



The Role of Standard Costs in Enhancing Cost Control Efficiency: An Applied Study on a Leading Libyan Telecommunications Company

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دور التكاليف المعيارية في تعزيز كفاءة الرقابة على التكاليف: دراسة تطبيقية على شركة اتصالات ليبية رائدة

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Abstract

Standard costing remains a potentially powerful but frequently under-designed element of management control. This study evaluates how standard costs can improve cost control at Libyana Mobile Phone Company by combining an integrative literature review, a secondary re-analysis of the 25-respondent survey contained in the supplied study document, current public evidence about Libyana and Libya's mobile market, and transparent numerical case scenarios. The literature indicates that standards are most useful when they represent causal resource consumption, are flexed for actual activity, are refreshed at an appropriate cadence, and are integrated with activity-based costing, service-quality indicators, and digital analytics. Re-analysis of the survey yields an overall weighted mean of 1.864 on a three-point scale, below the neutral midpoint of 2.000; 23.2% of all responses were favourable, 40.0% neutral, and 36.8% unfavourable. Respondents were most positive about comparing actual with planned financial performance (mean 2.28), but least positive about strategic costing (1.64) and pricing or cost-reduction decisions (1.56). These findings point to an implementation and decision-use gap rather than proof that standard costing is intrinsically ineffective. An illustrative telecom case decomposes LYD 133.0 thousand of unfavourable cost variance across energy, maintenance, and customer-care pools. Price and rate effects account for LYD 115.0 thousand, while net efficiency effects account for LYD 18.0 thousand, demonstrating why responsibility assignment and controllability matter. The study concludes that Libyana should use standard costing as a diagnostic spine—not as a stand-alone accounting routine—supported by site-, service-, and activity-level drivers, flexible budgets, monthly exception dashboards, quarterly standard reviews, quality guardrails, and a phased digital implementation.

Keywords: standard costing; cost control; variance analysis; telecommunications; Libyana; activity-based costing; digital management accounting; Libya.

الملخص

تظل محاسبة التكاليف المعيارية أداة قوية محتملة، لكنها غالباً ما تكون غير مصممة بالشكل الكافي ضمن أنظمة الرقابة الإدارية. تهدف هذه الدراسة إلى تقييم كيفية مساهمة التكاليف المعيارية في تحسين الرقابة على التكاليف في شركة ليبيا للهاتف المحمول، وذلك من خلال الجمع بين مراجعة تكاملية للأدبيات، وإعادة تحليل ثانوي للاستبيان المكون من 25 مشاركاً

الوارد في وثيقة الدراسة المقدمة، والأدلة العامة الحديثة المتعلقة بشركة ليبيا وسوق الاتصالات الليبي، بالإضافة إلى سيناريوهات رقمية توضيحية. تشير الأدبيات إلى أن التكاليف المعيارية تكون أكثر فاعلية عندما تمثل استهلاكاً سببياً للموارد، ويتم تعديلها وفقاً لمستوى النشاط الفعلي، ويتم تحديثها وفق دورية مناسبة، كما يتم دمجها مع نظام التكاليف على أساس النشاط، ومؤشرات جودة الخدمة، والتحليلات الرقمية. أظهر إعادة تحليل الاستبيان أن المتوسط المرجح الإجمالي بلغ 1.864 على مقياس ثلاثي، وهو أقل من نقطة الحياد البالغة 2.000؛ حيث بلغت نسبة الإجابات المؤيدة 23.2% من إجمالي الردود، بينما كانت 40.0% محايدة، و36.8% غير مؤيدة. وكان المشاركون أكثر إيجابية بشأن مقارنة الأداء المالي الفعلي بالمخطط له (بمتوسط 2.28)، بينما كانوا الأقل إيجابية فيما يتعلق بالتكاليف الاستراتيجية (1.64) وقرارات التسعير أو خفض التكاليف (1.56). تشير هذه النتائج إلى وجود فجوة في التطبيق واتخاذ القرار، وليس إلى أن محاسبة التكاليف المعيارية غير فعالة بطبيعتها. ويقدم المثال التوضيحي الخاص بقطاع الاتصالات تحليلاً لانحراف تكلفة غير ملائم بقيمة 133.0 ألف دينار ليبي، موزعاً بين تكاليف الطاقة والصيانة وخدمات العملاء. حيث تمثل تأثيرات الأسعار ومعدلات التكلفة 115.0 ألف دينار ليبي، بينما تمثل تأثيرات الكفاءة الصافية 18.0 ألف دينار ليبي، مما يوضح أهمية تحديد المسؤوليات وقابلية التحكم في التكاليف. وتخلص الدراسة إلى أنه ينبغي على شركة ليبيا استخدام التكاليف المعيارية باعتبارها أساساً تشخيصياً للرقابة، وليس مجرد إجراء محاسبي مستقل، وذلك من خلال دعمها بمحركات تكلفة على مستوى المواقع والخدمات والأنشطة، وموازنات مرنة، ولوحات متابعة شهرية للاستثناءات، ومراجعات ربع سنوية للتكاليف المعيارية، وضوابط لجودة الخدمة، وتنفيذ رقمي تدريجي.

الكلمات المفتاحية: التكاليف المعيارية؛ الرقابة على التكاليف؛ الاتصالات؛ ليبيا؛ التكاليف على أساس النشاط؛ المحاسبة الإدارية الرقمية؛ ليبيا.

1. Introduction

1.1 Background

Telecommunications operators convert large, shared and technically complex resource pools into continuously delivered services. Network power, leased capacity, site rental, maintenance, spectrum-related expenditure, depreciation, contractor support, customer service, information systems, and commercial channels do not map neatly to a physical unit of output. Yet managers still need credible answers to basic questions: what should a site, service, region, customer interaction, or unit of traffic cost; why did actual cost differ; who can influence the difference; and what action should follow?

Standard costing supplies a disciplined baseline by specifying expected quantities and prices or rates for a defined level of activity. Cost control then becomes a closed loop: establish attainable standards, capture actual consumption, flex the benchmark to actual activity, isolate variances, investigate material exceptions, take corrective action, and refresh standards when economic or technical assumptions change. Contemporary cost-accounting texts continue to treat this decomposition as a core planning and control mechanism [1, 2]. For external inventory measurement, IAS 2 permits techniques such as the standard cost method when the result approximates cost, but the managerial purpose is broader: decision support, accountability, learning, and resource optimization [3].

The need for disciplined cost intelligence is intensified in Libya's mobile market. Libyana reports more than 6.3 million subscribers, 34 service centres, and nationwide 3G/4G operations [18]. Current market indicators report 14.9 million cellular connections in Libya at the end of 2025—about 199% of the population—and 94.4% of connections classified as broadband-capable [19]. High multi-SIM penetration, technology transitions, geographically dispersed infrastructure, and volatile input conditions can make static or highly aggregated budgets inadequate. The World Bank's current series, sourced from the ITU, likewise shows the importance of long-run mobile-subscription data for market and capacity analysis [20].

1.2 Problem statement

The practical problem is not whether standards can be calculated; it is whether the resulting variances are sufficiently causal, timely, controllable, and decision-relevant. A total operating-expense variance may signal that spending exceeded budget, but it does not reveal whether the

cause was a tariff change, increased traffic, inefficient energy consumption, emergency maintenance, supplier rates, network expansion, service-quality protection, or inaccurate assumptions. When all differences are reported as a single adverse amount, managers can be held responsible for conditions they cannot control, while genuine inefficiency remains hidden. The supplied Libyana study also reveals an apparent credibility gap. Although respondents recognized the usefulness of actual-versus-plan comparison, they were much less convinced that standard costs meaningfully support strategic costing, pricing, forecasting, or cost reduction. This pattern makes the case especially valuable: it allows the study to examine not only the accounting technique but also the organizational conditions under which the technique becomes trusted and actionable.

1.3 Aim, research questions, and contribution

The aim is to develop an evidence-based and telecom-specific framework for using standard costs to improve cost control at Libyana. The study addresses four research questions:

- RQ1. Through which mechanisms can standard costs improve cost visibility, variance diagnosis, and managerial accountability in a mobile network operator?
- RQ2. What do the supplied survey data imply about the current perceived usefulness of standard costing at Libyana?
- RQ3. How should price/rate, usage/efficiency, activity-volume, and capacity variances be calculated and interpreted for telecom cost pools?
- RQ4. How should standard costing be combined with activity-based costing, rolling forecasts, service-quality indicators, and digital analytics?

The contribution is threefold. First, it translates manufacturing-oriented variance logic into telecom resource drivers. Second, it re-analyzes the original survey in a consistent quantitative structure and makes its limitations explicit. Third, it provides an implementable governance and dashboard design that protects service quality while improving cost accountability.

2. Literature Review

2.1 Standard cost as a control baseline

A standard cost is a predetermined expectation for the resources and rates required to deliver a defined output under specified operating conditions. The standard may be ideal, basic, historical, or currently attainable; for managerial control, currently attainable standards are generally preferable because they incorporate normal loss, expected downtime, and realistic capability. Datar and Rajan emphasize the diagnostic value of separating input-price and input-efficiency effects [1], while Drury and Tayles locate standards within the broader architecture of budgeting, responsibility accounting, and performance evaluation [2].

The strongest argument for standard costing is not that it predicts a single 'true' cost. Rather, it creates an explicit hypothesis about resource consumption that can be tested. Al-Shattarat, Al-Shattarat, and Dannoun report a positive association between standard-cost systems and performance among Jordanian industrial companies [5]. Teoh and Shanmugam's review concludes that standard costing and variance analysis remain relevant across global industries, while also emphasizing the need to adapt the technique to contemporary operating environments [6]. Musfitria and colleagues similarly show how standard costs support control and pricing decisions in a production case, although the evidence remains context-specific [7].

2.2 Relevance to services and telecommunications

Service operations challenge simple unit-cost logic because output is heterogeneous, capacity is often committed before demand is known, and a high proportion of cost is indirect or shared. In telecommunications, cost objects can include products, technologies, network sites, routes, regions, channels, subscriber segments, and service incidents. Major's telecom case shows that activity-based costing improved the tracing of indirect costs to services and supported both competition and regulatory accountability [8]. This evidence suggests that standard costing

should not replace causal allocation; it should set expected activity quantities and rates inside a richer activity model.

Time-driven activity-based costing (TDABC) is particularly compatible with telecom operations because capacity cost rates can be linked to practical capacity and time equations. Kaplan and Anderson proposed TDABC as a simpler way to update complex activity models and expose unused capacity [9]. For Libyana, a standard cost for a call-centre contact, field-maintenance job, site-hour, or provisioning transaction can therefore be calculated as a standard activity time multiplied by a practical-capacity rate, with explicit adjustment for complexity drivers.

2.3 Digitalisation, analytics, and control quality

Digitalisation changes both the speed and the granularity of management control. Möller, Schäffer, and Verbeeten argue that management accounting instruments, roles, and organizational arrangements are being reshaped by digital technologies [10]. Fähndrich's systematic review of 116 articles finds changes across management-control tasks, instruments, organization, and behaviour [11]. Knudsen similarly identifies changing boundaries, power relations, and knowledge production in digital accounting [12]. These findings matter for standard costing because sensor feeds, ERP data, network management systems, procurement records, and ticketing platforms can produce driver-level actuals in near real time.

Evidence also cautions against treating technology as a substitute for design discipline. Broccardo and colleagues find that skills and broad process digitalisation influence management-control maturity [13]. Bedford and co-authors show that automation and analytics can support finance objectives, but simultaneous deployment may reduce effectiveness when resources or strategic alignment are insufficient [14]. Recent reviews of artificial intelligence in management accounting emphasize both analytical opportunity and governance concerns [15]. Wasserbacher and Spindler warn that forecasting accuracy does not establish the causal effect of a managerial intervention [16]. Finally, van Slooten, Dirks, and Firk show that digitalisation can create role ambiguity for control-oriented accountants while benefiting stronger business-partner orientations [17].

2.4 Synthesis and research gap

Table 1. Synthesis of the literature and implications for Libyana

Stream	Core logic	Control value	Principal limitation	Evidence
Standard costing	Predetermined quantities and rates; price/usage decomposition	Fast exception signal; responsibility-centre discipline	Stale or unrealistic standards; short-term bias	[1], [2], [5]–[7]
ABC / TDABC	Trace resources to activities and cost objects using causal drivers	More credible service, channel, and site costs; exposes unused capacity	Model complexity and data burden	[8], [9]
Digital management control	Automated data capture, integration, dashboards, analytics	Greater frequency and granularity	Data quality, role ambiguity, resource overload	[10]–[14], [17]
AI / predictive analytics	Detection, forecasting, anomaly screening	Earlier warning and prioritization	Prediction is not causation;	[15], [16]

			explainability and governance risks	
Libyana context	Large mobile-service footprint and high national connection density	Strong case for site-, service-, and activity-level standards	Public data do not reveal internal cost ledgers	[18]–[20]

Note. Author synthesis of references [1]–[20].

The research gap is therefore not a lack of generic evidence that standards or analytics can be useful. It is the absence of a transparent, telecom-specific design that links physical resource consumption to flexed standards, separates controllable and non-controllable causes, and integrates cost outcomes with network and customer-service quality. The remainder of the study develops and tests that design against the supplied survey and illustrative cases.

3. Libyana and the Telecom Cost-Control Context

3.1 Public company profile and market setting

Libyana states that it began operations in September 2004, introduced 3G in September 2006, operates 34 service centres, provides 3G and 4G services, and serves more than 6.3 million subscribers [18]. These scale indicators imply a broad geographic footprint and a mix of network, customer-facing, commercial, and support activities. The company's public profile also emphasizes continued infrastructure development and service innovation, which creates an inherent control tension: cost reduction cannot be pursued at the expense of coverage, availability, capacity, resilience, or customer experience.

Libya's connection density further increases the need for activity-sensitive standards. DataReportal reports 14.9 million cellular connections at the end of 2025, 199% of population, with 94.4% broadband-capable [19]. Connection counts do not equal unique subscribers, but they indicate multi-SIM behaviour and a substantial addressable service base. Cost control should therefore distinguish the cost of maintaining readiness from the incremental cost of carrying traffic, serving active users, or supporting transactions.

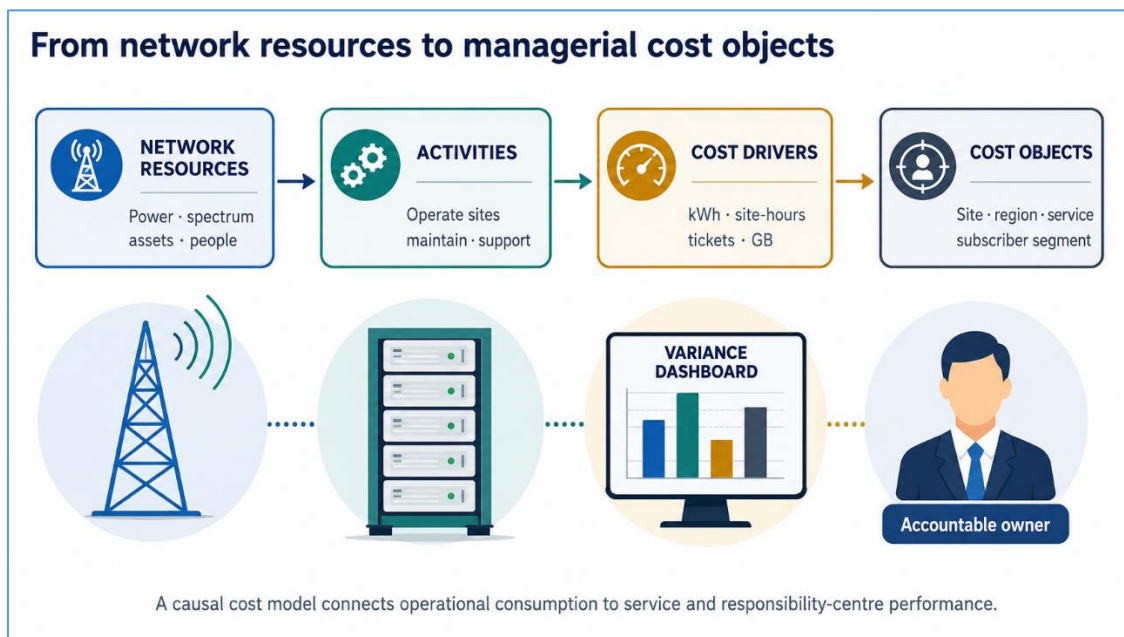


Figure 1. Telecom cost architecture for a causal standard-cost model

Note. Author-developed illustration based on managerial-costing logic in [4], telecom ABC evidence in [8], and the Libyana operating context in [18].

3.2 Telecom cost pools, drivers, and standards

Table 2. Proposed Libya cost pools and standard drivers

Cost pool	Representative resources	Candidate standard driver	Primary owner	Quality guardrail
Radio/access sites	Energy, site rent, field maintenance, spares	Site-hour; kWh/site-hour; maintenance job	Network operations / facilities	Availability, dropped-call rate
Core and transmission	Leased capacity, licences, support, power	Gbps-month; TB carried; node-hour	Core network / IT	Latency, congestion, resilience
Customer care	Staff, outsourcing, telephony, systems	Contact; standard minutes/contact; first-contact resolution	Customer operations	Wait time, satisfaction, repeat contacts
Sales and distribution	Commissions, cards/SIMs, outlets, campaigns	Activation; recharge; order; channel transaction	Commercial / channels	Conversion, churn, complaint rate
Provisioning and billing	IT processing, integrations, support	Provisioning event; bill; payment; API transaction	IT / finance operations	Error and rework rate
Shared support	Finance, HR, security, premises	Causal driver where feasible; otherwise disclosed sustaining cost	Corporate functions	Service-level adherence

Note. Author-developed telecom driver matrix; cost objects should be validated against Libya's chart of accounts, ERP, network-management, and ticketing data.

Design principle A standard should be expressed at the lowest level that is measurable, material, and actionable. Where a cost cannot be causally traced, it should be disclosed as a sustaining or common cost rather than forced into a misleading unit rate.

4. Conceptual and Analytical Framework

4.1 Core variance equations

For a controllable input, define AQ as actual quantity, AP as actual price or rate, SQ as the standard quantity allowed for actual activity, and SP as the standard price or rate. The total cost variance is the difference between actual cost and the flexed standard cost:

$$CV = AC - SC_f = (AQ \times AP) - (SQ \times SP) \quad (1)$$

The variance can be decomposed without double counting into price/rate and usage/efficiency components:

$$\text{Price or rate variance} = AQ \times (AP - SP) \quad (2)$$

$$\text{Usage or efficiency variance} = SP \times (AQ - SQ) \quad (3)$$

$$CV = AQ(AP - SP) + SP(AQ - SQ) \quad (4)$$

A positive value is labelled unfavourable (U) when actual cost exceeds the flexed standard; a negative value is favourable (F). This sign convention must be accompanied by interpretation. A favourable maintenance-efficiency variance may be undesirable if it results from deferred

preventive work and later outages. Conversely, an unfavourable usage variance may be appropriate when it protects service continuity during exceptional demand.

4.2 Activity, capacity, and materiality

Static budgets confound volume and efficiency. Let B_s be the static budget, B_f the budget flexed to actual activity, and AC actual cost. Then:

$$\text{Activity-volume variance} = B_f - B_s \quad (5)$$

$$\text{Flexible-budget variance} = AC - B_f \quad (6)$$

For capacity-intensive resources, a useful extension is to distinguish supplied from used capacity. If CR is the practical-capacity cost rate, T_s is capacity supplied, and T_u is capacity used:

$$\text{Unused-capacity cost} = CR \times (T_s - T_u) \quad (7)$$

Materiality should combine percentage and currency thresholds. A small percentage on a large energy pool can be material, while a high percentage on a minor account may not justify investigation. A practical exception rule is:

$$\text{Investigate if } |CV| \geq \max(\tau_{LYD}, \tau_{\%} \times SC_f) \quad (8)$$

The threshold τ should vary by cost pool, risk, data quality, and controllability. Safety, network continuity, regulatory compliance, fraud indicators, and customer-impact events should override pure financial thresholds.

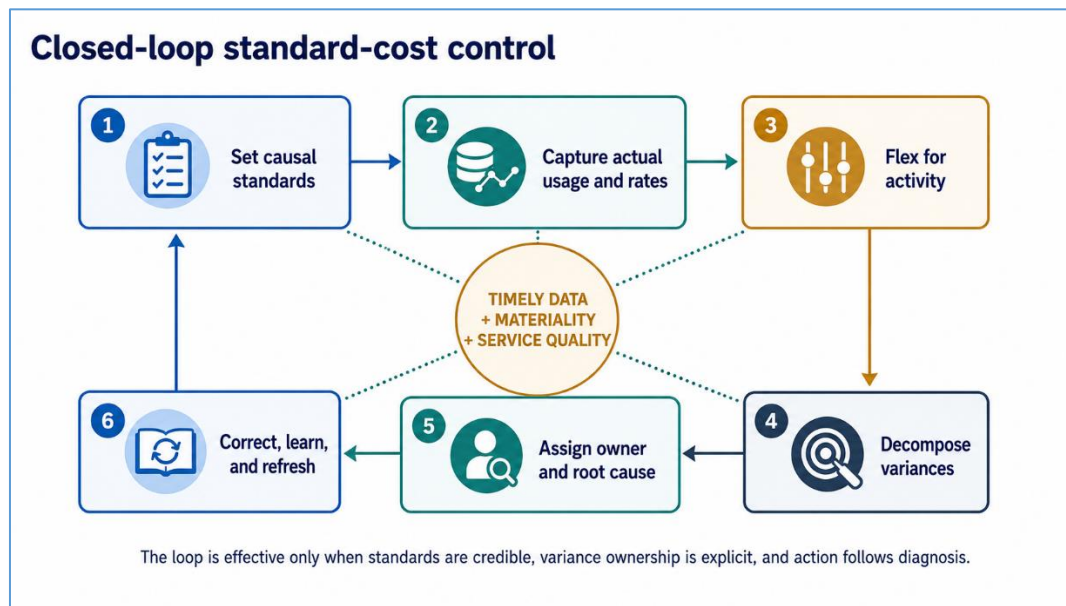


Figure 2. Closed-loop standard-cost control

Note. Author-developed control model synthesizing [1], [2], [4], and [10]–[17].

4.3 Conceptual propositions

- P1. The quality and refresh frequency of standards are positively associated with perceived cost-control usefulness.
- P2. Timely variance decomposition and clear ownership mediate the relationship between standard costing and corrective action.
- P3. Digital integration strengthens standard costing only when data definitions, governance, and user capability are mature.
- P4. Cost control is more sustainable when financial variances are jointly evaluated with network, customer, and risk indicators.

5. Methodology and Evidence Base

5.1 Research design

The study uses a pragmatic, multi-source design comprising: (i) an integrative review of cost-accounting, telecom costing, digital-control, and current professional sources; (ii) descriptive re-analysis of the aggregated survey counts in the supplied Libyana document; (iii) a public-source profile of Libyana and the Libyan mobile market; and (iv) illustrative variance scenarios designed to demonstrate the equations and decision logic. The design is analytical rather than causal: it develops a defensible implementation framework but does not claim that standard costing caused observed changes in Libyana's audited financial performance.

5.2 Survey re-analysis

The supplied document reports 25 respondents and 15 three-option items (Agree, Neutral, Disagree) across three domains: cost control, application of standard costing, and financial performance/planning. The scoring applied here is Agree = 3, Neutral = 2, and Disagree = 1. For item j with frequencies A_j , N_j , and D_j , the weighted mean is:

$$\text{Mean}_j = (3A_j + 2N_j + 1D_j) / 25 \quad (9)$$

A mean above 2.00 indicates net favourable orientation, 2.00 is neutral, and below 2.00 indicates net unfavourable orientation. The relative importance index is $\text{Mean}/3 \times 100$. Net agreement is $(\text{Agree} - \text{Disagree})/25 \times 100$ percentage points. Because only aggregated item counts were available, respondent-level reliability (for example, Cronbach's alpha), correlations, regressions, significance tests, and demographic cross-tabulations cannot be validly computed.

5.3 Numerical cases and data boundary

The operational cases use internally consistent but hypothetical LYD amounts and operating quantities. They are not Libyana financial disclosures and should not be represented as actual company performance. Their purpose is to show exactly how a telecom operator could calculate, reconcile, and interpret variances once validated internal data are available. The scenarios were selected to cover three common resource types: energy, contractor labour, and customer-care labour flexed for actual demand.

5.4 Validity and limitations

The survey sample is small ($n = 25$), apparently purposive, and available only as aggregated frequencies.

The timing, sampling frame, non-response process, and original instrument validation are not fully documented in the supplied file.

Public company pages describe scale and services but do not provide a segment-level cost ledger or audited standard-cost variance history.

The numerical case demonstrates mechanics and sensitivity; it does not estimate a realised savings percentage for Libyana.

Current external market data measure connections, not necessarily unique users or Libyana-only activity.

6. Applied Case Study I: Re-analysis of the Supplied Survey

6.1 Respondent profile

Table 3. Profile of the supplied survey sample ($n = 25$)

Dimension	Category	Frequency	Share
Gender	Male	15	60%
	Female	10	40%
Qualification	Higher diploma	7	28%
	Bachelor's degree	18	72%
Role	Company manager	1	4%
	Accountant	19	76%

	Accounts manager	1	4%
	Department head	4	16%
Experience	Under 5 years	9	36%
	5–10 years	6	24%
	10–15 years	4	16%
	Over 15 years	6	24%

Note. Re-analysis of frequency tables in the supplied study file. The source is an unpublished working document and is not counted among the 20 public references.

The profile is dominated by accountants (76%) and bachelor's-degree holders (72%). This makes the perceptions relevant to finance practice, but it also narrows generalisability: operations, network engineering, procurement, commercial, and executive perspectives are underrepresented. A future study should stratify the sample by responsibility centre so that variance usefulness can be compared between report preparers and operational users.

6.2 Item-level results

Table 4. Item-level survey results and weighted means

Item	Topic	Agree	Neutral	Disagree	Mean	Net agreement
Q1	Monitor actual costs	32%	32%	36%	1.96	–4 pp
Q2	Detect actual–planned variances	8%	52%	40%	1.68	–32 pp
Q3	Improve management cost decisions	12%	52%	36%	1.76	–24 pp
Q4	Improve efficiency / reduce cost	16%	52%	32%	1.84	–16 pp
Q5	Control labour and equipment	20%	52%	28%	1.92	–8 pp
Q6	Use for variance analysis	28%	48%	24%	2.04	+4 pp
Q7	Forecast future costs	20%	40%	40%	1.80	–20 pp
Q8	Enhance cost transparency	28%	36%	36%	1.92	–8 pp
Q9	Support performance management	32%	36%	32%	2.00	0 pp
Q10	Improve decisions and priorities	28%	36%	36%	1.92	–8 pp
Q11	Improve financial efficiency	40%	12%	48%	1.92	–8 pp
Q12	Support long-term planning	20%	32%	48%	1.72	–28 pp
Q13	Evaluate actual versus planned	52%	24%	24%	2.28	+28 pp
Q14	Determine cost strategies	8%	48%	44%	1.64	–36 pp
Q15	Support pricing / cost reduction	4%	48%	48%	1.56	–44 pp

Note. Author calculations from the supplied frequency tables. Mean uses Agree = 3, Neutral = 2, Disagree = 1; pp = percentage points.

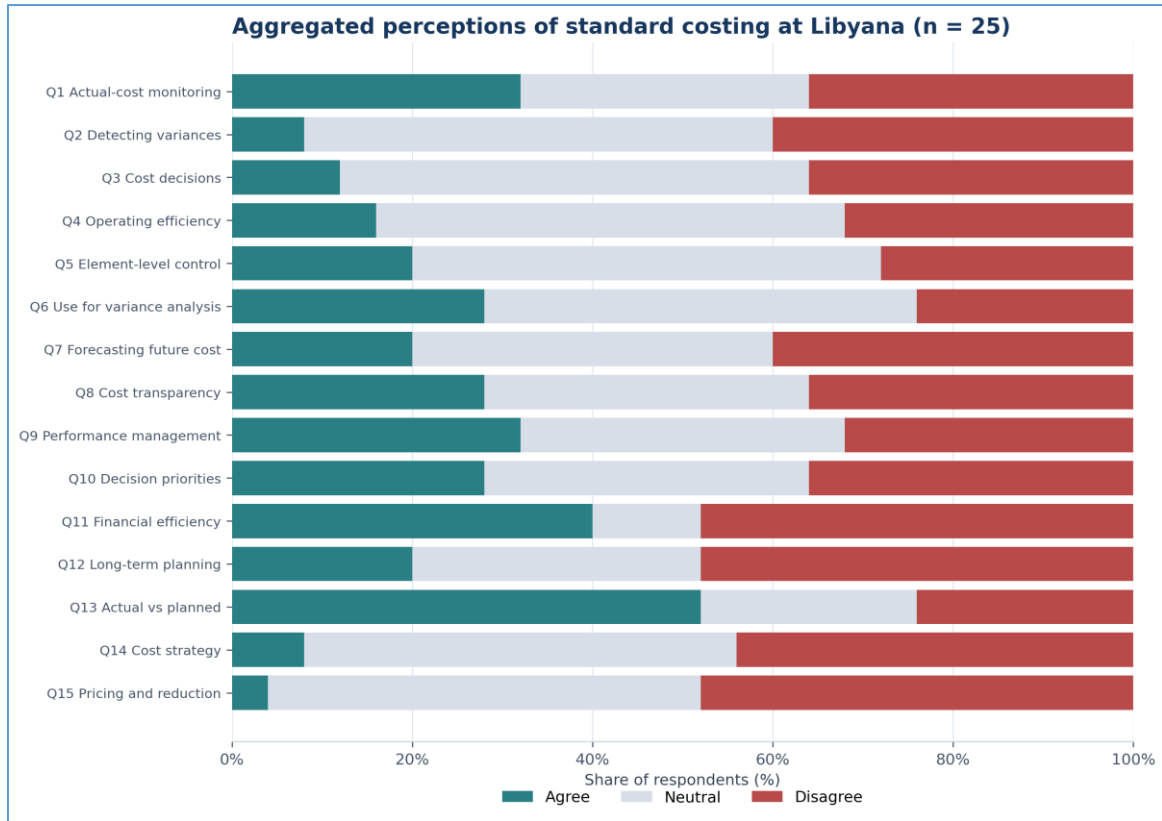


Figure 3. Distribution of responses across the 15 survey items

Note. Author's re-analysis of the supplied survey; percentages sum to 100% within each item.

6.3 Domain and overall results

Table 5. Domain-level survey summary

Domain	Agree count	Neutral count	Disagree count	Mean	Relative index	Net agreement
Cost control (Q1–Q5)	22	60	43	1.832	61.1%	–16.8 pp
Application (Q6–Q10)	34	49	42	1.936	64.5%	–6.4 pp
Financial performance/planning (Q11–Q15)	31	41	53	1.824	60.8%	–17.6 pp
Overall (15 items)	87	150	138	1.864	62.1%	–13.6 pp

Note. Counts are pooled across items within each domain; overall percentages are Agree 23.2%, Neutral 40.0%, and Disagree 36.8%.

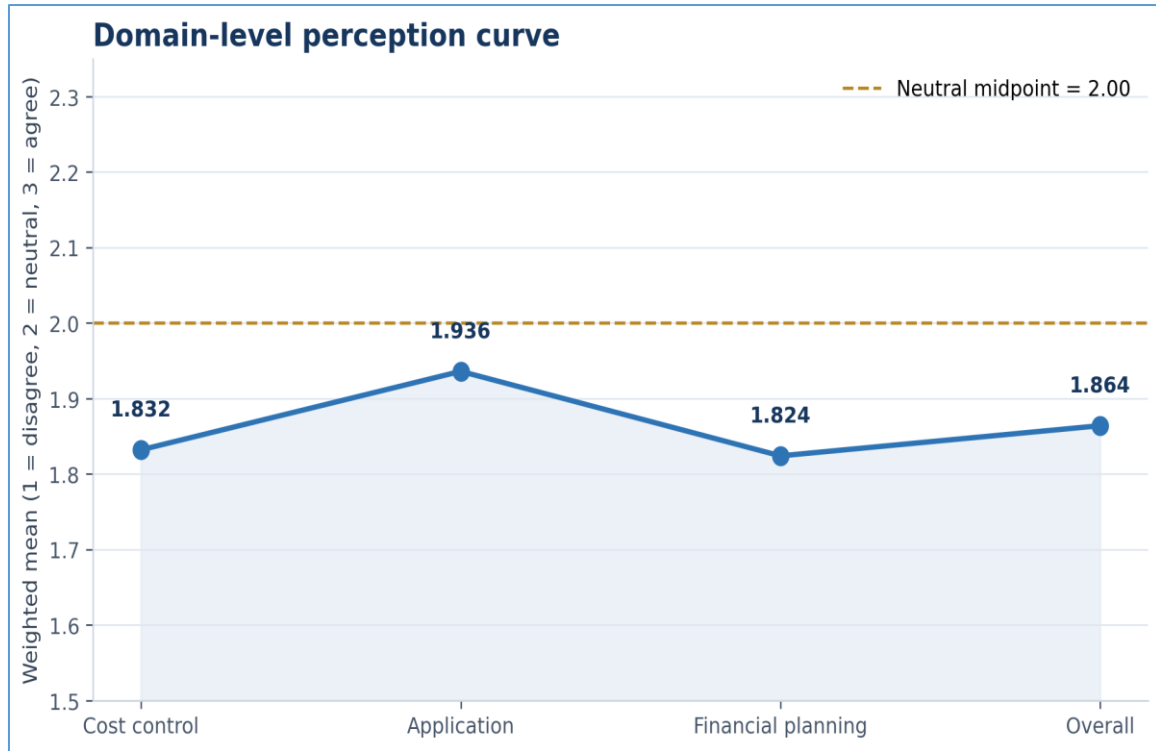


Figure 4. Domain-level weighted-mean curve
Note. Author calculations from the supplied survey.

All three domain means are below the neutral midpoint. The application domain is closest to neutral (1.936), whereas financial performance/planning is lowest (1.824). The most important contrast is between Q13 and Q15: respondents accept standard costing as a retrospective comparison device, but not yet as a strong basis for forward-looking pricing and cost-reduction decisions. This gap supports the interpretation that standard costing is present as an accounting comparison but insufficiently connected to causal drivers, decision rights, and operational action.

7. Applied Case Study II: Operational Variance Calculations

7.1 Network-site energy

Assume the flexed standard allows 1,200,000 kWh at LYD 0.45 per kWh, giving a standard cost of LYD 540,000. Actual consumption is 1,260,000 kWh at LYD 0.50, giving actual cost of LYD 630,000. Applying Equations 2–4:

$$\text{Energy price variance} = 1,260,000 \times (0.50 - 0.45) = \text{LYD } 63,000 \text{ U} \quad (10)$$

$$\text{Energy usage variance} = 0.45 \times (1,260,000 - 1,200,000) = \text{LYD } 27,000 \text{ U} \quad (11)$$

$$\text{Total energy variance} = 63,000 \text{ U} + 27,000 \text{ U} = \text{LYD } 90,000 \text{ U} \quad (12)$$

The decomposition assigns LYD 63,000 to the unit-price effect and LYD 27,000 to usage. The first may relate to tariff, supplier, fuel, or timing conditions; the second may relate to equipment efficiency, cooling, traffic, outages, generator reliance, or standard error. Investigation should be site- and technology-specific and should control for uptime and traffic.

7.2 Maintenance contractor labour

Assume a standard of 9,000 contractor hours at LYD 45 per hour (LYD 405,000). Actual performance is 8,600 hours at LYD 48 (LYD 412,800). The rate variance is LYD 25,800 U, the efficiency variance is LYD 18,000 F, and the net variance is LYD 7,800 U. A favourable

hour variance does not prove superior maintenance; backlog, repeat visits, and network availability must be reviewed before management claims savings.

7.3 Customer-care labour and flexible budgeting

Assume the static plan expected 150,000 contacts at 0.08 labour-hours per contact and LYD 30 per hour: 12,000 standard hours and LYD 360,000. Actual activity is 160,000 contacts, so the flexed standard is 12,800 hours and LYD 384,000. Actual labour is 13,100 hours at LYD 32, or LYD 419,200. The static-budget variance is LYD 59,200 U, but LYD 24,000 of this is explained by higher activity. The flexible-budget variance is therefore LYD 35,200 U, comprising LYD 26,200 U rate and LYD 9,000 U efficiency. This distinction prevents volume growth from being mislabelled as inefficiency.

Table 6. Illustrative telecom variance calculations

Cost pool	Flexed standard	Actual	Price/rate	Usage/efficiency	Total variance (LYD '000)
Network energy	1,200,000 kWh @ 0.45	1,260,000 kWh @ 0.50	63.0 U	27.0 U	90.0 U
Contract maintenance	9,000 h @ 45	8,600 h @ 48	25.8 U	18.0 F	7.8 U
Customer care (flexed)	12,800 h @ 30	13,100 h @ 32	26.2 U	9.0 U	35.2 U
Total	—	—	115.0 U	18.0 U net	133.0 U

Note. Illustrative calculations; U = unfavourable, F = favourable. The customer-care standard is flexed to 160,000 actual contacts.

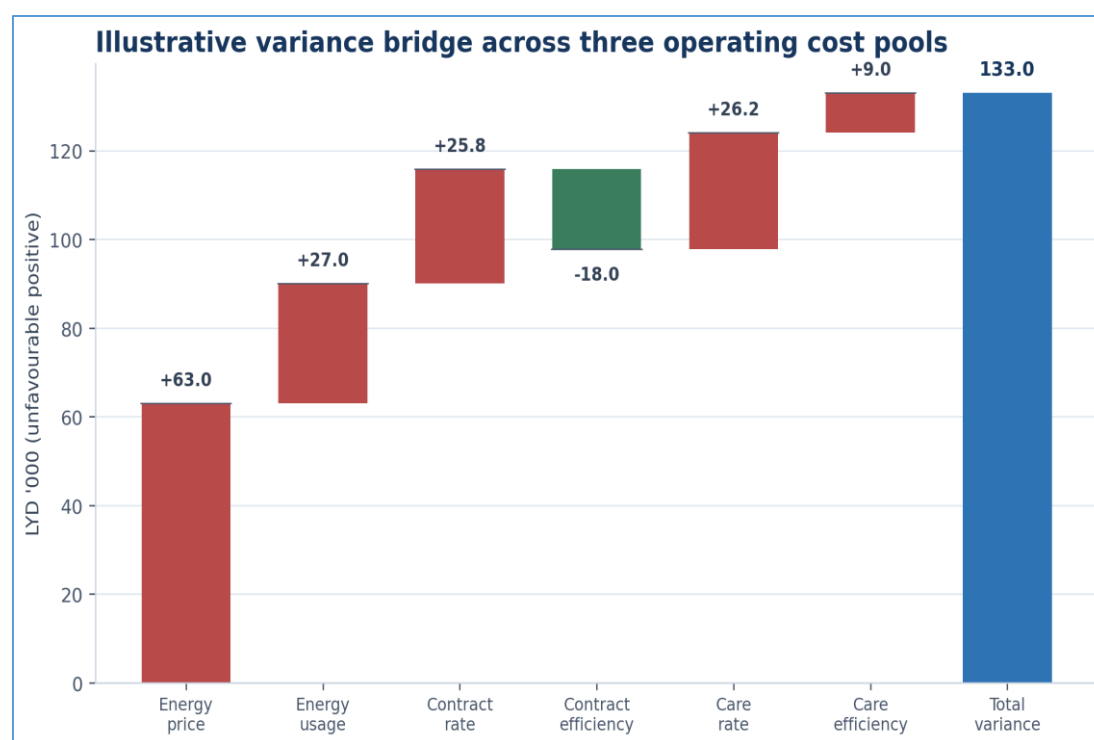


Figure 5. Illustrative variance bridge

Note. Author calculations from the hypothetical cases in Section 7.

The bridge shows that price and rate effects total LYD 115.0 thousand, or 86.5% of the total unfavourable variance, while net usage and efficiency effects total LYD 18.0 thousand, or 13.5%. The management response should therefore prioritize supplier/tariff and labour-rate governance while still examining the energy-usage and care-efficiency causes. A single total variance would obscure these distinct levers.

7.4 Energy sensitivity curve

With actual consumption held at 1,260,000 kWh, standard cost fixed at LYD 540,000, and the actual unit price varied from LYD 0.40 to LYD 0.60, total energy variance follows a linear sensitivity function. The break-even actual price is approximately LYD 0.429 per kWh because higher actual usage already creates a usage disadvantage. Figure 6 makes the threshold visible and provides a practical basis for scenario planning and supplier negotiation.

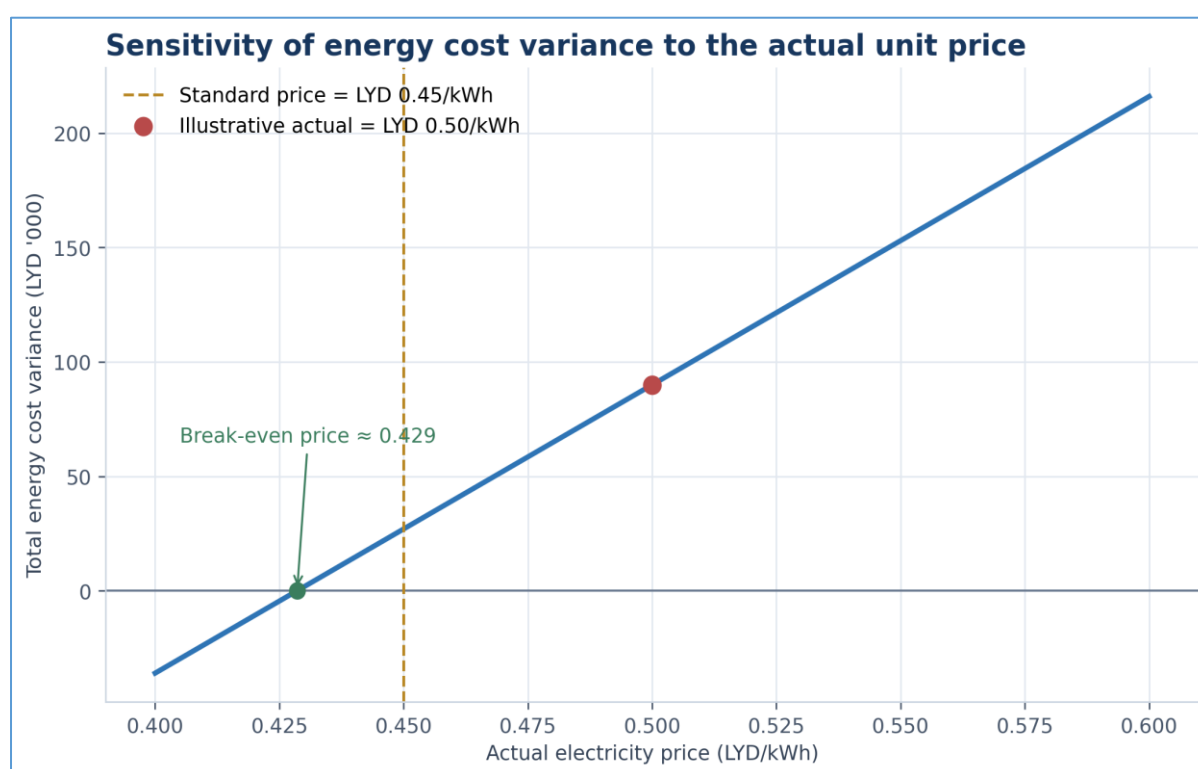


Figure 6. Energy-price sensitivity of the total cost variance

Note. Author simulation. $AQ = 1,260,000$ kWh; $SQ = 1,200,000$ kWh; $SP = \text{LYD } 0.45/\text{kWh}$.

7.5 Interpretation and control actions

Table 7. Variance ownership and response matrix

Variance	Likely root causes	Primary owner	Representative action
Energy price	Tariff/fuel/supplier change	Procurement + finance	Contract indexation, tariff confirmation, hedging/alternative supply where feasible
Energy usage	Traffic, cooling, equipment, outage, theft, standard error	Network operations	Site benchmark, weather/traffic normalization, equipment and battery review

Contract rate	Rate escalation, overtime, emergency call-outs	Procurement + maintenance	Rate-card compliance, vendor mix, SLA and emergency coding
Contract efficiency	Job complexity, preventive work, repeat visits	Maintenance	Validate backlog, first-time-fix, repeat visit, and availability
Care rate	Overtime, outsourcing mix, skill grade	Customer operations + HR	Workforce scheduling, skill routing, contract review
Care efficiency	Contact mix, systems, training, repeat contacts	Customer operations	Complexity-adjusted standard, self-service, first-contact resolution

Note. Proposed decision matrix; actions require validation against service, safety, and compliance indicators.

8. Comparison with Complementary Cost-Management Approaches

Standard costing should be positioned as the diagnostic spine of a broader system. Table 8 compares its role with ABC/TDABC, rolling forecasts, target costing, and predictive analytics. The approaches are complementary because they answer different questions: standards explain deviations from expected resource consumption; ABC/TDABC improves causal attribution; rolling forecasts update the expected future; target costing works backward from market and margin constraints; analytics screens large data volumes and detects patterns.

Table 8. Comparison of cost-management approaches

Approach	Primary question	Strength	Risk	Recommended Libyana role
Standard costing	Why did actual quantity/rate differ from the flexed expectation?	Fast, accountable exception reporting	Stale standards; gaming; volume confusion	Monthly control by cost pool
ABC / TDABC	Which activities and capacity resources caused service or customer cost?	Causal allocation; unused capacity visibility	Maintenance effort and data design	Quarterly model calibration; unit economics
Rolling forecast	What is now expected over the next 12–18 months?	Adapts to demand and price changes	Can become frequent re-budgeting without action	Forward plan and cash/resource outlook
Target costing	What cost is allowable at the required price and margin?	Market and design orientation	Less useful for unavoidable legacy capacity	New offers, channels, and technology decisions
Predictive / AI analytics	Which variances, anomalies, or drivers require attention?	Scale, speed, early warning	Prediction–causation gap; opacity and data risk	Prioritization and forecasting, with human review

Note. Synthesis of [1], [2], [8]–[17].

The recommended architecture is therefore layered. First, ABC/TDABC defines cost objects, activities, and practical-capacity rates. Second, standard costing sets expected quantities and rates for those drivers. Third, flexible budgets adjust for actual demand and network scope. Fourth, dashboards flag material exceptions and display linked quality outcomes. Fifth, rolling forecasts and analytics update expectations without rewriting the historical accountability baseline.

9. Results

Table 9. Consolidated findings

ID	Finding	Evidence / implication
R1	The survey indicates limited current confidence	Overall mean 1.864; 23.2% favourable, 40.0% neutral, 36.8% unfavourable across all item responses.
R2	Comparison is more accepted than decision use	Q13 actual-versus-plan mean 2.28; Q15 pricing/cost reduction mean 1.56.
R3	Implementation conditions determine value	Literature supports relevance but consistently points to data, causality, skills, behaviour, and digital-governance contingencies [5]–[17].
R4	Flexing is essential	The customer-care example reduces the apparent controllable variance from LYD 59.2k to LYD 35.2k after recognizing higher activity.
R5	Rate effects can dominate	In the illustrative three-pool case, price/rate effects are LYD 115.0k, 86.5% of the LYD 133.0k total variance.
R6	Quality must constrain cost conclusions	A favourable usage or labour-efficiency variance is not beneficial if it reflects deferred work, outages, repeat contacts, or lower service quality.
R7	Telecom-specific drivers are feasible	Site-hours, kWh, maintenance jobs, contacts, standard minutes, activations, transactions, capacity, and traffic provide measurable causal anchors.

Note. Integrated results from the supplied survey, literature review, and illustrative case analysis.

10. Discussion

10.1 What the survey means

The survey does not support a simple claim that respondents view standard costing as highly effective. The overall mean is below neutral, and neutrality is the largest response category. It would therefore be academically inappropriate to conclude that the original data demonstrate a strong positive impact. The more defensible conclusion is that respondents recognize the basic comparison function but perceive weak integration with strategic and forward-looking decisions. This is consistent with a maturity problem: standards may exist, yet they may not be sufficiently current, causal, granular, or connected to accountability and action.

The concentration of accountants in the sample may strengthen knowledge of reporting routines but understate or overstate operational usefulness. Network, procurement, customer-care, commercial, and IT managers experience different cost drivers and may judge the same report differently. The next field study should therefore test whether standard quality, timeliness, controllability, and digital integration explain perceived usefulness across functions.

10.2 Why standard costing can still improve control

The literature and case calculations show that the method's value lies in decomposition. A total overspend of LYD 133.0 thousand becomes managerially useful only after it is separated into price, rate, usage, and efficiency causes and assigned to owners with appropriate quality metrics. The customer-care example further shows why a flexed standard is indispensable: a static budget incorrectly attributes demand growth to cost inefficiency. These mechanics align with the continued relevance identified in recent standard-cost studies [5]–[7] while addressing the causal costing and capacity concerns emphasized by managerial-costing and TDABC approaches [4, 8, 9].

10.3 Digital opportunity and governance risk

Libyana's operational systems could, in principle, automate many actual drivers: energy meters, network-availability logs, maintenance tickets, contact-centre records, activations, payments, and traffic. Digital-control research suggests that such integration can increase speed and granularity [10]–[14]. However, adding automation and analytics without stable definitions can scale confusion. Bedford and colleagues' evidence that simultaneous automation and analytics may reduce effectiveness under resource constraints is particularly relevant [14]. Implementation should therefore start with a limited number of material cost pools and governed driver definitions before expanding.

Artificial intelligence can help rank anomalies, identify abnormal site consumption, forecast expected loads, and generate narrative explanations, but it should not automatically declare cause or responsibility. The prediction-versus-causation distinction is essential [15, 16]. Human investigation must establish whether a variance reflects inefficiency, an external price change, a deliberate service decision, inaccurate standards, or data error. Digitalisation also changes management-accountant roles; a business-partner orientation is more likely to convert analysis into action than a purely policing orientation [17].

10.4 Behavioural and ethical safeguards

Standards can create dysfunctional behaviour when used as punitive quotas. Managers may defer maintenance, shift cost classifications, reject necessary overtime, or reduce customer support merely to report favourable variances. The control system should separate planning variance from operational variance, record approved service-protection exceptions, and evaluate trends rather than isolated monthly outcomes. Responsibility should follow controllability: procurement should not own excess kWh, network operations should not own regulated tariff changes, and customer-care managers should not be penalized for demand changes before the budget is flexed.

11. Conclusions and Recommendations

11.1 Conclusion

Standard costs can materially improve cost control at Libyana, but the benefit is conditional. The technique should not be implemented as a static annual accounting schedule or a substitute for causal costing. It should be designed as a closed-loop management system that expresses standards in operational units, flexes benchmarks for actual activity, separates rate from efficiency effects, assigns controllable causes, protects service quality, and refreshes assumptions through disciplined governance.

The supplied survey provides cautious rather than affirmative evidence. Respondents see the clearest value in actual-versus-plan comparison but remain unconvinced about strategic and forward-looking applications. The study therefore interprets the principal challenge as an implementation gap. A better-designed system—supported by ABC/TDABC, digital data integration, exception thresholds, cross-functional ownership, and quality guardrails—can convert standard costing from a retrospective variance report into a practical operating-control language.

11.2 Phased implementation roadmap

Phase 1: Define (0–2 months): Select 3–5 material cost pools; map accounts to resources, activities, cost objects, owners, and quality metrics; document data lineage.

Phase 2: Baseline (2–4 months): Estimate practical capacity and attainable standards from clean historical and engineering data; separate external assumptions from controllable consumption.

Phase 3: Pilot (4–7 months): Pilot energy, maintenance, and customer care; flex for traffic/sites/contacts; use dual LYD and percentage thresholds; hold monthly root-cause reviews.

Phase 4: Integrate (7–10 months): Connect ERP, procurement, network, energy, ticketing, and contact-centre data; automate reconciliations and anomaly checks.

Phase 5: Scale (10–15 months): Extend to provisioning, billing, sales channels, and shared support; add ABC/TDABC cost-to-serve views and rolling forecasts.

Phase 6: Assure (ongoing): Quarterly standard review; annual model validation; independent data-quality and behavioural-risk checks; training and documented override governance.

11.3 Recommended dashboard and governance rules

Report actual, static-budget, flexed-standard, price/rate, usage/efficiency, activity-volume, and unused-capacity values in one reconciliation.

Show both LYD and percentage materiality and include a three-month trend to reduce overreaction to noise.

Pair every cost variance with at least one service or risk guardrail; no 'favourable' classification should stand alone when quality deteriorates.

Assign one accountable owner and one supporting owner to each root-cause category, while preserving a category for non-controllable external effects.

Refresh volatile rates monthly or quarterly; refresh engineering quantities when technology, configuration, or practical capacity changes materially.

Use AI for anomaly ranking and narrative assistance only after data lineage, model documentation, access control, and human approval are established.

Repeat the employee study with a larger stratified sample and respondent-level data, enabling reliability analysis and hypothesis testing.

Decision rule Adopt standard costing as a managed operating system: causal standards + flexible budgets + explicit ownership + quality guardrails + periodic learning. Do not treat the variance report as an end in itself.

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Compliance with ethical standards

Disclosure of conflict of interest

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