IoT TECHNOLOGY CONSULTANCY

Technical Consultancy Framework for Textile Manufacturing & Agricultural Applications

Pakistan • 2026

Prepared for direct professional use by Noori Engineering Industries

Document control

How to read this document

This document is intentionally written as an engineering consultancy framework rather than as a product catalogue. It begins with the operating problem, establishes the role of measurement and data, then moves through architecture, use cases, business-case discipline and implementation. The objective is to make an IoT recommendation only when the operational decision, measurement path and expected evidence are sufficiently clear.

Consultancy boundary

NEI’s textile scope remains engineering-led: machinery assessment, selection, troubleshooting, process and equipment engineering, and modernization. IoT consultancy extends that engineering perspective into sensing, connectivity, monitoring, analytics, automation concepts and operational intelligence for textile operations and selected agricultural applications. In agriculture, the scope is technology readiness and monitoring—not agricultural machinery supply.

Executive perspective

Industrial IoT becomes commercially meaningful when it improves a decision that matters to an operator, engineer, maintenance team, production manager or asset owner. The hardware is only one layer of that process. A sensor that produces data without a defined action is not, by itself, an operational improvement.

For textile manufacturing, the most credible starting point is the existing machine and process. Many plants contain productive brownfield equipment with PLCs, drives, HMIs, meters, counters or control signals that can provide useful information before a new instrumentation package is considered. The consultancy task is therefore to understand what already exists, identify what is missing, and connect the minimum useful measurement to a decision.

For agriculture, the same principle applies but the decision context changes. Soil and environmental conditions, irrigation flow and pressure, pump and valve state, field connectivity and remote observations can be brought together when they answer a practical question such as when to irrigate, where conditions are changing, whether equipment is behaving normally, or where a field requires attention.

1. Pakistan market context

Pakistan’s industrial and agricultural structure gives IoT consultancy two distinct but related application environments. Textile and apparel remain central to the country’s export economy, while agriculture remains a major contributor to economic activity and resource use.

The Pakistan Economic Survey 2025–26 reports textile exports of approximately US$13.5 billion during July–March FY2026, representing 59.6% of total exports in that period. It also reports agriculture at 23.44% of GDP in FY2025–26. These figures establish sectoral importance; they do not imply that every factory, farm or machine requires IoT. citeturn1search13turn1search12

Current manufacturing data also shows why the proposition should remain practical rather than technology-led. Pakistan Bureau of Statistics reports overall large-scale manufacturing growth of 5.77% during July–May 2025–26, while its textile component recorded a cumulative decline over that period. The implication for consultancy is not that technology automatically solves sector pressure, but that efficiency, visibility, modernization and evidence-based engineering can be relevant where they address specific operating constraints. citeturn0search0

2. Textile manufacturing: where IoT can support engineering

Textile machinery environments are unusually suited to an engineering-led IoT approach because the physical asset, process condition and production outcome are closely related. The useful question is not simply whether a machine can be connected, but which machine state or process variable can be measured reliably enough to improve a decision.

Downtime and maintenance visibility

Machine-state signals, fault events, operating hours and selected condition indicators can turn an unstructured downtime problem into a sequence of events that can be reviewed by engineering and maintenance teams. Where a credible failure mode exists, vibration or temperature can supplement existing electrical and control information. The objective is prioritization: which asset needs attention, what changed, and how frequently the event occurs.

Energy intelligence

Energy data becomes more useful when it is related to production. A plant can move from total consumption to questions such as energy per batch, energy per machine-hour, energy per unit of production or abnormal load profiles. The correct KPI depends on the process and the availability of reliable production data.

Process stability

Critical process variables can be monitored for drift, excursions or abnormal combinations. The value is greatest where a deviation has a known relationship to quality, throughput, energy use or equipment condition. IoT should not be used to collect every possible variable simply because collection is technically possible.

Brownfield modernization

Older productive machinery does not automatically need replacement to become more observable. Existing PLCs, drives, HMIs, meters, counters and control signals should be assessed before duplicate sensors are installed. Where gaps remain, targeted retrofit instrumentation can provide a bridge between legacy equipment and modern monitoring.

3. Agricultural IoT: sensing the field and the water system

The agricultural opportunity addressed here is digital monitoring and technology readiness. It is deliberately separated from agricultural machinery. The consultancy question is how field and irrigation information can become reliable enough to support a decision.

Typical decision questions

Connectivity and remote environments

Agricultural IoT frequently operates outside controlled industrial buildings. The architecture therefore needs to consider power availability, network coverage, gateway placement, weather exposure, maintenance access and data buffering. ITU’s current work on IoT network systems for digital agriculture explicitly recognizes connectivity challenges in remote agricultural environments and the need for secure, interoperable and power-conscious architectures. citeturn0search8

FAO’s digital agriculture work likewise emphasizes the use of IoT and related technologies for data-driven agricultural decisions. The consultancy should treat remote sensing, satellite observations and field sensors as complementary layers rather than assuming one source is sufficient for every decision. citeturn0search11

4. Textile sensor-to-decision architecture

A professional deployment begins with the machine and process, then selects measurement points. Existing PLC, drive, HMI, meter and control signals should be assessed before duplicate sensors are added.

5. Agricultural sensor-to-decision architecture

Agricultural IoT should be designed around the agronomic or operational decision: when to irrigate, where conditions are changing, whether a pump or valve is behaving normally, or whether a field requires attention.

The architecture can use a field gateway with cellular, LoRaWAN or another appropriate backhaul, followed by a data layer for history and rules, a dashboard for moisture and alerts, and an action layer for pump or valve status. Final architecture depends on site survey, field geometry, connectivity and power constraints.

6. Operational intelligence: the dashboard as a decision interface

The dashboard is where engineering data becomes operational intelligence. Its purpose is not to display the maximum number of sensors; it is to make the right exceptions and trends visible to the people responsible for action.

Any example dashboard values used in demonstrations should be labelled illustrative. They must not be represented as NEI customer results unless measured in a real engagement. This distinction is retained from the source dossier and is essential for commercial credibility. fileciteturn38file0L119-L144

7. Priority use cases

* OEE should be used only where availability, production and quality data are sufficiently reliable.

These use cases should be treated as a starting portfolio rather than a fixed package. A customer engagement should identify one operational pain point, establish its baseline and determine whether the proposed intervention can generate evidence within the customer’s actual operating conditions.

8. Building a defensible business case

IoT projects are often weakened by promising savings before a baseline exists. A professional consultancy should quantify the opportunity from customer data and make the calculation transparent.

Commercial outputs

A consultancy engagement may produce a baseline report, measurement plan, pilot architecture, dashboard prototype, data-quality report, opportunity register, verified KPI report and scale-up roadmap. The exact deliverables should be agreed from the customer’s problem and asset/process environment.

9. A practical implementation pathway

The implementation pathway should be deliberately staged. The first objective is not to maximize connected assets; it is to reduce uncertainty around one operational problem.

10. 90-day pilot framework

The 90-day structure is a planning framework, not a universal project duration. Site access, procurement, instrumentation, connectivity, commissioning and customer approval can alter the schedule. Scale should follow only when the pilot demonstrates reliable data, a useful decision workflow and measurable evidence of value.

11. Technology roadmap: what becomes possible after the basics work

Advanced technology should be introduced only when the underlying data, process knowledge and operational workflow are mature enough to support it.

The direction is consistent with current international IIoT guidance: ITU-T Y.4228 emphasizes integration, compatibility, scalability, efficiency and security across device, network and service-support layers, including protection of facilities, networks, applications and data. citeturn0search7

12. Industrial IoT security and reliability

Connectivity changes the risk profile of industrial equipment. A consultancy that recommends connected assets should therefore consider security and reliability as part of the architecture, not as an afterthought.

ITU’s industrial IoT framework specifically identifies security, sensitive-information protection, operational safety and reliability as core considerations for IIoT infrastructure. ITU also approved work on security requirements for IIoT-based smart manufacturing in 2026. citeturn0search7turn0search4

13. What a customer can expect from NEI

The consultancy engagement is intended to translate the customer’s operating environment into an engineering and technology roadmap. The starting point is the operation—not a predetermined hardware package.

This customer-facing scope is directly grounded in the supplied NEI dossier. fileciteturn38file0L217-L227

14. Research and evidence notes

This document combines the supplied NEI consultancy dossier with current official and standards-oriented sources used to verify market context and technical framing. The source material remains the authority for NEI’s stated scope. External sources are used to strengthen context, not to manufacture capabilities or customer results.

Pakistan economic context

The Pakistan Economic Survey 2025–26 reports textile exports of US$13.5 billion during July–March FY2026 and identifies the textile sector as 59.6% of total exports in that period. It also reports agriculture at 23.44% of GDP and agriculture-sector growth of 2.89% in FY2025–26. citeturn1search13turn1search14

Manufacturing performance

PBS reports provisional overall large-scale manufacturing growth of 5.77% during July–May 2025–26, while the textile component recorded a cumulative decline over the same period. This supports a cautious market narrative focused on measurable efficiency and modernization rather than blanket claims about IoT demand. citeturn0search0

Digital agriculture and connectivity

ITU describes digital agriculture as an area where IoT, AI, automation and related technologies can support precision farming, production risk information, traceability and analytics. Its current work also recognizes remote-area connectivity constraints and the need for interoperability, power efficiency and secure data flow. citeturn0search10turn0search8

Industrial IoT infrastructure

ITU-T Y.4228 frames IIoT infrastructure around device, network and service-support capabilities, with integration, compatibility, scalability, efficiency, reliability and security as important requirements. citeturn0search7

15. Source register

Claims and evidence discipline

Official statistics are presented as market context. External research findings remain external evidence and are not represented as NEI customer outcomes. Architecture diagrams and example dashboards are conceptual. Illustrative figures must be labelled as such. No percentage saving, production result, certification, customer count or guaranteed timeline should be published as an NEI claim unless it has been independently verified and approved for publication.

The consultancy position

Noori Engineering Industries can approach IoT as an extension of engineering rather than as a separate technology exercise. The practical sequence is straightforward: understand the asset and process, identify the decision, establish the baseline, select the measurement and connectivity path, turn the resulting data into operational visibility, verify the outcome and scale only what has demonstrated value.

For textile operations, that means connecting machinery intelligence to maintenance, energy, production and process decisions where the data can support action. For agricultural applications, it means building field and irrigation visibility around the decisions that matter—without confusing IoT consultancy with agricultural machinery supply.

NOORI ENGINEERING INDUSTRIES
Faisalabad, Pakistan

INTERNATIONAL TECHNICAL FRAMEWORK

This edition is structured as a professional consultancy reference rather than a product brochure. It uses internationally recognizable IoT, manufacturing and industrial cybersecurity concepts while distinguishing standards alignment from certification or compliance claims.

ISO/IEC 30141:2024 provides a standardized IoT reference architecture using common vocabulary, reusable designs and implementation patterns. ISO 23247 provides a manufacturing digital-twin framework and reference architecture. ITU-T Y.4228:2024 addresses IIoT infrastructure capabilities for smart manufacturing, including device, network, application-support, identification and security considerations. IEC 62443 provides the principal industrial cybersecurity reference family, with IEC PAS 62443-1-6:2025 addressing application of the series to IIoT.

Reference Architecture for Textile and Agricultural IoT

A practical deployment should be treated as a layered engineering system: machine-side sensing and actuation; edge processing and protocol handling; controlled connectivity; data and application services; and governance/security. Deterministic machine safety and control remain within the appropriate machine/control architecture.

Operational Dashboard and KPI Framework

A professional IIoT dashboard is a decision interface, not a collection of decorative gauges. Each KPI should have a defined source, unit, timestamp, aggregation interval, owner and data-quality state.

Illustrative dashboard only. Values are examples and are not claims about an actual NOORI installation.

Reference Architecture Diagram

Conceptual architecture. Final project architecture is determined by the machine, site, network, safety and data requirements.

IIoT Maturity Path

The maturity model is a decision framework rather than a mandatory sequence. Projects should begin with the operational problem and measurable baseline.

Cybersecurity, Safety and Governance

Connected machinery changes the risk boundary of a conventional machine. The consultancy therefore treats cybersecurity as an engineering lifecycle concern: asset inventory, identity and least privilege, network segmentation, secure remote access, logging, backup and recovery, configuration control, and incident response should be considered during design.

IEC 62443 is used as the principal industrial cybersecurity reference family. IEC PAS 62443-1-6:2025 specifically addresses applying the 62443 series to IIoT. The document uses these references for design discipline and does not imply certification.

Consultancy Deliverables

Current-state machine and process assessment

Instrumentation and data-point register

Connectivity and network assessment

IIoT reference architecture and system boundary

Dashboard and KPI specification

Data-quality and timestamping requirements

Cybersecurity and access-control considerations

Pilot scope, acceptance criteria and measurement baseline

Deployment roadmap with scale-up decision gates

Post-pilot measured-outcome review

Measurement and Business-Case Methodology

No savings percentage should be presented as a guaranteed outcome before a baseline exists. A defensible engagement establishes a measurement period, operational denominator, current-state losses, intervention and like-for-like post-deployment comparison.

Examples include energy per kilogram of processed fabric, downtime hours per operating week, irrigation volume per cultivated area, pump runtime per irrigation cycle, alarm events per shift, or batch duration under comparable production conditions. Financial assumptions should be documented separately from measured values.

International Reference Standards and Recommendations

Authoritative Online References

ISO/IEC 30141:2024 — https://www.iso.org/standard/88800.html

ISO 23247-1:2021 — https://www.iso.org/standard/75066.html

ISO 23247-2:2021 — https://www.iso.org/standard/78743.html

ISO 23247-4:2021 — https://www.iso.org/standard/78745.html

ITU-T Y.4228:2024 — https://www.itu.int/rec/T-REC-Y.4228-202408-I/en

IEC PAS 62443-1-6:2025 — https://webstore.iec.ch/en/publication/102885

DOCUMENT PURPOSE A customer-facing technical framework for assessing machinery, defining useful measurements, connecting brownfield and modern equipment, developing operational visibility, and determining where IoT can produce a defensible business case. The agricultural scope is limited to IoT technology consultancy; this document does not position Noori Engineering Industries as an agricultural machinery manufacturer, seller, or agricultural machinery consultancy.

Item	Detail
Document	IoT TECHNOLOGY CONSULTANCY
Organization	Noori Engineering Industries
Location	Faisalabad, Pakistan
Edition	Version 2 — Publication-ready technical edition
Date	2026
Primary use	Customer discussions, consultancy discovery, technical scoping and proposal preparation

Item	Detail
Evidence rule	External statistics and research are identified as external evidence; illustrative architecture and examples are not presented as deployed NEI results.

THE OPERATING PRINCIPLE Begin with the customer’s operation. Define the decision. Establish a baseline. Determine the data path. Select the measurement technology. Prove the result. Scale only when the evidence supports it.

Market signal	What it means for consultancy
Large textile and apparel export base	Potential scale for machinery visibility, energy intelligence, condition monitoring and modernization.
Mixed manufacturing performance	Interventions should be tied to measured operating problems rather than broad technology narratives.
Agriculture at 23.44% of GDP	A substantial operating environment for field sensing, irrigation intelligence and remote visibility.
Connectivity constraints in remote areas	Architecture must account for buffering, power, intermittent networks and appropriate backhaul.

NEI PROPOSITION The proposition is not “install sensors.” It is to make existing productive assets more observable and decisions more evidence-based. This distinction is central to a credible industrial consultancy.

Decision	Potential evidence
When to irrigate?	Soil moisture, crop/field context, weather and irrigation history.
Where are field conditions changing?	Distributed sensing, remote observations and historical trends.
Is irrigation equipment behaving normally?	Flow, pressure, pump state, valve state and connectivity health.
Which area requires attention?	Exception rules, threshold logic and field-level alerts.
Is the system producing useful information?	Sensor health, battery/power status, connectivity and data completeness.

Layer	Role	Engineering questions
Machine / process	Physical operating context	What decision matters? What failure or process condition is being investigated?
Measurement	Vibration, temperature, energy, speed/state, process variables	Accuracy? range? environment? calibration? sampling?
PLC / RTU / node	Signal acquisition	What already exists? Which protocols and interfaces are available?
Edge gateway	Buffer, filter, translate	What happens during network interruption? What should remain local?
Network	Reliable communication	Ethernet, Wi-Fi, cellular, LoRaWAN or another path? What are coverage and resilience requirements?
Data layer	History and integration	Ownership? retention? API? timestamps? data quality?

Layer	Role	Engineering questions
Analytics	Patterns, rules and KPIs	Which decision improves? Which alarm is actionable?
Dashboard	Operational visibility	Who acts, and how quickly?
Control	Validated action where appropriate	Safety, interlocks, fail-safe behavior and authorization?

ARCHITECTURE RULE Do not buy hardware before defining the decision, baseline, data path and success metric. The architecture should follow the operational problem, not the catalogue of available devices.

Measurement domain	Examples	Purpose
Soil	Moisture; temperature; EC/pH where justified	Characterize field conditions relevant to the selected decision.
Microclimate	Air temperature; relative humidity; rainfall	Provide local environmental context.
Irrigation	Flow; pressure; pump state; valve state	Verify delivery and identify abnormal behavior.
Remote observation	Satellite-derived or other remote-sensing information	Add spatial context beyond point sensors.
System health	Battery/solar; connectivity; sensor diagnostics	Prevent false confidence caused by missing or degraded data.

SCOPE BOUNDARY Agriculture scope: IoT monitoring and technology readiness—not agricultural machinery. Any physical equipment outside the IoT monitoring/control scope should be assessed and specified separately.

Level	Recommended information
Executive	Availability, energy/unit, active alerts, data quality and trend direction.
Engineering	Condition, temperature, vibration, process stability and selected asset signals.
Production	Machine state, output, downtime, utilization and relevant production context.
Alerts	Severity, acknowledgement, owner, event time and response status.
Drill-down	Asset → sensor → event → engineering context.
History	Shift/day/machine/line/field comparison where data quality permits.

Customer problem	Potential intervention	Decision improved	Evidence / KPI
Unplanned downtime	State + condition sensing	Maintenance priority	Unplanned hours
High energy cost	Metering + production data	Energy optimization	kWh/unit
Process / quality drift	Critical-variable monitoring	Early intervention	Out-of-band time
Aging machinery	Brownfield connectivity	Modernization priority	Availability / OEE*
Irrigation uncertainty	Soil + flow + weather	Watering decision	Water/area
Remote field visibility	Gateway + alerts	Faster response	Alert-to-action time

Value area	Measurement approach
Downtime	Avoidable downtime hours × verified contribution/value per operating hour.
Energy	Baseline energy/unit − improved energy/unit, multiplied by production volume and applicable tariff.
Maintenance	Avoided failure exposure + reduced emergency intervention − monitoring and maintenance cost.
Water	Baseline water use − verified improved water use, multiplied by actual water/energy cost.
Quality	Reduction in scrap/rework × verified unit value.
Investment	Annual verified benefit evaluated against lifecycle cost, payback and implementation risk.

EVIDENCE BEFORE PROMISE Do not promise a percentage saving before measurement. Establish the baseline, test the intervention, verify the result and only then decide whether the business case supports scale.

Stage	Work	Decision gate
Discovery	Asset/process mapping; stakeholder interviews; current controls and data review.	Is the problem specific enough to measure?
Baseline	Collect current performance and establish data quality.	Is there a defensible starting point?
Architecture	Select measurement points, interfaces, gateway, network and data path.	Can the required information be obtained reliably?
Pilot	Install and commission selected points; validate telemetry and context.	Is the data complete and trustworthy?
Operationalization	Dashboard, alerts, trends and operator/engineer workflow.	Does someone use the information to make a better decision?
Verification	Compare against baseline and quantify evidence.	Is there measurable value or learning?
Scale	Extend only the elements that have passed the evidence test.	What should be standardized, improved or stopped?

Period	Engineering activity	Customer output
Days 1–15	Discovery, asset/process mapping, baseline	Problem statement + baseline
Days 16–30	Architecture + measurement plan	Technical design + pilot bill of materials
Days 31–45	Install / commission selected points	Validated data stream
Days 46–60	Dashboard, alerts and data-quality checks	Operational visibility
Days 61–75	Trend/anomaly analysis + operator feedback	Decision workflow
Days 76–90	Verification + scale/no-scale review	Business case + roadmap

Technology	Appropriate role	Prerequisite
Edge AI	Local anomaly detection where latency or connectivity makes edge processing valuable.	Reliable signals and a defined detection problem.
Predictive maintenance	Evidence-based failure-risk estimation.	Historical failure/condition data and a credible failure mode.
Machine vision	Selected inspection or quality measurements.	Stable imaging conditions and a measurable visual characteristic.
Digital twins	Live asset/process state linked to an engineering model.	Clear simulation purpose and reliable state data.
Remote sensing	Broader agricultural context alongside field observations.	Appropriate spatial/temporal resolution and decision relevance.
AI-assisted engineering	Support troubleshooting and analysis while retaining engineering approval.	Controlled data, review process and human accountability.
Secure remote operations	Controlled remote access, logging and device identity.	Network segmentation, authorization and operational safeguards.
Interoperability	Avoid isolated sensor islands and enable future integration.	Defined interfaces, data ownership and integration requirements.

Concern	Minimum design question
Asset identity	Can each device, gateway or account be identified and managed?
Access control	Who can view, configure or control each system?
Network separation	Can monitoring traffic be separated from critical control networks where appropriate?
Data protection	What information is collected, where is it stored, and who is authorized to access it?
Remote access	Is remote access controlled, logged, time-bounded and revocable?
Failure behavior	What happens if the network, gateway, sensor or data service fails?
Operational safety	Can the IoT layer affect a machine or process without appropriate interlocks and authorization?

Consultancy activity	Customer outcome
Engineering assessment	Understanding of machinery, process, operating conditions and constraints.
Technology assessment	Identification of where sensing, connectivity or analytics are justified.
Architecture	A practical path from existing equipment to connected operations.
Modernization assessment	Retrofit and upgrade opportunities considered before replacement.
IoT readiness	Definition of measurement points, data paths, dashboards, connectivity and future integration.
Opportunity analysis	Technical interventions connected to measurable outcomes.

Consultancy activity	Customer outcome
Roadmap	Clear separation between immediate actions, deferred work and future preparation.
Evidence management	Measured results separated from external research and illustrative scenarios.

Source	Publisher	Use in this document
Pakistan Economic Survey 2025–26	Ministry of Finance, Government of Pakistan	Official national economic, agriculture, manufacturing and export context.
Pakistan Bureau of Statistics — Industry / QIM	Pakistan Bureau of Statistics	Current large-scale manufacturing and textile production indicators.
ITU-T Y.4228 (08/2024)	International Telecommunication Union	Industrial IoT infrastructure requirements and security/reliability framework.
ITU-T digital agriculture work programme	International Telecommunication Union	Current framing of IoT network requirements for remote digital agriculture.
ITU-T Y Supplement 83 (07/2024)	International Telecommunication Union	AI and IoT applications and best practices for digital agriculture.
NEI Pakistan Market Master Consultancy Dossier 2026	Noori Engineering Industries / supplied project source	Primary source for NEI scope, use cases, architecture concepts, customer outputs and implementation framework.

ASSESS → MEASURE → CONNECT → VISUALIZE → PROVE → OPTIMIZE → SCALE A disciplined pathway from engineering problem to measurable operational intelligence.

Standards positioning These references are used as architectural and engineering benchmarks. This document does not claim that NOORI ENGINEERING INDUSTRIES is certified to any referenced standard unless separately verified.

Layer	Primary role	Representative elements	Engineering concern
Physical / Machine	Observe process	Sensors, PLCs, drives, meters	Calibration, installation, environmental suitability
Edge / Gateway	Normalize and buffer	Gateway, protocol adapter, local rules	Latency, resilience, compatibility
Connectivity	Transport data	Ethernet, Wi-Fi, cellular, LPWAN where suitable	Coverage, segmentation, availability
Data / Application	Create decisions	Historian, time-series store, dashboards, alerts	Context, timestamps, data quality
Governance / Security	Control trust	Identity, roles, logging, backups, asset inventory	Cyber risk, accountability, lifecycle

KPI family	Example metric	Source	Decision use	Quality check
Availability	Runtime / scheduled time	PLC / machine state	Maintenance and scheduling	State completeness
Energy intensity	kWh / production unit	Meter / drive / gateway	Energy review	Meter plausibility

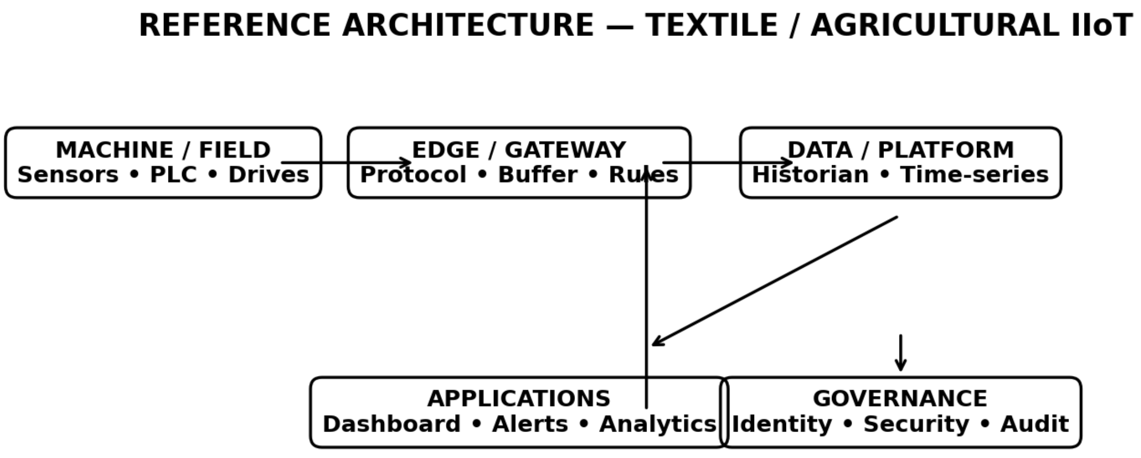
KPI family	Example metric	Source	Decision use	Quality check
Process stability	Temperature / pressure variation	Process sensors	Process review	Calibration / range
Downtime	Duration by reason	Machine state + operator	Loss analysis	Reason-code completeness
Irrigation	Flow / runtime / pressure	Flow meter + pump + sensors	Irrigation control	Sensor health / communications

Safety boundary IoT monitoring must not compromise machine safety functions. Any control action affecting safety, interlocks, emergency systems or deterministic operation requires appropriate engineering assessment.

Evidence discipline Illustrative charts demonstrate analytical design. Customer case studies should use measured project data with a defined baseline, period, methodology and scope.

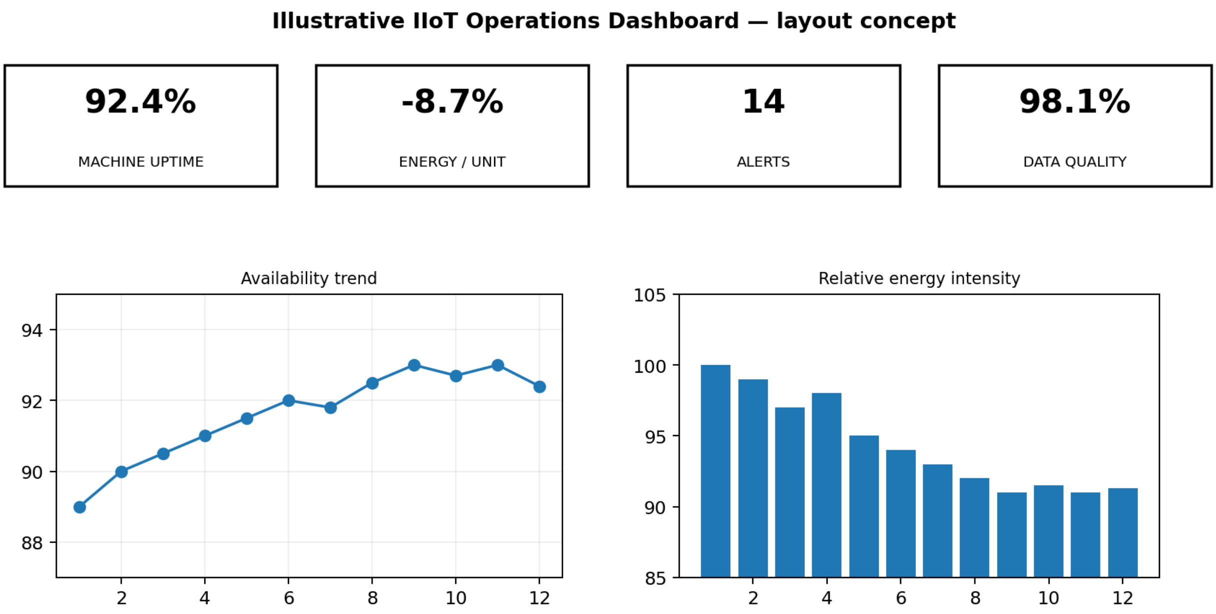
Reference	Relevance	Use in this consultancy
ISO/IEC 30141:2024	IoT reference architecture	Architecture vocabulary, views and implementation discipline
ISO 23247-1/-2/-4:2021	Manufacturing digital twin	Digital-twin principles, reference architecture and information exchange
ITU-T Y.4228:2024	IIoT infrastructure for smart manufacturing	Device, gateway, network, application and security framework
IEC 62443 family	Industrial cybersecurity	Security lifecycle and IACS/IIoT risk framing

IIoT Reference Architecture



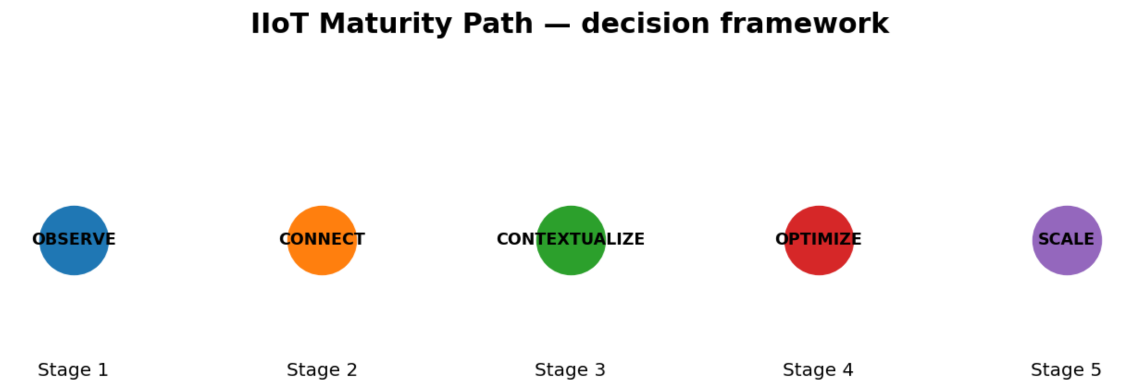
Illustrative consultancy framework visual.

Illustrative IIoT Management Dashboard



Illustrative consultancy framework visual.

IIoT Maturity Model



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