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+15878858911
editorial-office@sciformat.ca

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DIGITAL TRACEABILITY GOVERNANCE AND FOOD-RECALL READINESS: A COBIT 2019-BASED DIAGNOSIS AND 2030 SCENARIOS

Douas Lynda (Corresponding Author, Email: lynda.douas@univ-oeb.dz)

Dr., Department of Management Sciences (GEA) — Université Larbi Ben M'hidi, Oum El Bouaghi, Algeria
ORCID ID: 0000-0003-0241-5341

ABSTRACT

Food-safety incidents raise a critical governance question: how reliably can firms identify and contain contaminated products? This exploratory mixed-method single-case study examines traceability-governance readiness in AgriCo Group, an Algerian agri-food conglomerate, using COBIT 2019 as a diagnostic lens. Interviews and documentary evidence provide the primary evidence, complemented by a questionnaire (n = 32) for descriptive triangulation. The overall diagnostic score is 2.5/5, revealing marked functional asymmetry: DSS reaches 3.4/5, compared with APO at 2.1/5 and MEA at 2.3/5. This pattern supports the provisional concept of functional asymmetric maturity, whereby operational IT capabilities develop faster than strategic alignment, data ownership, and monitoring capabilities. Four readiness dimensions—data governance, operational traceability, change and integration control, and governance assurance—structure a governance roadmap and conditional scenarios to 2030. While the single-case design does not establish causal effects on food-safety outcomes, the study provides a testable framework for examining how private-sector IT governance shapes digital traceability and food-recall readiness.

KEYWORDS

COBIT 2019, IT Governance, Food Traceability, Functional Asymmetric Maturity, Scenario Planning, Algeria

CITATION

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1. Introduction

Food-safety surveillance depends not only on regulatory rules and digital tools, but also on whether private firms can produce trustworthy, lot-level information when an incident occurs. This study therefore treats traceability governance as an organizational capability linking internal IT arrangements to public-health surveillance.

This study treats AgriCo not simply as an isolated organizational shortcoming, but as an illustrative case through which to examine a wider mechanism: operational IT investment can advance under production and compliance pressure while data ownership, strategic alignment, and monitoring remain weak.

To the author's knowledge, no published study has applied COBIT 2019 to an Algerian agri-food firm. The framework has accumulated applications in outsourced IT and public-sector contexts (Gantman & Fedorowicz, 2016), but the agri-food context in North Africa remains unexamined — a gap made more urgent by Algeria's National Economic Recovery Plan (2020–2024) and by the absence, documented in Section 2.5, of any explicit IT governance benchmark in Algeria's food safety apparatus.

Research Question

How does an imbalance between operational IT capability and strategic governance affect traceability-governance readiness in a multi-site Algerian agri-food group, and how can COBIT 2019 be adapted to diagnose that imbalance?

The paper is organized as follows: theoretical foundations, literature, and regulatory/public health context (Section 2), methodology (Section 3), AgriCo Group as an illustrative case of a systemic governance gap (Section 4), maturity diagnosis (Section 5), policy and regulatory recommendations (Section 6), discussion and theoretical implications (Section 7), prospective scenarios to 2030 (Section 8), scientific contributions (Section 9), and conclusion (Section 10).

2. Theoretical Framework and Literature Review

2.1 Theoretical Foundations

The study combines IT–business alignment, dynamic capabilities, and socio-technical governance perspectives. IT–business alignment explains why operational IT capability must be connected to organizational priorities; dynamic capabilities explain why capabilities may develop unevenly; and a socio-technical perspective directs attention to the interaction between systems, routines, roles, and accountability. COBIT 2019 is used as the organizing diagnostic framework rather than as a complete theory of traceability.

This theoretical reading motivates the study’s first analytical proposition: P1 – perceived maturity differs across the five COBIT 2019 governance and management domains at AgriCo, consistent with asymmetric development patterns documented in industrial emerging-economy firms. If dynamic capabilities in one governance domain can develop without a corresponding capability in another, this domain-level heterogeneity should be visible across the interview, documentary, and survey evidence, not just in aggregate scores.

2.2 Framework Choice: Why COBIT 2019?

Three alternatives were screened before COBIT 2019 was adopted (Table 1). ISO 38500:2015 offers simplicity but no maturity metrics. ITIL 4 (Axelos, 2019) is strong on service management but does not cover strategic governance. The OECD Digital Governance framework (2020) suits public-sector contexts, not private industrial firms. COBIT 2019 (ISACA, 2018a, 2018b) offers per-process maturity scoring and integration with ISO/IEC 27001 and ITIL 4, making it the most suitable among the frameworks considered for producing the domain-level diagnostic scores required in this study.

Table 1. Comparison of Candidate IT-Governance Frameworks

Framework	Maturity / Assessment Metrics	Fit for This Study
ISO 38500:2015	Six board-level principles; no maturity scoring	Too high-level for empirical diagnosis
ITIL 4 (Axelos, 2019)	Service-management practice maturity	Strong on service delivery; no strategic-governance or IT-business alignment coverage
OECD Digital Governance (2020)	Six-dimension public-sector digital government framework	Designed for public-sector, data-and-AI contexts, not private industrial firms
COBIT 2019 (ISACA, 2018a, 2018b)	Per-process maturity scoring, modular design factors	Selected: most suitable candidate for the domain-level diagnostic approach used in this study

(Source: Author, based on Section 2.2)

2.2.1 Known Limitations in Emerging Economy Contexts

COBIT 2019 nonetheless carries structural biases worth acknowledging: documentation-based assessment can penalize firms that coordinate IT effectively through informal, relational mechanisms (Gantman & Fedorowicz, 2016), a bias with particular relevance for developing-economy firms where lower formalization does not necessarily mean governance is absent (Al-Ruithe et al., 2019). Ahriz et al. (2018) show a lighter, prioritization-based approach can make COBIT workable in resource-constrained institutions; it is applied similarly here — mapping what the firm actually does rather than prescribing an idealized model.

2.3 Food Traceability and IT Governance

Food traceability is treated here as a governance-dependent information capability rather than as a purely technical function. ISO 22005:2007 provides the traceability reference point, while the study focuses on the organizational conditions that determine whether product, batch, and custody information can be retrieved, interpreted, and trusted during a recall.

Available contextual evidence suggests uneven adoption of electronic traceability infrastructure among Algerian agri-food firms, consistent with the international pattern that traceability failures may reflect governance weaknesses as well as technological limitations. Agri-food is distinctive among COBIT contexts because traceability failure carries a physical, time-bound, legally enforceable consequence that other COBIT-literature sectors do not face in the same form — a possible mechanism underlying the DSS–APO asymmetry examined in Section 7.2.

This distinction between regulation-compelled operational capability and voluntary strategic governance motivates the study's second analytical proposition: P2 – DSS (delivery, service and support) maturity is descriptively higher than APO (align, plan and organise) and MEA (monitor, evaluate and assess) maturity. If food safety regulation and physical product risk compel DSS-domain capability regardless of firm strategy, DSS should lead both APO and MEA by a margin visible across the triangulated evidence.

2.4 Literature Synthesis

The COBIT-based and COBIT-adjacent governance-maturity literature is heterogeneous in method and reporting, which limits direct score-for-score comparison across studies; the synthesis below characterizes what each study actually examined rather than treating differently-scoped studies as reporting comparable maturity scores.

None of the studies most cited in this literature reports COBIT domain scores directly comparable to this paper's scale: Lunardi et al. (2017) modeled 87 Brazilian firms without maturity scores; Gantman and Fedorowicz (2016) identify informal control mechanisms without a numeric score; Kamble et al. (2020) reviews agri-food supply chains, not a COBIT application; De Haes et al. (2020) is a theoretical text; Pournader et al. (2021) reviews AI in supply chains without COBIT scores; Ahriz et al. (2018) propose a project-selection model, not a maturity assessment. The comparison below is conceptual, not score-for-score.

What these studies share is a recurring qualitative theme rather than a common numeric benchmark: several describe operational or delivery-facing IT capability developing ahead of strategic governance capability, under different labels and in different sectors (Lunardi et al., 2017; Gantman & Fedorowicz, 2016; Kamble et al., 2020) — a theme the field has recently organized a dedicated research minitrack around (De Haes et al., 2023). This is convergent qualitative evidence for a recurring operational-strategic asymmetry, not statistical confirmation of a specific pattern; Section 7.1 situates the present findings against this literature in the same qualitative terms.

Whether COBIT 2019 adoption is associated with stronger traceability performance, or merely describes existing capability, is itself an open question rather than a settled premise, which motivates the study's third analytical proposition: P3 – BAI (build, acquire and implement) capability, ERP coverage, and executive commitment are perceived by participants as important conditions for reliable food traceability performance. Because this is a single-case, cross-sectional design with no pre/post comparison, P3 is assessed qualitatively through interview and documentary evidence rather than through correlation; no claim that COBIT adoption causes improved traceability is made. Section 7.1 assesses P1, P2, and P3 against the triangulated evidence.

2.5 Regulatory Surveillance Capacity and Public Health Burden

RASFF is usually seen as a compliance burden. That framing understates what it is: a real-time public health surveillance network depending on exporting firms' own traceability data. Recall speed can depend on whether the originating firm can produce lot-level records on demand — precisely APO14, AgriCo's weakest objective (1.9/5, Section 5.2). A firm can be compliant on paper at shipment and still be a surveillance blind spot at the point of an incident if its data governance cannot reconstruct the chain of custody fast enough. 4,695 RASFF notifications were logged in 2023 (European Commission, 2024) — suggesting that private-sector IT-governance capacity, in addition to certification, may influence containment speed.

Benchmarked against RASFF and the OECD's digital-government framework (OECD, 2020), the regulatory sources reviewed for this study did not identify an equivalent requirement in Algeria's food safety enforcement apparatus that firms demonstrate a minimum level of internal IT governance maturity as a condition of market access; compliance appears to be verified through documentation and periodic inspection rather than data governance capability. This is not unique to Algeria: Ahriz et al. (2018) document a

comparable absence of benchmarks in Moroccan public institutions, suggesting Algerian regulators currently lack a lever comparable to an EU-style precondition of demonstrated governance maturity (Section 6).

The WHO attributes roughly 33 million Disability-Adjusted Life Years annually to foodborne illness worldwide, with Africa carrying a disproportionate share (World Health Organization [WHO], 2015; Havelaar et al., 2015). Delayed traceability does not itself cause contamination, but it extends the exposure window between an incident's onset and containment — a plausibility argument rather than an epidemiological estimate, since a rigorous DALY attribution would require incident-level data this study did not have access to.

3. Research Methodology

3.1 Epistemological Positioning

This qualitatively driven, embedded mixed-method single-case study gives primary evidentiary weight to interview and documentary evidence, while the descriptive survey component (Section 3.3) serves a triangulating and illustrative role rather than an independent quantitative evidentiary basis.

3.2 Single Case Study Design — Justification and Limits

The single-case design is a deliberate choice and the study's most significant limitation. AgriCo has revelatory character (Yin, 2014): a large, digitally transitioning agri-food group with documented multi-site ERP deployment, with a formal institutional partnership providing otherwise unavailable access. It is also a plausible critical case (Flyvbjerg, 2006): if the asymmetry examined fails to appear in a digitally advanced firm of this kind, it is unlikely to appear in less mature firms, though this would need external verification. Transferability to other North African agri-food firms is plausible where multi-site structure, sector-specific traceability requirements, and absent centralized IT governance coincide.

3.3 Data Collection

Following standard mixed-methods design principles (Creswell & Plano Clark, 2018), the empirical work rests on three data sources: twelve semi-structured interviews (October–December 2024, 45–90 minutes each), organized around COBIT 2019's five domains with targeted probes on DSS03/DSS05 (operational traceability) and APO02/APO09 (strategic alignment); a structured questionnaire (below); and internal documentary evidence (Section 3.4.1). Independent double coding was applied to 40% of the interview corpus as a reliability check (Miles & Huberman, 1994); coders discussed and resolved disagreements through consensus, and a formal agreement statistic was not computed for this exploratory round.

A structured 45-item Likert questionnaire was distributed to 38 managers; 32 completed questionnaires were returned, yielding a response rate of 84.2%. $n = 32$ is low for quantitative governance research: the sample is purposive, and the questionnaire serves a triangulation rather than sole evidentiary role. Qualitative saturation was assessed separately for the twelve interviews described above; no survey-based saturation claim is made.

3.3.1 Methodological Justification of Sample Size

$n = 32$ is defensible on grounds specific to this design: the study is exploratory rather than confirmatory, so the questionnaire structures observations already grounded in interview and documentary evidence; the design is a single revelatory case study (Yin, 2014), so the population of interest is respondents within one firm; and the inferential target is analytical, not statistical, generalization (Section 3.1). These grounds do not remove the limitation, which Section 3.5 continues to flag.

Table 2: Questionnaire Respondent Profile

Function	n	Respondents%	Mean Tenure
IT Managers / CIO office	8	25.0%	9.3 yrs
Logistics & SCM Directors	7	21.9%	11.2 yrs
Quality & Traceability Managers	6	18.8%	7.8 yrs
Senior Management / CEO office	5	15.6%	14.1 yrs
Controllers / Finance Managers	4	12.5%	6.5 yrs
Production Managers	2	6.3%	8.0 yrs
Total	32	100%	9.5 yrs

(Source: Author, 2025)

The sample concentrates in roles with direct governance or traceability responsibility (IT, logistics/SCM, and quality together account for 65.7% of respondents) and averages 9.5 years of tenure, supporting the claim that self-reported scores reflect informed judgment.

3.4 Construct Validity and Reliability

Content validity was established by mapping each questionnaire item to a COBIT 2019 objective and reviewing the instrument with two independent specialists. Given the exploratory single-case design and the small survey sample relative to the 45-item instrument, no factor-analytic validation was undertaken. The questionnaire was therefore used primarily as a descriptive triangulation tool alongside interview and documentary evidence.

3.4.1 Triangulation and Bias Controls

Social desirability is a known risk in perceptual assessments (Podsakoff et al., 2003), so questionnaire and interview data were cross-checked against three documentary sources — SLAs, HACCP manuals, and audit reports — with no material discrepancy. Organizational access bias was mitigated through full anonymization, an external observer in three interviews, and pre-documented cross-validation procedures (Gibbert et al., 2008), while flagging it as unresolved.

3.5 Study Limitations — What the Data Cannot Support

Four limitations bound this study's claims. First, statistical generalization is not possible: AgriCo's scores are diagnostic for this firm, not population estimates. Second, the survey component is used descriptively and for triangulation rather than for statistical generalization; Section 7.1 therefore reports the domain-level findings descriptively and cross-checks them against interview and documentary evidence. Third, restricted access to budget documentation limited analysis of several APO objectives. Fourth, documentary evidence covers FY2021–2023, while interviews and the questionnaire were conducted in October–December 2024, so the profile reflects conditions at fieldwork. A related limitation: the functional asymmetric maturity pattern and the Section 8 scenarios, induced from a single case, should be read as provisional rather than established.

3.6 Ethical Considerations

Participation was voluntary and based on informed consent. Participants were informed of the purpose of the study, their right to decline participation or withdraw, and the measures adopted to protect confidentiality. Interview and questionnaire data were anonymized, and the case organization is reported under the pseudonym “AgriCo Group,” with potentially identifying organizational details generalized (Section 4.1). No formal ethics-committee approval number was available for this study. Accordingly, the research is reported on the basis of the informed-consent, confidentiality, voluntary-participation, and data-anonymization procedures actually implemented during data collection. No personally identifiable or sensitive personal data are reported in the manuscript. No conflicts of interest to declare.

4. AgriCo as an Illustrative Case of a Regulatory Governance Blind Spot

The unit of analysis in what follows is not AgriCo's internal management practice as an end in itself, but AgriCo as an illustrative instance of a market-wide condition: private agri-food firms operating within a regulatory system that presumes, without verifying, that exporters possess the internal data governance needed to make traceability regulation function. What Section 5's diagnosis identifies at AgriCo is read here as evidence that helps interrogate the reliability of that presumption, not merely as a profile of one company.

4.1 Strategic Positioning

AgriCo Group, founded in 1984, is one of Algeria's largest private agri-food conglomerates, headquartered in an industrial zone in eastern Algeria. The group comprises five subsidiaries — food-preservation, two milling operations, and two real-estate/tourism subsidiaries — spanning pasta, semolina, couscous, tomato concentrate, and preserves. It employs roughly 1,700–2,000 people, generates approximately €200–300 million in annual revenue, and has held market leadership in pasta and couscous in Algeria since 2019, with a wheat-milling capacity of 700 tonnes/day (internal documentation and interviews, Section 3.4) — a multi-subsidiary structure subject to national and export food safety obligations demanding more than basic ERP deployment.

4.2 Digital Transition and IS Architecture

The group's digital transition began in 2017 with SAP Business One across core functions (Beldjazia, 2024). Within roughly a year, the finance and accounting function experienced a partial implementation failure — attributed to inadequate training and change-management resistance — leading management to withdraw finance/accounting from SAP's scope and adopt a dedicated tool (PC-COMPTA) instead.

This partial rollback is itself informative: it is a directly observable instance of the pattern this study's domain-level diagnosis develops further — operational IT investment proceeding without the change-management and governance formalization needed to sustain it, producing localized corrective retreats rather than a coordinated digital strategy. The domain-level diagnosis below examines whether this pattern recurs systematically across COBIT's five governance domains.

5. COBIT 2019 Maturity Diagnosis

5.1 EDM — Evaluate, Direct & Monitor (Score: 2.3/5)

At the group level, no IT Governance Committee exists; investment decisions are concentrated in a handful of senior roles without structured business-side participation. EDM01 (governance framework establishment) scores 1.8/5 — the clearest indicator of this absence — while EDM03 (risk optimization) reaches 2.8/5, driven by export compliance pressure rather than internal governance design, a pattern recurring across domains. Without institutionalized governance, coherence between IT investment and strategic direction remains situational: whatever alignment exists reflects individual decisions, fragile across leadership transitions.

5.2 APO — Align, Plan & Organise (Score: 2.1/5)

APO is the weakest domain. APO02 (manage strategy) scores 1.7/5 — no formalized IT roadmap exists; APO09 (manage service agreements) reaches 2.0/5, with SLAs largely implicit; APO14 (manage data) at 1.9/5 is the most consequential gap, since ISO 22005:2007 compliance in a recall scenario requires traceable lot-level data only formalized data governance can provide. APO underdevelopment is the mechanism through which strategic risk accumulates: without data governance or strategic planning, operational gains stay organizationally isolated. The APO14 score rests more on interview and procedure-manual evidence than budget documentation (restricted access, Section 3.5), though the finding is consistent across all three data sources.

5.3 BAI — Build, Acquire & Implement (Score: 2.4/5)

ERP project management is reasonably structured (BAI01: 2.8/5), but gaps appear post-implementation: configuration changes to traceability systems are undocumented (BAI06: 2.1/5) — a recall-scenario vulnerability — and IT assets are tracked operationally (BAI09: 2.0/5) but not managed strategically. The result is organizational amnesia: implementation knowledge is not captured, and each project restarts from scratch rather than building a cumulative asset base.

5.4 DSS — Deliver, Service & Support (Score: 3.4/5)

DSS is the clear strength, consistent with P2. Production continuity, legal traceability, and immediate quality consequences make operational IT reliability non-negotiable, developing DSS capacity from the operational level upward (DSS01: 3.8/5; DSS04: 3.5/5), even where strategic intent is not formalized. One gap remains — DSS05 (security services) at 2.6/5, insufficient access-control segmentation, a residual risk regulators cannot see from outside the firm. This supports the first criterion of the pattern discussed in Section 7: operational capability can develop through sector imperatives without strategic governance, and the DSS–APO coexistence is not accidental.

5.5 MEA — Monitor, Evaluate & Assess (Score: 2.3/5)

No formalized IT KPIs exist. MEA01 (manage performance) scores 2.0/5, internal audits are infrequent and informal (MEA02: 2.1/5), and MEA03 (external compliance) reaches 2.8/5 — again through regulatory pressure rather than internal monitoring discipline. Without monitoring, the information asymmetry between IT management and leadership that Jensen and Meckling (1976) identify goes unaddressed, so resources keep flowing toward visible, compliance-driven operational IT and away from strategic governance nobody is required to measure.

5.6 Maturity Profile — Synthesis

Figure 1 shows the COBIT 2019 radar chart. Table 3 summarizes the domain scores.

COBIT 2019 Maturity Profile — AgriCo Group

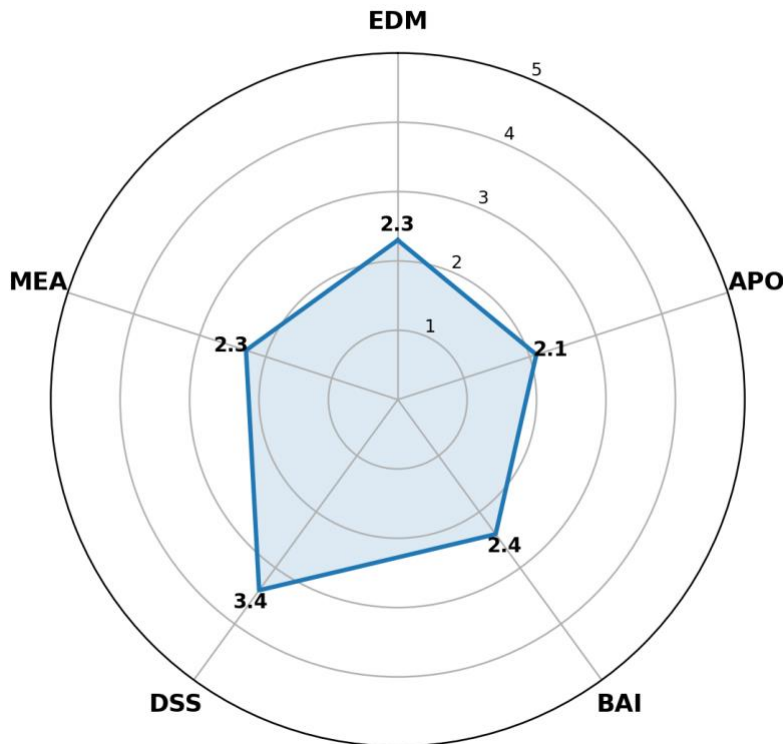


Fig. 1. COBIT 2019 Maturity Profile — AgriCo Group

Source: Author, 2025, based on Table 3 domain scores.

Table 3. COBIT 2019 Maturity Diagnosis — AgriCo Group

Domain	Description	Score /5	Relative Position (this study)	Comparative Literature
EDM	Evaluate, Direct & Monitor	2.3	Mid-range	N/A
APO	Align, Plan & Organise	2.1	Weakest domain	Not directly comparable (see Section 2.4)
BAI	Build, Acquire & Implement	2.4	Mid-range	Not directly comparable (see Section 2.4)
DSS	Deliver, Service & Support	3.4	Strongest domain	Not directly comparable (see Section 2.4)
MEA	Monitor, Evaluate & Assess	2.3	Tied with EDM	N/A
Global	AgriCo Group (2025)	2.5	Overall diagnostic score	Not benchmarked against a validated cross-study composite (see Section 2.4)

(Source: Author, 2025)

5.6.1 Composite Score — Calculation

For each respondent, a domain score was calculated as the arithmetic mean of the questionnaire items assigned to that domain; group-level EDM, APO, BAI, DSS, and MEA scores were then calculated as the means of the corresponding respondent-level scores. These scores are treated as diagnostic indicators. To strengthen the traceability interpretation, the study reads the scores through four readiness dimensions: data governance, operational traceability, change and integration control, and governance assurance. Because no independent recall-performance test was collected, these dimensions are used as an analytical model of readiness rather than as a validated composite index.

The composite score is less analytically interesting than the profile shape: a DSS apex and an APO/MEA trough forming a descriptively distinctive and qualitatively corroborated configuration, discussed theoretically and practically in Section 7.

6. Policy and Regulatory Recommendations

The diagnosis in Section 5 identifies a firm-level governance gap; the public health question here is what Algeria's Ministry of Health and Ministry of Agriculture can do about the fact that the regulatory sources reviewed for this study did not identify a mechanism that verifies whether such a gap exists before an incident forces it into the open. The recommendations below are addressed to regulators rather than to AgriCo's management, sequenced by the same governance-before-technology logic as the underlying diagnosis: verification and accountability mechanisms first, financial incentives and regional alignment second.

Table 4. Policy Recommendations for Algerian Food-Safety and Export Regulators

Category	Recommended Action	COBIT Domain(s)	Responsible Authority / Rationale
Foundational	Mandate a minimum IT governance baseline (documented data policy, named accountable role) for agrément renewal	APO14 / EDM01	Ministry of Agriculture/Health — closes the gap: no governance precondition for market access today
Foundational	Require GS1-compatible lot-level e-traceability records above a size threshold	APO14 / BAI09	Ministry of Commerce/export agencies — gives regulators a verifiable trail independent of firm goodwill
Surveillance	Create a RASFF-style national rapid-alert unit, linked to customs	MEA01 / MEA03	Ministry of Health & Agriculture — converts scattered reports into a searchable national record
Verification	Add risk-based IT-governance audits to existing product-safety inspections	MEA02	National food-safety inspectorate — shifts inspection from paperwork to ongoing capability
Incentive design	Tie digitalization financing to demonstrated APO/MEA maturity, not just tool purchase	APO / MEA	Ministry of Industry/digital funds — rewards formalization over unused tools
Regional alignment	Align traceability data standards with EU RASFF ahead of export rejections	APO14 / BAI06	Ministry of Commerce/EU counterparts — cuts the lag between EU rule changes and exporter readiness

(Source: Author, 2025)

Foundational recommendations — a governance baseline and mandatory e-traceability — are positioned first: a surveillance system built on an ungoverned private sector inherits that sector's blind spots regardless of the regulator's own sophistication, and tying agrément renewal to a documented baseline costs the state little, since it is an audit requirement rather than a subsidy. The surveillance-capacity recommendation (a national rapid-alert unit) is the regulatory counterpart to AgriCo's MEA gap: the state currently lacks the infrastructure to aggregate incident signals in anything resembling RASFF's real-time architecture. Incentive design and regional alignment are placed last because they presuppose this verification infrastructure.

7. Discussion

7.1 Assessment of Analytical Propositions

P1, P2, and P3 are assessed descriptively rather than through inferential testing, consistent with the exploratory single-case design and the survey's triangulating role (Sections 3.1–3.5). The five domain means range from 2.1/5 (APO) to 3.4/5 (DSS) — a descriptively distinctive and qualitatively corroborated configuration — recurring across the survey means, interviews, and documentary record. The triangulated evidence is consistent with P1 and P2, without constituting inferential confirmation: maturity is uneven, and DSS leads both APO and MEA by a margin attributed to regulatory pressure rather than deliberate design (Sections 5.2, 5.4). The evidence is likewise consistent with P3: participants describe BAI capability, ERP coverage, and executive commitment as preconditions for reliable traceability.

Table 5. Qualitative Assessment of Propositions P1, P2, and P3

Proposition	Analytical expectation	Triangulated evidence	Assessment
P1	Perceived maturity differs across the five COBIT 2019 domains.	Domain means range from 2.1/5 (APO) to 3.4/5 (DSS); interviews and documents describe corresponding differences.	Consistent with P1; not inferentially confirmed.
P2	DSS maturity is higher than APO and MEA maturity.	DSS = 3.4/5, APO = 2.1/5, and MEA = 2.3/5; the pattern recurs across survey, interview, and documentary evidence.	Descriptively supported and qualitatively corroborated.
P3	BAI capability, ERP coverage, and executive commitment are important conditions for reliable traceability.	Participants and documentary evidence identify implementation capability, ERP coverage, and leadership commitment as relevant conditions.	Qualitatively consistent; no causal or correlational claim is made.

(Source: Author, 2025)

At $n = 32$, these findings are a descriptively distinctive and qualitatively corroborated configuration rather than a statistically confirmed result; the DSS–APO and DSS–MEA gaps are nonetheless the study's most robust finding, since they recur independently in the survey means, the interviews, and the documentary record.

Positioned against the literature, AgriCo's profile — a DSS ceiling alongside an APO floor — echoes the operational-versus-strategic asymmetry discussed qualitatively elsewhere (Lunardi et al., 2017; Gantman & Fedorowicz, 2016; Kamble et al., 2020), though those studies lack comparable COBIT scores, so the comparison is conceptual. This suggests, as a proposition for further testing, that functional asymmetric maturity may reflect sector-driven pressure combined with limited governance formalization rather than a fixed property of emerging economies as a category — a proposition multi-firm replication would need to test.

7.2 Functional Asymmetric Maturity: A Provisional Conceptual Pattern

The study's principal conceptual contribution is an exploratory mechanism named functional asymmetric maturity. It describes a condition in which operational IT-governance capabilities develop faster than strategic alignment, data ownership, and monitoring capabilities. In this study, the mechanism is proposed to operate through three linked conditions: sectoral pressure for operational continuity, investment in production-facing systems, and limited formalization of accountability and data governance.

Adjacent literature is consistent with this reading: Becker et al. (2009) propose a procedural framework for developing domain-specific maturity models, consistent with treating IT governance maturity as varying by domain rather than as a single overall stage; contingency theory (Donaldson, 2001) frames asymmetric configurations as contextually rational responses rather than simple failures.

This is a conceptual contribution: existing constructs describe uneven maturity without jointly specifying which domains, at what threshold, and under what conditions the imbalance stabilizes. Becker et al.'s (2009) procedural framework models domain-level variation explicitly but does not specify threshold values; Tiwana and Kim (2015) tie governance logic to IT asset type; De Haes et al. (2020) show formal structures improve alignment on average without explaining durable decoupling. Functional asymmetric maturity specifies threshold and mechanism together, open to revision by multi-firm replication.

Table 6. Positioning Functional Asymmetric Maturity Against Related Constructs

Dimension	Becker et al. (2009)	De Haes et al. (2020)	This Study
Definition of maturity	Generic staged progression toward an idealized overall level, applicable across IT practices	Degree of formal governance structuring enabling business-IT alignment	Domain-specific configuration where operational and strategic capability develop unevenly and durably
Unit of analysis	IT practice, generic across sectors	Governance mechanism (structural/relational)	COBIT domain (EDM/APO/BAI/DSS/MEA) within one multi-site agri-food firm
Level of assessment	Overall, staged maturity level	Mechanism-level maturity	Domain-level maturity, compared pairwise (DSS vs. APO)
Governance perspective	Treats unevenness as noise to correct toward one stage	Assumes formal structures raise alignment on average	Treats asymmetry as stable and structurally generated, not noise
Contribution	General framework for maturity models	Evidence that formal structures improve alignment	Identifies case-derived heuristic markers ($DSS \geq 3.0$, $APO \leq 2.2$) and three generative mechanisms
Limitations (relative to this study)	No mechanism for why some domains resist convergence	No explanation for why formalization stays absent elsewhere	Single-case induction; boundaries need multi-firm replication (§3.5)

(Source: Author, 2025)

Two extensions follow. For IT–business alignment theory, alignment appears domain-specific rather than binary: IT–production alignment can be strong while IT–strategy alignment is structurally absent — a sectoral moderator the Henderson-Venkatraman framework does not capture. For COBIT 2019, the main limitation here is its presupposition of organizational homogeneity: it does not operationalize site-calibrated assessment for multi-site firms with heterogeneous adoption, despite the design-factor mechanism permitting this in principle.

7.3 Implications for Practitioners and Policymakers

For managers, the pattern is structurally predictable: the AgriCo case suggests that DSS may outpace APO in production-driven environments. The agenda is sequencing — APO and MEA require deliberate investment, while DSS largely develops on its own. Regulatory justification is the most tractable entry point for governance proposals to skeptical boards, since the binding constraint is organizational, not financial. At the policy level, incorporating COBIT 2019 benchmarks as conditions for public digital investment support would create incentives that currently do not exist.

8. Prospective Scenarios for IT Governance Trajectories (Horizon 2030)

8.1 Scenario Construction Method

The AgriCo baseline (Sections 5–7) is read here as the starting point for a scenario-planning exercise focused on traceability-governance readiness. The scenarios do not forecast food-safety incidents or quantify future performance. Instead, they show how changes in external pressure and internal formalization could alter the balance between operational capability and governance assurance by 2030.

8.2 Four Scenarios to 2030

Persistent Asymmetry (low pressure, low commitment) extends the current baseline: DSS keeps developing operationally while APO/MEA stay informal, and traceability remains functional day-to-day but fragile under recall conditions. Compliance Scramble (high pressure, low commitment) follows if Section 6's reforms are enacted without a matching internal push: reactive documentation appears quickly, but certification risks becoming formality rather than capability. Voluntary Maturation (low pressure, high commitment) follows if firms invest in formalization on their own initiative, producing a slower but more durable narrowing of the DSS–APO gap. Governed Digital Transition (high pressure, high commitment) is most desirable:

regulatory tightening and internal investment reinforce each other, converting asymmetric into balanced maturity.

8.3 Strategic Reading: Where the Current Trajectory Points

The baseline evidence places AgriCo, as of fieldwork, closest to Persistent Asymmetry. Movement toward Governed Digital Transition depends on two levers examined separately in this study — regulatory (Section 6) and managerial (Section 7.3) — and the scenarios suggest neither is sufficient alone, as Compliance Scramble and Voluntary Maturation both show. Read this way, Section 6's policy recommendations are one half of a two-sided push whose other half is AgriCo's own internal governance agenda.

9. Scientific Contributions

The study makes four connected contributions. First, it adapts COBIT 2019 to examine traceability-governance readiness rather than generic IT maturity. Second, it proposes functional asymmetric maturity as a provisional mechanism linking operational pressure to uneven development across governance domains. Third, it provides a four-dimension analytical model—data governance, operational traceability, change and integration control, and governance assurance—that can guide future measurement. Fourth, it translates the diagnosis into a governance roadmap and conditional scenarios for regulators and managers.

10. Conclusions

This study examined traceability-governance readiness in AgriCo Group through a COBIT 2019-based diagnostic. The central finding is not simply that the overall score is 2.5/5, but that operational capability is stronger than strategic and monitoring formalization: DSS reaches 3.4/5, whereas APO reaches 2.1/5 and MEA 2.3/5. This configuration is consistent with the proposed mechanism of functional asymmetric maturity.

These conclusions are bounded by the single-case design, the purposive survey sample, restricted access to financial and budget documentation, and the absence of an independent tabletop recall test or longitudinal performance measure. The study therefore does not claim that the observed scores cause slower recalls or poorer food-safety outcomes. It claims that the observed governance configuration identifies a plausible and testable readiness risk.

The anonymized interview coding scheme and the questionnaire instrument itself remain available to other researchers on reasonable request, subject to the institutional partnership's confidentiality terms.

What this study can claim, without overreaching, is that COBIT 2019 can be adapted to diagnose the organizational conditions underlying traceability governance in an Algerian agri-food group; that the case displays a provisional pattern of functional asymmetric maturity; and that the proposed readiness dimensions and mechanism provide a structured basis for comparative and longitudinal research. Future studies should validate the model through multi-firm samples, direct recall-readiness tests, and repeated measurement over time.

The AgriCo case should therefore be read as a potential warning rather than evidence of an isolated firm-level issue: wherever a national food safety surveillance system delegates traceability to private firms without verifying their internal data governance, the system may inherit a blind spot that is difficult for regulators to detect from outside the firm—a structural vulnerability that is unlikely to be unique to Algeria, and that emerging economies pursuing export-led agri-food growth would be well advised to treat as a public health priority, not merely an IT maturity gap.

REFERENCES

1. Ahriz, S., El Yamami, A., Mansouri, K., & Qbadou, M. (2018). COBIT 5-based approach for IT project portfolio management: Application to a Moroccan university. *International Journal of Advanced Computer Science and Applications*, 9(4), 88–95. <https://doi.org/10.14569/IJACSA.2018.090416>
2. Akkerman, R., Farahani, P., & Grunow, M. (2010). Quality, safety and sustainability in food distribution: A review of quantitative operations management approaches and challenges. *OR Spectrum*, 32(4), 863–904. <https://doi.org/10.1007/s00291-010-0223-2>
3. Al-Ruithe, M., Benkhelifa, E., & Hameed, K. (2019). A systematic literature review of data governance and cloud data governance. *Personal and Ubiquitous Computing*, 23(5), 839–859. <https://doi.org/10.1007/s00779-017-1104-3>
4. Archer, M. S. (1995). *Realist social theory: The morphogenetic approach*. Cambridge University Press.
5. Aung, M. M., & Chang, Y. S. (2014). Traceability in a food supply chain: Safety and quality perspectives. *Food Control*, 39, 172–184. <https://doi.org/10.1016/j.foodcont.2013.11.007>
6. Axelos. (2019). *ITIL Foundation: ITIL 4 edition*. The Stationery Office.
7. Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. <https://doi.org/10.1177/014920639101700108>
8. Becker, J., Knackstedt, R., & Pöppelbuß, J. (2009). Developing maturity models for IT management. *Business & Information Systems Engineering*, 1(3), 213–222. <https://doi.org/10.1007/s12599-009-0044-5>
9. Beldjazia, M. (2024). L'effet de l'implémentation des ERP sur le contrôle de gestion : Cas d'entreprise Amor Benamor [Mémoire de master, École Nationale Supérieure de Management, Kolea].
10. Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research (3rd ed.)*. SAGE Publications.
11. De Haes, S., Van Grembergen, W., Joshi, A., & Huygh, T. (2020). *Enterprise governance of information technology: Achieving alignment and value in digital transformation (3rd ed.)*. Springer. <https://doi.org/10.1007/978-3-030-25918-1>
12. De Haes, S., Van Grembergen, W., Huygh, T., & Joshi, A. (2023). *Introduction to the minitrack "IT governance and its mechanisms" (HICSS 56)*. Proceedings of the 56th Hawaii International Conference on System Sciences, 5875–5876. <https://hdl.handle.net/10125/103348>
13. Donaldson, L. (2001). *The contingency theory of organizations*. SAGE Publications.
14. European Commission. (2024). Commission publishes 2023 Annual Report on food safety alerts and agri-food fraud investigations. Directorate-General for Health and Food Safety. <https://ec.europa.eu/newsroom/sante/items/847722/en>
15. FAO. (2021). *Traceability frameworks for agri-food chains: Technical guidelines*. Food and Agriculture Organization. <https://www.fao.org/3/cb5416en/cb5416en.pdf>
16. Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245. <https://doi.org/10.1177/1077800405284363>
17. Gantman, S., & Fedorowicz, J. (2016). Communication and control in outsourced IS development projects: Mapping to COBIT domains. *International Journal of Accounting Information Systems*, 21, 63–83. <https://doi.org/10.1016/j.accinf.2016.05.001>
18. Gibbert, M., Ruigrok, W., & Wicki, B. (2008). What passes as a rigorous case study? *Strategic Management Journal*, 29(13), 1465–1474. <https://doi.org/10.1002/smj.722>
19. Havelaar, A. H., Kirk, M. D., Torgerson, P. R., Gibb, H. J., Hald, T., Lake, R. J., Praet, N., Bellinger, D. C., de Silva, N. R., Gargouri, N., Speybroeck, N., Cawthorne, A., Mathers, C., Stein, C., Angulo, F. J., & Devleesschauwer, B. (2015). World Health Organization global estimates and regional comparisons of the burden of foodborne disease in 2010. *PLOS Medicine*, 12(12), e1001923. <https://doi.org/10.1371/journal.pmed.1001923>
20. Henderson, J. C., & Venkatraman, N. (1993). Strategic alignment: Leveraging information technology for transforming organizations. *IBM Systems Journal*, 32(1), 4–16.
21. ISACA. (2018a). *COBIT 2019 framework: Introduction and methodology*. ISACA.
22. ISACA. (2018b). *COBIT 2019 framework: Governance and management objectives*. ISACA.
23. ISO 22005:2007. (2007). *Traceability in the feed and food chain: General principles and basic requirements for system design and implementation*. International Organization for Standardization.
24. ISO 38500:2015. (2015). *Information technology: Governance of IT for the organization*. International Organization for Standardization.
25. Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360. [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X)
26. Kamble, S. S., Gunasekaran, A., & Gawankar, S. A. (2020). Achieving sustainable performance in a data-driven agriculture supply chain: A review for research and applications. *International Journal of Production Economics*, 219, 179–194. <https://doi.org/10.1016/j.ijpe.2019.05.022>

27. Lunardi, G. L., Maçada, A. C. G., Becker, J. L., & Van Grembergen, W. (2017). Antecedents of IT governance effectiveness: An empirical examination in Brazilian firms. *Journal of Information Systems*, 31(1), 41–57. <https://doi.org/10.2308/isyss-51626>
28. Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook (2nd ed.)*. SAGE Publications.
29. OECD. (2020). *The OECD digital government policy framework: Six dimensions of a digital government (OECD Public Governance Policy Papers No. 02)*. OECD Publishing. <https://doi.org/10.1787/f64fed2a-en>
30. Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
31. Pournader, M., Ghaderi, H., Hassanzadegan, A., & Fahimnia, B. (2021). Artificial intelligence applications in supply chain management. *International Journal of Production Economics*, 241, Article 108250. <https://doi.org/10.1016/j.ijpe.2021.108250>
32. Soomro, Z. A., Shah, M. H., & Ahmed, J. (2016). Information security management needs more holistic approach: A review of issues and challenges. *International Journal of Information Management*, 36(2), 215–225. <https://doi.org/10.1016/j.ijinfomgt.2015.11.011>
33. Tiwana, A., & Kim, S. K. (2015). Discriminating IT governance. *Information Systems Research*, 26(4), 656–674. <https://doi.org/10.1287/isre.2015.0591>
34. World Health Organization. (2015). *WHO estimates of the global burden of foodborne diseases: Foodborne disease burden epidemiology reference group 2007–2015*. <https://www.who.int/publications/i/item/9789241565165>
35. Weill, P., & Ross, J. W. (2004). *IT governance: How top performers manage IT decision rights for superior results*. Harvard Business School Press.
36. Yin, R. K. (2014). *Case study research: Design and methods (5th ed.)*. SAGE Publications.