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Data-Interoperable Collaborative Governance for Monitoring Indonesia's Free Nutritious Meal Program in Ambon

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A B S T R A C T
Indonesia's Free Nutritious Meal (MBG) program connects nutrition, education, health, logistics, and local economic development, yet its operational monitoring remains fragmented. This study develops a governance design for an interoperable monitoring and evaluation dashboard in Ambon City. A design-oriented qualitative case study analyzed 17 public reports published from May 2025 to April 2026, official MBG guidelines, and a research design document. Thematic coding and process-risk mapping identified recurring problems in food safety, distribution timing, target-data consistency, complaint handling, and cross-agency accountability. The study proposes a minimum dataset, actionable key performance indicators, role-based access, audit trails, and an escalation workflow. Dashboard effectiveness depends less on visualization than on shared definitions, data stewardship, and institutionalized collaborative decision-making.

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INTRODUCTION

School meal programs are no longer understood merely as food distribution schemes. At scale, they operate as integrated public-service systems that connect nutrition, education, health surveillance, procurement, local production, logistics, social protection, and public accountability. Global evidence associates well-designed school meals with improved participation, learning readiness, social protection, and local food-system development, although effects depend heavily on food quality, regularity, safety, and implementation capacity (Bundy et al., 2018; Wall et al., 2022). The administrative challenge therefore lies not only in serving meals, but in ensuring that every meal can be traced through a reliable chain of targeting, production, delivery, receipt, quality control, and corrective action.

Indonesia's Free Nutritious Meal program, commonly referred to as Makan Bergizi Gratis (MBG), has rapidly become a major national public-service undertaking. The National Nutrition Agency's governance guidelines define a multi-level system involving central units, regional service offices, Nutrition Fulfilment Service Units or Satuan Pelayanan Pemenuhan Gizi (SPPG), educational institutions, health agencies, food-safety authorities, and partner organizations (Badan Gizi Nasional [BGN], 2024, 2025a). The 2026 technical guidance further emphasizes coordinated delivery from national to local levels and the identification of eligible beneficiaries (BGN, 2025b). Food-safety certification, hygiene, sanitation, and risk-control requirements have also been formalized as conditions for accountable SPPG operation (BGN, 2025c). These provisions demonstrate that MBG is institutionally designed as a governed service network rather than a stand-alone kitchen program.

The difficulty is that a governed network can still function as disconnected organizations. Each actor records only a fragment of the service chain: schools hold enrolment and receipt records; SPPGs hold menu, production, and dispatch records; health offices and laboratories hold inspection and sample results; local governments handle waste, labour, and coordination issues; and BGN retains program authority. When identifiers, reporting schedules, definitions, or escalation procedures differ, the same program can produce several competing versions of operational reality. A kitchen may appear active in one list, suspended in another, and still be associated with schools in a third. A complaint may be publicly known but absent from a structured incident register. A delivery may be marked as completed even when it arrives after students have left. The result is administrative visibility without operational control.

Ambon City provides a strategically important case. Its island-city geography, dispersed schools, traffic and access variation, and dependence on multiple service units amplify the relationship between distance, delivery time, temperature control, and meal quality. Documentary reports from 2025-2026 describe suspected food-safety incidents, expired ingredients, inadequate sanitation, incomplete wastewater facilities, timing mismatches, public complaints, and concerns about worker conditions. At the same time, local authorities have emphasized the program's potential to support local suppliers, employment, and public trust. The coexistence of high social value and high

operational risk makes Ambon an appropriate setting for examining how data interoperability and collaborative governance can be combined in a practical monitoring design.

Existing dashboard projects often focus on visual presentation while treating data definitions, ownership, verification, and response as external matters. Public-sector digital transformation research shows that technology produces value only when it is accompanied by changes in work processes, organizational responsibilities, and decision routines (Mergel et al., 2019; Tangi et al., 2021; Haug et al., 2024). Similarly, public-health dashboard studies caution that visual access alone does not guarantee usability or actionability; users need credible, timely, relevant, and interpretable indicators connected to decision authority (Schulze et al., 2023). For MBG, a dashboard that merely displays counts would reproduce fragmentation in a more attractive format without resolving the underlying governance problem.

This study addresses that gap by developing a design specification for an interoperable MBG monitoring and evaluation dashboard grounded in collaborative governance. It asks how recurring implementation risks in Ambon can be translated into a minimum dataset, actionable indicators, accountable roles, and a structured escalation workflow. The study contributes by treating the dashboard as a governance artifact: a socio-technical arrangement that links shared data definitions, cross-organizational responsibility, food-safety control, and corrective action. The objective is not to claim that a fully tested production system already exists, but to establish an empirically grounded design that can guide prototyping, pilot implementation, and institutional adoption.

LITERATURE REVIEW

School Meals as a Multisector Public Service

School meals create value through several pathways. They can reduce short-term hunger, support attendance and concentration, provide a platform for health and nutrition interventions, and transfer resources to households. Home-grown procurement can also connect public expenditure with local producers and labour markets (Bundy et al., 2018; Wall et al., 2022). These benefits are not automatic. Program effects vary with targeting accuracy, menu adequacy, implementation consistency, food safety, and the capacity to detect and correct delivery failures (Wall et al., 2022). This makes monitoring a constitutive part of the intervention rather than an administrative afterthought.

Large-scale meal services are especially sensitive to process variation. Failures may arise during supplier selection, ingredient storage, cooking, cooling, portioning, transportation, receipt, waste handling, or incident response. A final meal count cannot reveal where quality deteriorated. Effective monitoring therefore requires end-to-end traceability and process indicators, including batch identity, dispatch time, delivery time, receipt verification, temperature or quality checks where applicable, inspection status, and case closure. BGN's national guidelines already recognize incident response, investigation, inter-agency coordination, corrective action, reporting, and follow-up as core elements of food-safety governance (BGN, 2024). The unresolved

design question is how these elements can be operationalized across organizations at city level.

Collaborative Governance and Shared Accountability

Collaborative governance refers to public decision and implementation processes in which government agencies engage non-state or cross-organizational actors through structured, consensus-oriented arrangements (Ansell & Gash, 2008). Its effectiveness depends on starting conditions, institutional design, facilitative leadership, trust building, shared understanding, and repeated interaction. Emerson et al. (2012) extend this logic through the concepts of principled engagement, shared motivation, and capacity for joint action. These frameworks are relevant to MBG because no single actor controls the complete service chain or all of the information needed to assess it.

Collaboration, however, does not mean that responsibility is dissolved into meetings. Cross-sector arrangements require explicit role allocation, authority, resources, information-sharing rules, and mechanisms for accountability (Bryson et al., 2015; Sorensen & Torfing, 2021). For an MBG dashboard, collaborative governance must be translated into operational design: who enters each field, who validates it, who can view sensitive information, who owns an alert, how quickly it must be handled, and who verifies closure. Shared indicators can support a common understanding, but only when they have agreed definitions and are linked to decision rights.

Data Interoperability, Governance, and Actionable Dashboards

Interoperability is often mistaken for a technical connection between applications. In public administration, it includes technical, semantic, organizational, and legal compatibility. Systems must exchange data, but actors must also agree on meanings, responsibilities, permissions, and legitimate uses (Khatri & Brown, 2010; Abraham et al., 2019). Semantic interoperability is particularly important for MBG because apparently simple variables such as active kitchen, delivered portion, incident, beneficiary, and compliant inspection can be defined differently across agencies.

Data governance provides the decision framework for managing data as an organizational resource. It clarifies ownership and stewardship, quality rules, metadata, access, accountability, and issue resolution (Khatri & Brown, 2010; Abraham et al., 2019). Government settings add public-value, privacy, transparency, and inter-organizational constraints (Dawes, 2010; Mao et al., 2022). A minimum dataset should therefore collect only information needed for decisions, while role-based access and aggregation protect personal and operationally sensitive information.

A dashboard becomes actionable when every displayed indicator is connected to a threshold, responsible owner, expected response time, and evidence of follow-up. Data-driven dashboards can improve transparency and accountability, but the design must prevent selective disclosure, inaccurate aggregation, and visual certainty unsupported by data quality (Matheus et al., 2020; Schulze et al., 2023). The conceptual framework in Figure 1 integrates

operational risk, interoperability, and collaborative governance into a feedback cycle of monitoring and correction.

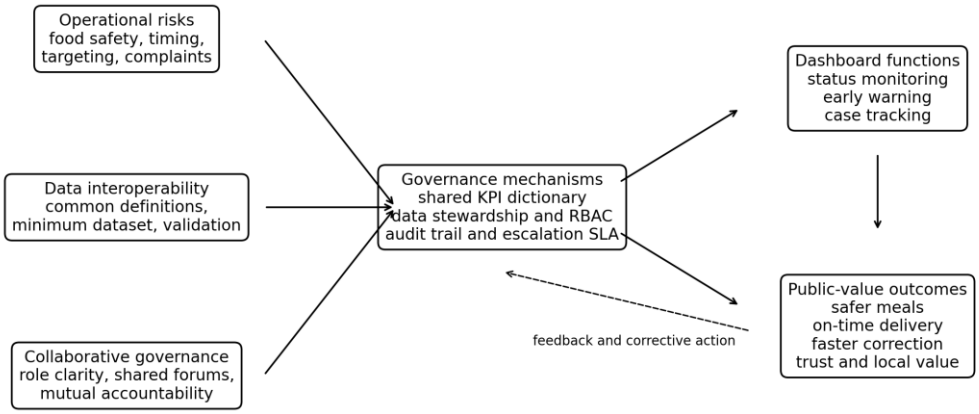

Figure 1. Conceptual Framework for an Interoperable and Collaborative MBG Monitoring System

METHODOLOGY

This study used a design-oriented qualitative case-study approach informed by Design Science Research (DSR). DSR is appropriate when a study seeks to understand a practical problem and produce an artifact or design knowledge that addresses it (Hevner et al., 2004; Peffers et al., 2007; Gregor & Hevner, 2013). The present work covers problem identification, objective definition, and design specification. It does not claim completion of software development or field usability testing; those activities belong to the subsequent prototyping and pilot stages.

The case was Ambon City, Maluku, Indonesia. Documentary evidence consisted of 17 publicly accessible reports compiled by the research team and published between May 2025 and April 2026, official BGN governance and food-safety guidance, and the approved research design for the proposed Ambon dashboard. The reports included material from government agencies, public oversight bodies, national and local news organizations, and education-sector sources. They covered program coverage, coordination meetings, inspections, food-safety concerns, delivery problems, SPPG compliance, workforce issues, and local procurement. Because the available materials did not contain verbatim interview transcripts, no interview claims were made; all empirical statements were treated as documentary evidence.

Analysis proceeded in four stages. First, the service chain was mapped from beneficiary identification to production, dispatch, delivery, receipt, quality control, complaint handling, and incident closure. Second, documentary statements were coded deductively using five governance domains: data quality, service timeliness, food safety, collaborative accountability, and public value. Inductive coding was then used to identify recurring issues within each domain. Third, a risk-control matrix translated each issue into the data fields, indicators,

ownership, and response mechanisms needed to manage it. Fourth, the proposed design was checked against DSR relevance criteria and collaborative-governance principles, with emphasis on problem-artifact fit, role clarity, actionability, and feasibility in a resource-constrained local-government environment.

Triangulation was conducted across source types. A problem was treated as recurrent when it appeared in more than one independent report or when a local report aligned with an official control requirement. Conflicting figures were not averaged; they were recorded as evidence of data-version and source-of-truth problems. The design follows data-minimization principles: identifiable beneficiary information should remain restricted, while public reporting should use aggregated indicators. The study did not evaluate individual SPPGs or assign legal responsibility for reported incidents.

Table 1. Documentary Corpus and Analytical Use

Source group	Coverage	Primary analytical use	Credibility treatment
Official BGN guidance	National governance, technical implementation, food-safety certification, and incident response	Normative requirements, role definitions, compliance controls	Used as the principal normative reference
Government and oversight reports	Local coordination, audits, inspections, school coverage, and supervision	Operational conditions and formal institutional responses	Prioritized when specific and attributable
Local and national media reports	Complaints, suspected incidents, sanitation, timing, labour, and public trust	Risk identification and recurrence mapping	Triangulated; allegations were not treated as adjudicated facts
Research design document	Proposed DSR stages, stakeholders, KPI groups, interoperability, and pilot plan	Artifact objectives and feasibility constraints	Used to delimit the design stage and intended outputs

RESULT AND DISCUSSION

Diagnostic Finding 1: Monitoring Is Fragmented Across the Service Chain

The documentary evidence indicates that Ambon's MBG implementation is visible through many separate reports but not through one reconciled operational record. Coverage figures, kitchen status, inspection findings, school

complaints, and corrective actions appear in different institutional and media channels. One report stated that approximately 64,000 students had been reached and that 29 of a targeted 32 kitchens were operating in early March 2026. Other documents focused on suspended kitchens across Maluku, but cited different totals of 51 and 53 units. The discrepancy may reflect timing, scope, or later correction, yet the public record did not expose a version history or a common reference date. This type of numerical contradiction becomes a significant management problem when data are used without common version control, reporting dates, and authoritative sources.

The core problem is not that actors have no data. Rather, they hold non-interoperable fragments. A school can confirm meal receipt but may not see the production batch or inspection status of the originating SPPG. A health agency may record a laboratory or sanitation finding without an integrated link to the relevant delivery, school, menu, and corrective action. Local government can identify waste-management or labour concerns but may not be the owner of SPPG operational data. BGN has program authority, while schools and local agencies observe daily outcomes. Without common identifiers for SPPG, school, delivery route, batch, and incident, evidence cannot be reliably joined across the chain.

The analysis therefore identifies five interoperability gaps. The first is identifier inconsistency, especially for service units, schools, and beneficiary aggregates. The second is semantic inconsistency in terms such as operational, compliant, delivered, and incident closed. The third is temporal inconsistency because reports may refer to different dates without an effective-date field. The fourth is validation inconsistency, including unclear responsibility for verifying counts and status changes. The fifth is access inconsistency: some data are public, some are operationally restricted, and some concern personal or health information, yet the available documents do not show a unified role-based access structure.

Diagnostic Finding 2: Food-Safety and Distribution Risks Require Event-Level Traceability

Food safety was the most recurrent risk domain. The compiled reports described expired ingredients, weak kitchen sanitation, inadequate or incomplete wastewater facilities, waste accumulation, suspected spoiled meals, pest findings, concern about coliform contamination, and suspected food-poisoning events. The study does not determine the legal truth of each allegation. Their governance significance lies in recurrence across independent sources and their direct correspondence with BGN requirements for hygiene, sanitation, food-safety certification, sample retention, incident response, investigation, and corrective action (BGN, 2024, 2025c).

Distribution risk was closely connected to food safety and service usefulness. Reports described meals arriving after students had left, distance-related deterioration, and calls for improved SPPG zoning. A delivery record that contains only a completed status cannot distinguish timely service from late arrival, partial receipt, rejection, or compromised quality. Event-level monitoring requires planned dispatch, actual dispatch, planned arrival, actual arrival,

recipient confirmation, exception reason, and route or zone. These fields allow the dashboard to calculate lateness and identify whether a recurring problem is associated with a route, SPPG, school schedule, or production delay.

The evidence also supports a batch-and-case model. Every meal delivery should be associated with a production batch and menu record. Every safety complaint or suspected incident should generate a unique case identifier linked to the batch, SPPG, school, date, affected group, immediate response, sample or inspection evidence, responsible authority, corrective action, and closure verification. This design prevents complaints from becoming detached public narratives and converts them into traceable management objects.

Table 2. Recurrent Governance Risks and Required Controls

Risk domain	**Documentary pattern**	**Data/control implication**	**Dashboard response**
Food safety and hygiene	Expired ingredients, sanitation concerns, wastewater and pest issues, suspected illness	Batch identity, certification status, inspection record, sample/lab result, corrective-action evidence	Compliance flag, high-priority alert, case timeline
Distribution and zoning	Late arrival, schedule mismatch, quality decline over distance	Planned and actual times, route, distance/zone, receipt confirmation, exception reason	On-time rate, route heat map, recurring-delay alert
Coverage and status data	Different totals for active or suspended units and incomplete target realization	Effective date, source, version, validation owner, standardized unit identifiers	Single status register with history and reconciliation queue
Complaints and incidents	Public complaints followed by ad hoc inspection or coordination	Unique case ID, severity, owner, SLA, action, verification, closure	Open-case count, overdue alerts, closure evidence
Workforce and procurement	High daily workload, wage/hour concerns, calls for local sourcing	Staffing and shift indicators, supplier location, basic compliance and procurement fields	Capacity warning and local-value indicators
Transparency and trust	Calls for public disclosure and repeated reputational controversy	Public/private data separation, publication rules, quality notes	Aggregated public view and data-quality disclaimer

Design Finding 1: A Minimum Dataset Must Follow Decisions, Not Institutional Silos

The proposed minimum dataset is organized around decisions that must be made, rather than around the existing boundaries of organizations. Each domain contains only fields needed to verify service delivery, manage risk, or demonstrate accountability. The structure uses standardized identifiers and reference tables for SPPGs, schools, administrative areas, routes, suppliers, and reporting periods. Every transactional record contains a timestamp, reporting source, validation status, and last-update metadata. This is necessary because a current value without provenance cannot serve as a reliable management record.

Beneficiary data should be aggregated for routine city-level monitoring, with identifiable records retained only where legally and operationally required. The dashboard needs counts by school and beneficiary category, not unrestricted student-level profiles. Production and distribution data require greater granularity because failures occur at batch and delivery-event level. Food-safety and incident records require controlled access due to health and investigative sensitivity. Public views should therefore show aggregated coverage, timeliness, certification, and case-resolution indicators without exposing personal data or unverified allegations.

Table 3. Proposed Minimum Dataset for the Ambon MBG Dashboard

Domain	**Core fields**	**Primary owner/steward**	**Update frequency**
Reference and master data	SPPG ID, school ID, location code, route/zone, service capacity, operational status, effective date	BGN/KPPG with city verification	On change
Beneficiary and coverage	Eligible aggregate, planned recipients, served recipients, absence/exclusion reason, reporting date	School and education office	Daily/weekly
Menu and production	Batch ID, menu, portion category, ingredients, production quantity, preparation completion, retained sample flag	SPPG	Each batch
Dispatch and receipt	Vehicle/route, planned and actual dispatch, planned and actual arrival,	SPPG and school	Each delivery

	quantity sent/received, receipt status, exception		
Food safety and compliance	SLHS/HACCP status, inspection date, findings, water/food test, expiry, corrective action, reinspection	Health office/BPOM/BGN	On inspection/event
Complaints and incidents	Case ID, reporter channel, type, severity, linked batch, affected location, immediate action, owner, SLA, status	Joint incident secretariat	Real time/on event
Workforce and local value	Active workers, shift hours, training, local supplier share, supplier location, selected welfare/compliance flags	SPPG/local agencies	Monthly
Audit and data quality	Creator, timestamp, validator, version, completeness score, inconsistency flag, correction history	System and designated steward	Automatic/continuous

Design Finding 2: Indicators Must Be Actionable and Paired With Escalation Rules

The indicator design distinguishes descriptive counts from actionable key performance indicators (KPIs). A descriptive count answers how many; an actionable KPI indicates whether intervention is required, by whom, and within what time. Each KPI therefore includes a formula, reporting level, threshold, owner, service-level agreement (SLA), and expected evidence of response. Thresholds in Table 4 are proposed starting points for pilot validation, not final national standards. They should be calibrated with BGN, health authorities, SPPGs, and schools.

The dashboard should use a three-level status model. Green indicates that the value is within the agreed range and no special action is required. Amber indicates emerging risk that requires review by an operational owner. Red indicates an immediate safety, compliance, or service failure requiring escalation.

Some events, such as a suspected food-safety incident or expired ingredient finding, should trigger red status regardless of aggregate performance. This prevents good average figures from concealing a severe event.

Alerts must remain open until there is verified evidence of closure. A response note is not closure. Closure requires completion of the assigned corrective action and verification by a role independent of the original data entry where feasible. The dashboard should display both response time and verified closure time, because rapid acknowledgement can coexist with slow correction.

Table 4. Proposed Actionable KPI and Alert Matrix

KPI	Definition	Initial alert rule	Owner and expected action
Coverage realization	Served recipients / planned recipients x 100%	Amber below 95%; red below 90% or unexplained exclusion	Education/school verifies denominator and cause
On-time delivery	Deliveries received within agreed window / all deliveries	Amber below 95%; red below 90% or meal arrives after school session	SPPG/logistics corrects route or production schedule
Quantity accuracy	Absolute difference between sent and received portions	Amber above 2%; red above 5%	SPPG and school reconcile the event
Valid certification	Operational SPPGs with valid required certification / operational SPPGs	Red for any operating unit lacking mandatory status	BGN/health authority restricts or conditions operation
Critical inspection findings	Open critical findings by SPPG	Red immediately	Health/BGN assigns correction and reinspection
Incident acknowledgement	Time from report to responsible-owner acknowledgement	Red when safety cases exceed agreed urgent SLA	Incident lead activates response protocol
Verified case closure	Cases closed with verification / cases due for closure	Amber below 90%; red for overdue severe cases	Joint secretariat follows up and verifies evidence
Data completeness	Required fields completed /	Amber below 98%; red below	Data steward returns records for correction

	required fields expected	95% for critical datasets	
Cross-source inconsistency	Unresolved conflicts in unit, coverage, or status records	Amber after one reporting cycle; red when affecting safety/operations	KPPG data steward reconciles and records decision
Local supplier share	Value or volume sourced from qualified local suppliers	Trend indicator; threshold set by policy	Procurement owner balances local value and safety

Design Finding 3: Collaborative Governance Must Be Embedded in System Roles

The documentary evidence shows substantial coordination activity: evaluation meetings, inspections, legislative hearings, health-agency involvement, food-safety supervision, and informal communication groups. These actions demonstrate institutional concern, but they are mostly event-driven. The proposed model converts coordination into a standing operating arrangement. It establishes a city MBG monitoring forum, a data-stewardship function, and a joint incident workflow. The forum should not replace BGN authority; it should align city-level evidence and action across actors whose mandates intersect.

Role-based access control (RBAC) is required both for privacy and accountability. Schools should confirm receipt and report complaints but should not edit SPPG production records. SPPGs should record production and dispatch but should not validate their own critical inspection findings. Health and food-safety authorities should enter or validate inspection and laboratory results. BGN/KPPG should maintain unit status and program authority. The city government should coordinate local services, including waste, labour, procurement facilitation, and cross-agency response. A limited public view should disclose aggregated performance and verified information, rather than operationally sensitive or personally identifiable details.

The proposed escalation sequence is: detection, classification, assignment, acknowledgement, immediate control, investigation, corrective action, verification, closure, and learning review. Each stage produces a timestamp and responsible role. Serious cases should automatically notify the designated incident lead and relevant authorities. Recurrent amber alerts should also escalate, because repeated minor lateness or incomplete data may indicate a structural failure that no single red event captures.

Table 5. Proposed Role and Escalation Matrix

Actor	**Core dashboard role**	**Data authority**	**Escalation responsibility**
BGN/KPPG	Program owner and	Approve SPPG master status	Decide restrictions,

	unit-status authority	and national definitions	suspension, or program-level correction
Ambon City Government	Cross-agency coordinator and local public-value steward	Validate local reference data and coordinate supporting services	Convene response and remove local administrative barriers
SPPG	Production and dispatch operator	Create batch, menu, quantity, staffing, and dispatch records	Control immediate operational causes and submit evidence
School	Receipt verifier and beneficiary-interface point	Confirm quantity, time, acceptance, and complaint information	Protect students, report exceptions, preserve evidence
Health Office/BPOM/laboratory	Safety assessor and technical validator	Enter inspections, testing, classification, and reinspection results	Lead or support technical investigation and verification
Education Office	Coverage and school-schedule steward	Validate planned recipients, schedules, and school identifiers	Resolve denominator, timing, and institutional issues
Public/parents	Feedback source through controlled channels	Submit complaints or feedback; no direct record editing	Receive verified public information and case reference

Design Finding 4: A Modular Architecture Supports Low-Cost Implementation

The proposed architecture is modular so that implementation can begin with controlled spreadsheet or CSV templates and later move toward application programming interfaces. The first priority is not sophisticated software but stable codes, mandatory fields, validation rules, and a reconciled master register. Data ingestion should flag duplicates, impossible timestamps, missing identifiers,

conflicting unit status, and incomplete critical fields before records enter the KPI layer.

The governance layer manages user roles, ownership, audit trails, and data-quality rules. The analytics layer calculates KPI values, thresholds, trends, and spatial or zonal patterns. User views differ according to responsibility: executives need risk summaries and unresolved high-priority cases; operations teams need delivery and capacity detail; safety authorities need inspection and incident views; and the public should receive an aggregated transparency page. Figure 2 illustrates the architecture and its action loop.

A practical pilot should begin with three to five schools and one to two SPPGs representing different routes or zones. Test scenarios should include normal delivery, late delivery, quantity discrepancy, missing certification, critical inspection finding, suspected illness, incomplete data, and conflicting status records. Evaluation should examine functional accuracy, data completeness, alert routing, response evidence, usability, and whether actors actually use the dashboard in coordination meetings.

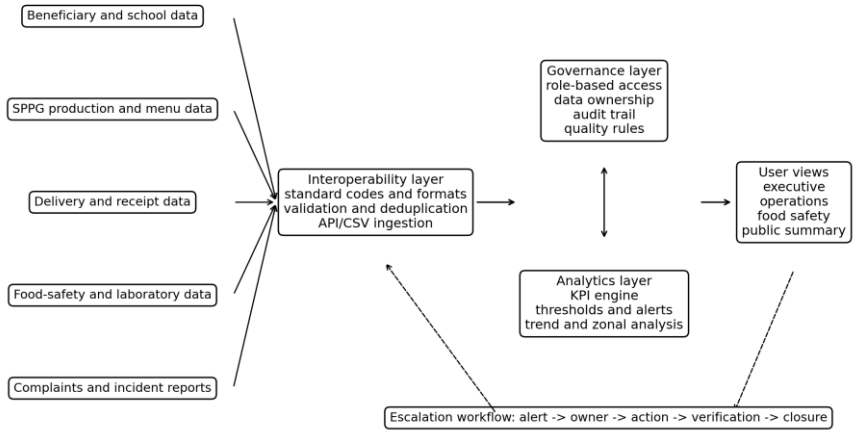

Figure 2. Proposed Modular Architecture and Escalation Loop for the Ambon MBG Dashboard

From Reporting Fragmentation to Governed Action

The central finding is that Ambon's monitoring challenge is not primarily a lack of reporting. It is a lack of governed integration between reports and decisions. The documentary record contains many signals: inspections, complaints, coordination meetings, kitchen status announcements, school coverage figures, and calls for corrective action. Yet these signals are difficult to reconcile because they do not share a complete operational data model. The proposed dashboard addresses this by creating a chain of evidence from the service event to the management response.

This distinction matters for digital-government practice. Digital transformation is not achieved when paper or WhatsApp messages are copied into a screen. It requires a redesign of process, responsibility, and decision logic (Mergel et al., 2019; Haug et al., 2024). In the proposed model, data fields are selected because they support specific decisions; KPIs are linked to thresholds;

alerts are assigned to owners; and closure requires verification. The dashboard is therefore a coordination infrastructure, not a decorative reporting layer.

The conflicting public figures for suspended SPPGs provide a compact illustration of why versioning and effective dates matter. Both figures may have been correct at different moments or under different scopes. A traditional dashboard might display the latest number without explaining its lineage. A governed dashboard would retain the status history, reference date, source, validation decision, and scope. This approach improves transparency because it shows how a number became authoritative, not simply what number currently occupies the tile.

Interoperability Is Institutional Before It Is Technical

The study supports the broader argument that public-sector interoperability is multidimensional. A common file format will not resolve different definitions of operational status, incident severity, or case closure. Technical exchange becomes useful only when semantic and organizational agreements are established. The minimum dataset and indicator dictionary are thus governance instruments. They force actors to agree on the meaning, source, frequency, and validation of each critical element.

Data stewardship is essential in a network where authority and observation are distributed. BGN/KPPG may be the authoritative source for SPPG status, while schools are the authoritative source for receipt and immediate acceptance. Health authorities are authoritative for inspection classifications and laboratory evidence. The dashboard should preserve these differentiated authorities rather than pretending that one database owner can accurately create all records. This federated stewardship model is consistent with data-governance research emphasizing decision rights and accountability (Khatri & Brown, 2010; Abraham et al., 2019).

The proposed architecture also recognizes infrastructure constraints. Starting with validated templates is not a lesser form of interoperability if definitions, identifiers, and rules are stable. Premature automation can accelerate inconsistent data. A staged approach allows Ambon to establish governance, test fields and thresholds, and only then invest in deeper integration. This staged sequence is deliberately pragmatic and improves implementation reliability.

Collaborative Governance Under Asymmetric Authority

MBG involves asymmetric authority. BGN holds national program authority, while the city government, schools, health services, food-safety institutions, SPPGs, and communities' control or observe different parts of implementation. Collaborative governance is therefore not an equal partnership in every decision. It is an arrangement for joint problem solving within legally differentiated mandates. The proposed role matrix respects this asymmetry while preventing gaps between mandates.

The model strengthens collaborative capacity in three ways. First, it creates shared situational awareness through reconciled data and indicators. Second, it specifies joint-action capacity through alert ownership, SLAs, and verification. Third, it supports accountability by preserving an audit trail of who knew what,

when action was assigned, and whether correction was verified. These mechanisms operationalize the collaborative-governance concepts of shared understanding, capacity for joint action, and institutional design (Ansell & Gash, 2008; Emerson et al., 2012).

The design also reduces the risk that collaboration becomes a substitute for responsibility. Meetings and messaging groups can improve communication, but without a case register they may not reliably track unresolved actions. The dashboard converts discussion into assigned and time-bound work. This is especially important for incidents spanning several agencies, where each actor may perform a legitimate task while no one maintains the complete case trajectory.

Island-City Logistics and Risk-Sensitive Zoning

Ambon's geographical context makes delivery time a safety and quality variable, not merely an efficiency measure. Route distance, access conditions, school schedules, production capacity, and dispatch sequencing interact. The proposed dashboard should therefore analyze delivery performance by zone and route, rather than relying only on citywide averages. A high overall on-time rate can conceal recurrent lateness at peripheral schools.

Risk-sensitive zoning can use empirical travel and receipt data to adjust SPPG-school assignments, production sequence, dispatch windows, and contingency arrangements. The dashboard does not itself decide zoning, but provides evidence for collaborative review. Over time, the data can distinguish a one-off delay from a structural mismatch between kitchen capacity and service geography. This contributes to both food quality and equity, because difficult-to-reach schools should not systematically receive inferior service.

The same logic applies to capacity. Reports describing large daily production loads and worker concerns suggest that meal volume, staffing, shift duration, and compliance should be monitored together. Production targets that exceed safe process capacity can create quality risks even when delivery counts appear successful. A balanced scorecard must therefore avoid rewarding quantity at the expense of safety and labour conditions.

Public Value, Local Procurement, and Trust

Local leaders have framed MBG as a source of nutritional and economic value through local purchasing and employment. This aligns with home-grown school-feeding approaches that connect meal provision to local food systems (Bundy et al., 2018). The proposed design includes local supplier share and workforce indicators, but these should not become simplistic targets. Local procurement must remain subject to quality, safety, price, and continuity requirements. The dashboard can make these trade-offs visible by linking supplier information with quality and delivery outcomes.

Transparency is equally important. Public controversy can weaken trust even when problems are localized. A public dashboard should communicate verified aggregate information on reach, timeliness, certification, inspections, and case resolution, along with clear explanations of data limitations. It should not publish identifiable health data, unverified accusations, or operational details that could compromise investigations. Transparency by design therefore requires

explicit rules on what can be responsibly disclosed, at what level of aggregation, and after which verification process.

Trust is likely to improve when the public can see not only positive coverage figures but also how problems are handled. Reporting the number of complaints without resolution information may increase concern. Reporting verified closure rates, recurring-risk trends, and corrective actions demonstrates institutional learning. This supports public-value governance by connecting performance, accountability, and stakeholder legitimacy (Bryson et al., 2014).

Implementation Priorities and Feasibility

Implementation should begin with governance agreements rather than procurement of a complex platform. The first phase should approve the stakeholder map, master identifiers, minimum dataset, indicator dictionary, access matrix, and escalation SOP. The second phase should configure low-cost data-entry templates and a prototype dashboard. The third phase should conduct a limited pilot, evaluate usability and response performance, and revise thresholds. The fourth phase should scale gradually and automate integration where source systems are sufficiently stable.

Several safeguards are necessary. A data-quality dashboard should accompany the service dashboard so that completeness and inconsistency remain visible. Audit logs must be immutable to ordinary users. Critical alerts should have backup notification channels. Sensitive data should be encrypted and access reviewed periodically. Training should be role-specific, because a school receiver, health inspector, SPPG operator, and executive user need different workflows. Finally, the governance forum should review recurrent patterns, not only individual cases, and convert lessons into zoning, training, supplier, or SOP changes.

The design is feasible because it does not require all institutions to replace their systems immediately. It creates a shared data contract and governance mechanism that can sit above existing practices. Its main implementation risk is organizational: actors may resist additional data entry, disagree over definitions, or treat alerts as reputational threats. Participatory design and pilot feedback are therefore essential. The dashboard should reduce duplicate reporting and support operational work rather than create an additional administrative burden.

CONCLUSIONS AND RECOMMENDATIONS

The MBG program in Ambon is a complex public-service network whose nutritional and economic potential depends on reliable operational governance. Documentary evidence reveals recurring risks in food safety, delivery timing, data consistency, complaint handling, and cross-agency accountability. These risks cannot be adequately managed through periodic administrative reports or isolated inspections. They require a shared system that connects service events, authoritative data, risk thresholds, responsible actors, and verified corrective action.

This study proposes an interoperable and collaborative dashboard design built around eight minimum-data domains, actionable KPIs, role-based access, audit trails, and an escalation workflow. Its principal contribution is conceptual

and practical: the dashboard is framed as a governance artifact rather than a visualization product. The design shows that data interoperability must include shared meanings and stewardship, while collaborative governance must include explicit decision rights and time-bound responsibility.

The immediate recommendation is to establish a city-level design workshop involving BGN/KPPG, Ambon City Government, SPPGs, schools, education and health agencies, food-safety authorities, and selected community representatives. The workshop should validate the minimum dataset, determine authoritative sources, set pilot thresholds, approve the access matrix, and test the incident SOP. A limited pilot should then assess data completeness, KPI accuracy, alert routing, usability, and verified response performance before citywide expansion. Public reporting should use aggregated, verified information and clearly separate operational monitoring from public transparency.

FURTHER STUDY

This study is limited by its documentary dataset. Public reports may emphasize visible controversies and do not provide complete operational records. The available materials did not include verbatim stakeholder interviews, structured observation, transactional data, or a functioning prototype. Consequently, the proposed thresholds and workflows require participatory validation and field testing.

Further research should conduct interviews and process observation across schools, SPPGs, BGN/KPPG, health and education agencies, and local government; develop and pilot the prototype; assess usability using the System Usability Scale and task-based testing; and evaluate whether dashboard use improves response time, data consistency, delivery timeliness, food-safety compliance, and trust. Comparative studies across island and mainland cities would clarify which design elements are context-specific and which can support national replication.

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