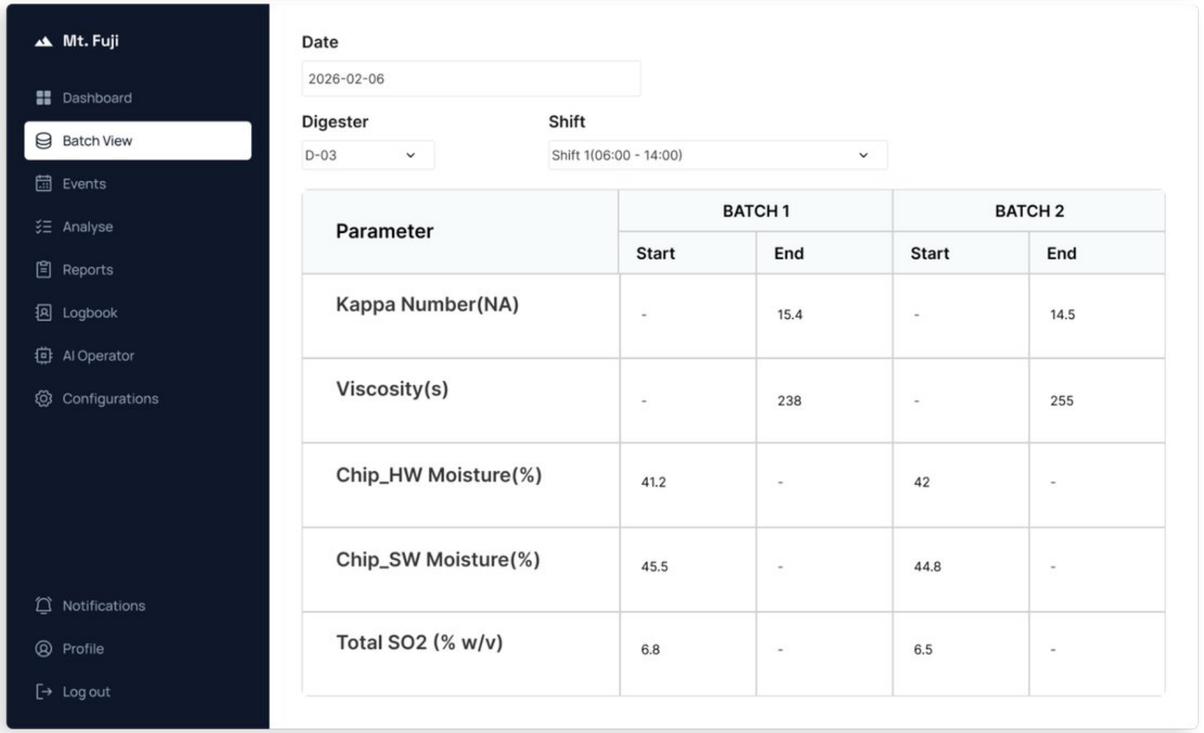
B4	**14.5**

The Operator Logbook: Capture Made Simple

Step 3- Digital capture at source

Structured shift-wise entry - by operator, by time slot. No new hardware.





The Human Layer: Operator Adoption

Operators understand the WHY

Understanding why readings matter ensures consistent data entry and lasting operator habits every single day.

Tools make capture EASIER

If structured entry is harder than the paper log, it won't survive a busy shift.

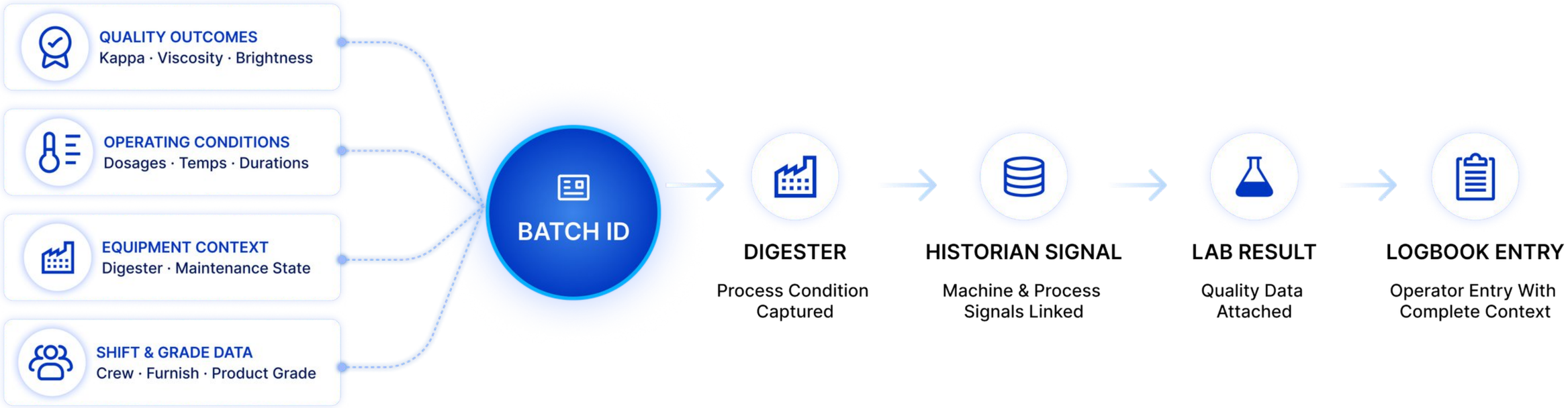
Operators see THEIR data pay off

When their inputs visibly improve their shift, entry becomes habit, not mandate.

When operators see their data improving their shift, data quality and insight become self-reinforcing.

Connecting Data Silos into a Unified Foundation

Step 4 - Contextualise every measurement

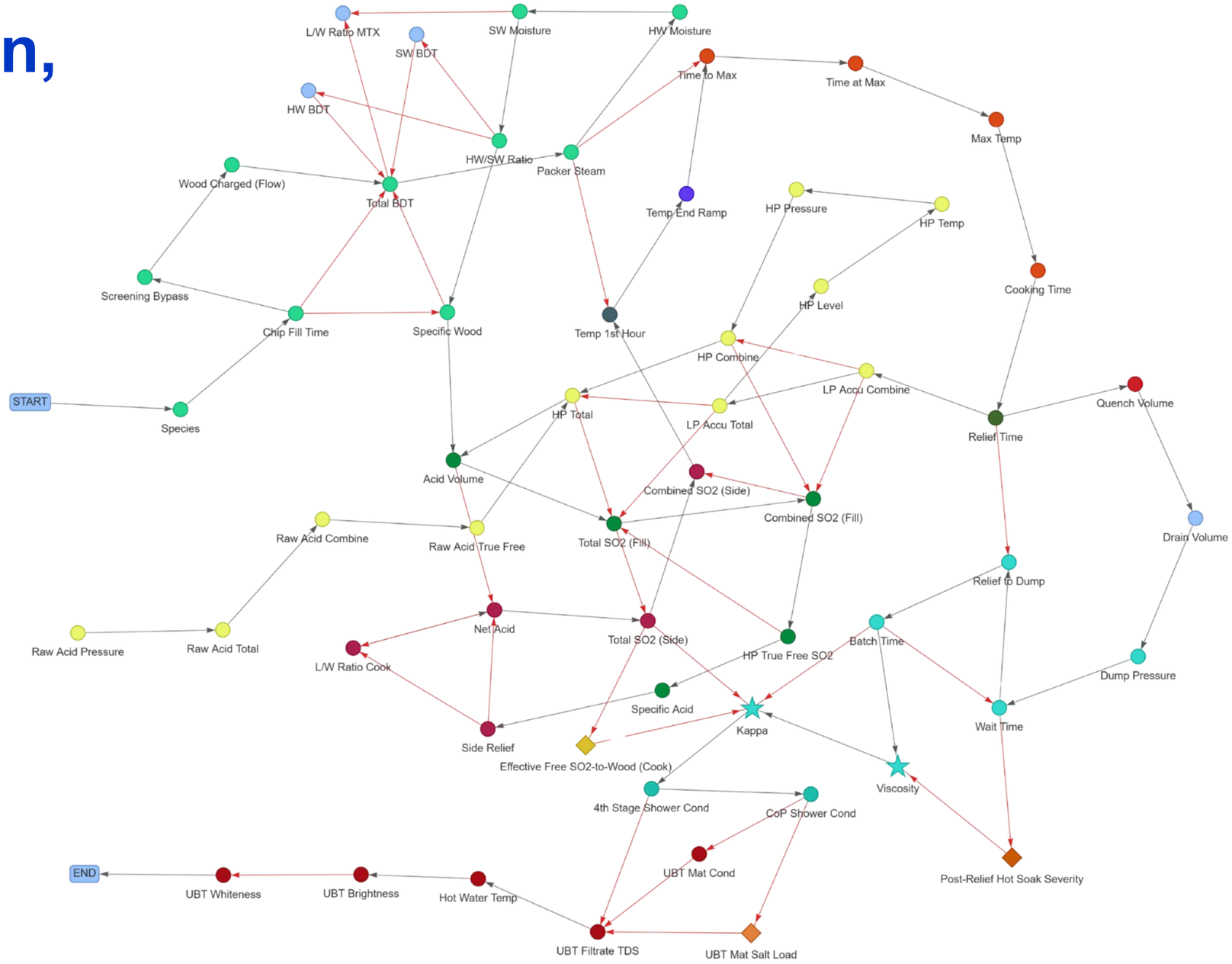


This layer is built not for today's analysis alone - it anticipates the predictive and prescriptive AI that follows.

The Data Foundation, Fully Connected

Step 5 - Unified Data layer

The knowledge graph behind the analysis - every sensor, parameter, lab result and KPI, linked.



KG Legend Hide

Node Types

- Boundary
- Sensor / Parameter
- KPI
- Hidden State / Virtual

Edge Types

- FLOWS_TO
- INFLUENCES

The Central Finding: Joint Quality Achievement

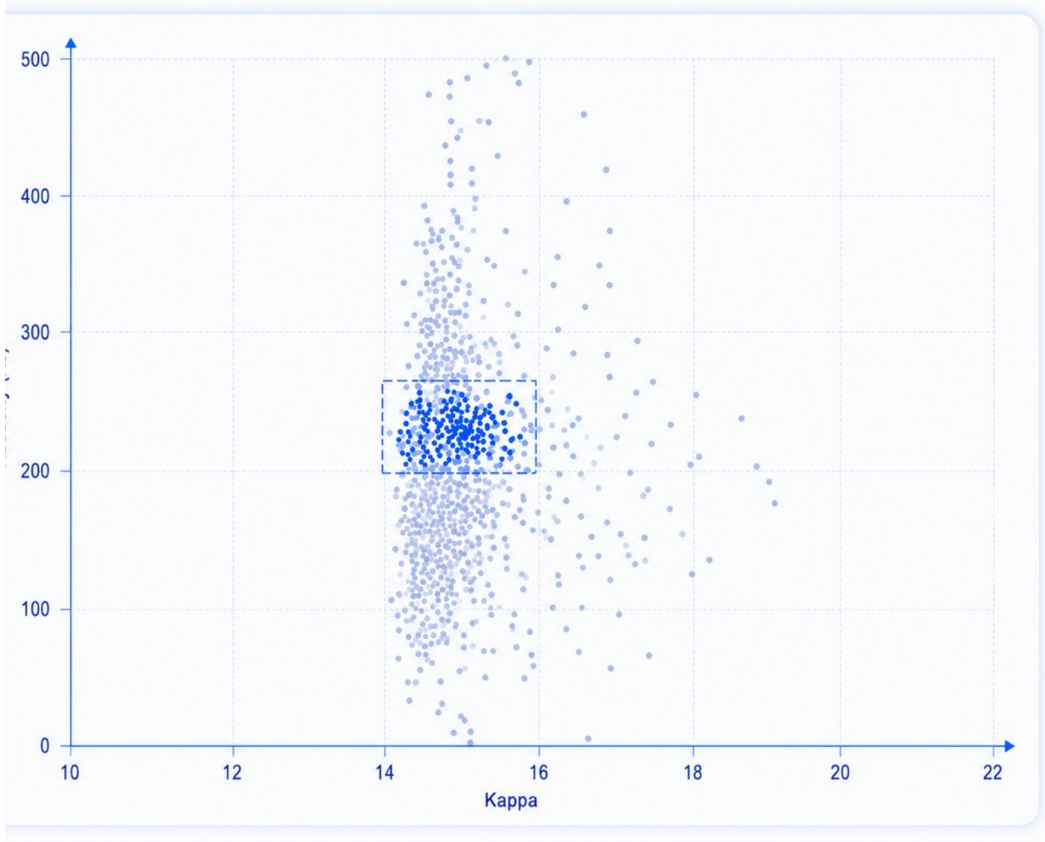
The knowledge graph behind the analysis - every sensor, parameter, lab result and KPI, linked.

23%

JOINT SUCCESS RATE

Kappa in target	(72.3%)	Viscosity in target	(26.5%)	Both - golden	(23%)

Across digesters: 20.1–23.4%. No single vessel fails - the constraint is systemic, in the recipe not the equipment, so the fix benefits the whole mill.

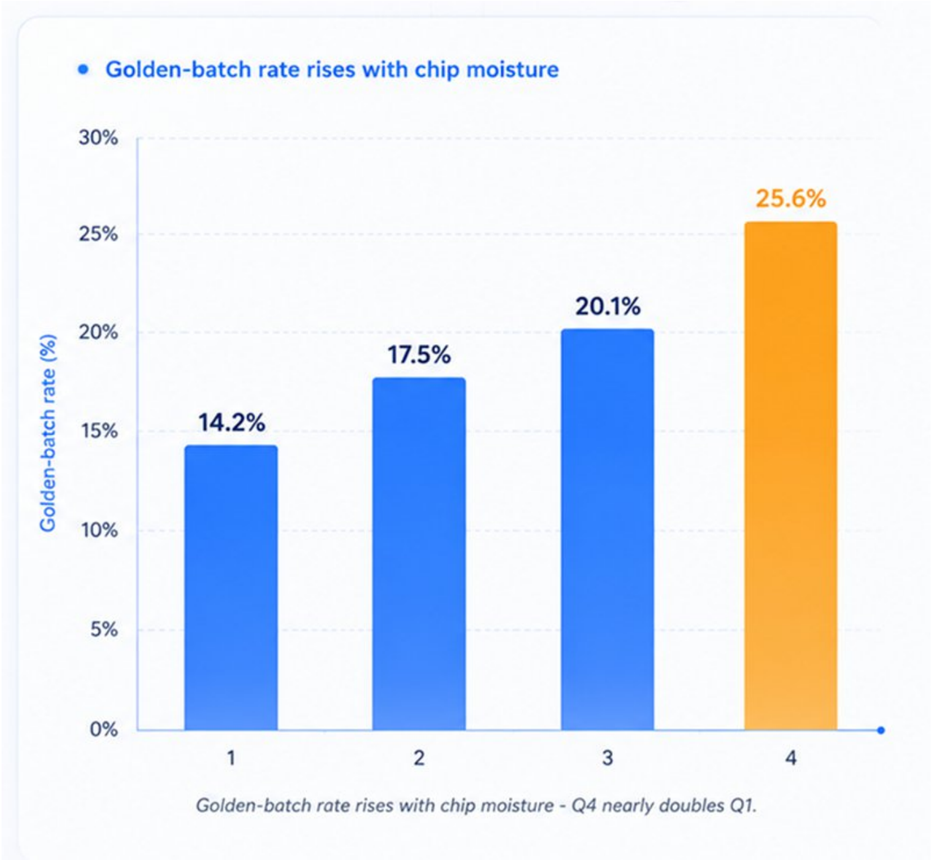


Chip Moisture: The Finding That Inverted Conventional Wisdom

Conventional mill logic:
high chip moisture is operationally inconvenient - so it is generally minimised.

25.6%

golden-batch rate in the wettest chips - nearly double the 14.2% in the driest.

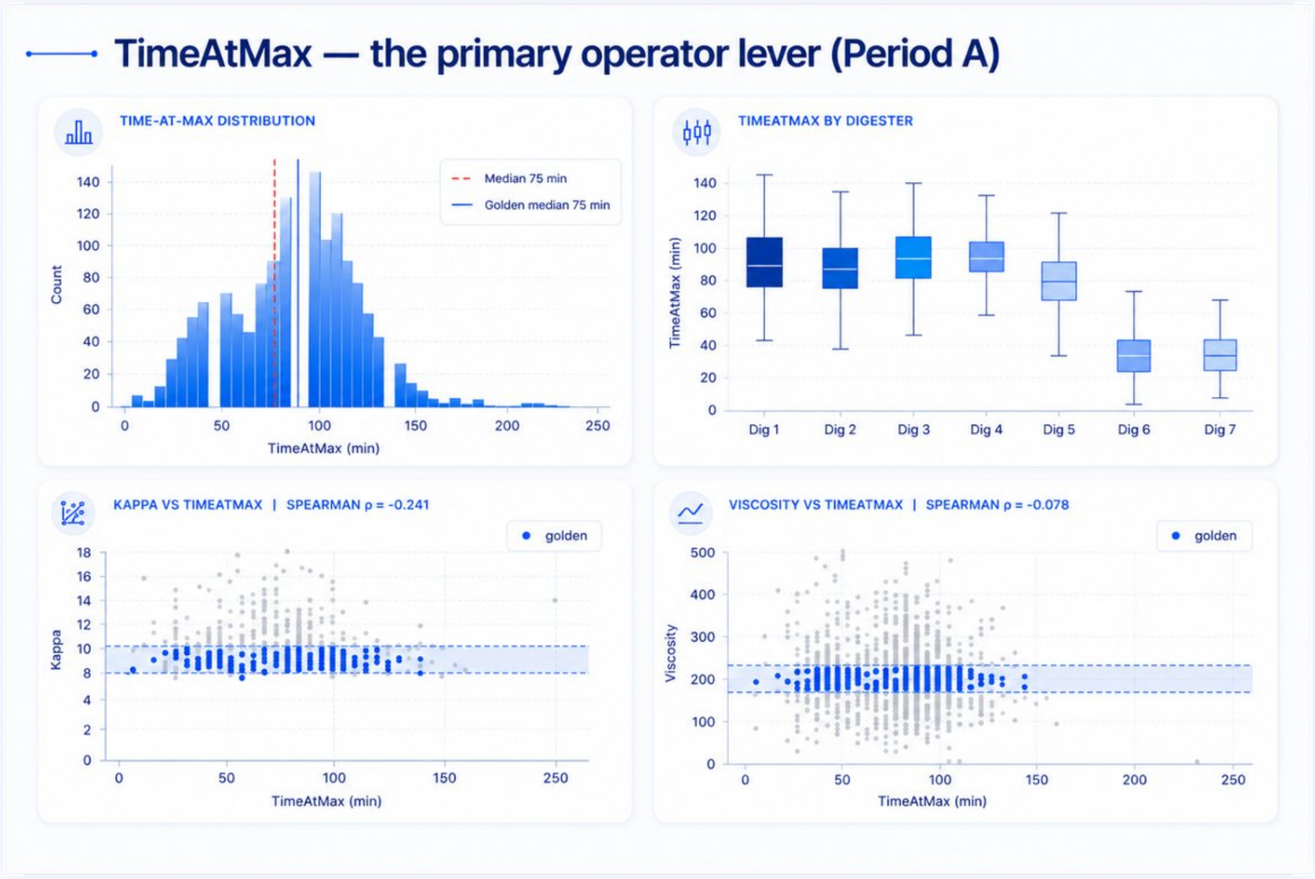


ACTIONABLE RECOMMENDATION

Set a hard 38% minimum. Stop penalising wet chips.

No capital, no new equipment - tell the wood yard today and update the SOP.

Time at Maximum Temperature: The Operator's Most Direct Lever



THE OPPORTUNITY

Time-at-max is the most controllable lever on the floor - and trimming it modestly is the fastest, lowest-risk way to lift viscosity. It sits entirely in the operator's hands.

TWO LEVERS, ONE JOB EACH

SO_2 loading controls Kappa; time-at-max controls Viscosity. Because cook time barely moves Kappa ($\rho = -0.24$), the cook can be shortened to protect strength without losing Kappa control.

The Golden Operating Envelope

Parameter	Direction	How it protects Viscosity without sacrificing Kappa
SO_2-to-wood ratio	→ balanced	Sets impregnation chemistry - even acid distribution protects viscosity.
Free & total SO_2 levels	→ controlled	Stable active-acid concentration prevents viscosity-destroying hot spots.
Net acid dosage	→ optimised	Enough delignification for Kappa, without over-acidifying and shedding strength.
Total cook duration	↓ moderate	Limits cumulative thermal exposure that degrades the cellulose chain.
Time at maximum temperature	↓ reduced	The single strongest lever - less peak-temp time directly preserves viscosity.
Chip moisture	↑ higher	Uniform penetration; avoids localised overcooking

VESSEL-LEVEL CALIBRATION

The acid-chemistry recipe is portable across all six digesters - implement it mill-wide immediately.

Cook severity - time at maximum temperature - must be calibrated per vessel. Roll it out digester by digester.

DOWNSTREAM LINEAGE

Extending batch traceability into bleaching links cooking consistency to bleachability and chemical demand - quantifying the downstream value of a good cook and enabling targeted bleach-chemical optimisation.

From Descriptive to Predictive: The Road Ahead

Where we are

DESCRIPTIVE

The Golden Batch Analysis - a defined operating envelope and a per-digester recipe, read from historical data looking backward.

Next

PREDICTIVE

A model reads current batch conditions in real time and alerts the operator ~20 minutes before a likely Viscosity miss - early enough to intervene.

Then

PRESCRIPTIVE

The system recommends a specific cook-duration or dosage change; the operator approves with one tap; the adjustment logs automatically.

The Golden Batch Analysis is the descriptive starting point - not an end state. The same data foundation carries the mill from here into predictive and prescriptive AI - each stage a natural next step, and you're ready the day you choose to take it.

Key Takeaways

- Only 23% of batches jointly hit Kappa and Viscosity.
- Replicable without capital investment.
- Foundation before AI, always.
- Data is the bottleneck - not the algorithm.

HABER

Thank You!