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A CONCEPTUAL MANAGEMENT FRAMEWORK FOR RESOURCE AND FINANCIAL OPTIMISATION OF CONSTRUCTION SMES IN SRI LANKA

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ABSTRACT

Construction small and medium-sized enterprises (SMEs) in Sri Lanka play a significant role in project delivery. However, many continue to manage procurement, site records, inventory movements, supplier payments, and financial information through fragmented and partially manual systems. This fragmentation contributes to delayed reconciliation, duplicated data entry, weak audit trails, limited visibility of committed costs, and inadequate monitoring of project cash-flow exposure. This study developed a conceptual management framework for strategic resource and financial optimisation in Sri Lankan construction SMEs. A sequential explanatory mixed-method research design was adopted. The quantitative phase comprised a questionnaire survey of 30 construction practitioners, and the responses were analysed using Relative Importance Index (RII). The qualitative phase comprised eight semi-structured interviews with SME-related stakeholders, and the data were analysed thematically to refine and validate the proposed framework. The findings revealed that budget overruns, wastage, stock mismatches, cash-flow uncertainty, and poor cost visibility were the most critical management challenges. The highest-ranked framework requirements were exception-based alerts, real-time cash-flow visibility, supplier payment tracking, delivery-status monitoring, and budget-versus-actual dashboards. The proposed framework consists of four interrelated layers, namely mobile site-data capture, validation and three-way matching, accounting-system interface, and analytical dashboards. The study contributes to construction SME management by proposing an affordable, modular, and practically implementable conceptual management framework that links site-level resource evidence with financial control. Future research should develop and test a functional prototype to evaluate its impact on reconciliation time, payment delays, stock accuracy, and cost visibility.

Keywords: *Construction SMEs; Financial management; Resource management; Sri Lanka.*

1. INTRODUCTION

The construction industry depends on the continuous coordination of materials, site production records, procurement approvals, and financial transactions. When these

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information flows are delayed or fragmented, they can contribute to cost overruns, schedule inefficiencies, weak audit trails, and poor project-level decision-making (World Economic Forum, 2016). This issue is particularly significant for SMEs, where limited digital capacity, restricted administrative resources, and informal management practices often reduce the visibility of project operations and financial commitments (Gessa et al., 2023).

Sri Lankan construction SMEs operate in a dynamic environment due to cost pressure, fluctuating payment cycles, and limited working-capital resilience, which further underscores the importance of timely operational and financial control (Central Bank of Sri Lanka, 2023). However, many SMEs continue to rely on Excel sheets, manual records, and disconnected software applications. These practices limit real-time visibility of inventory movements, committed costs, invoice status, supplier payments, and project cash-flow exposure (Ranadewa et al., 2018). Existing accounting tools may support ledger management, but they often remain disconnected from procurement, material tracking, goods received notes (GRNs), and project-level cost commitments. Conversely, full enterprise resource planning (ERP) systems may provide broader integration, but their cost, complexity, and implementation requirements can exceed the capacity of many construction SMEs.

Accordingly, the aim of this study is to develop a conceptual management framework for strategic resource and financial optimisation in Sri Lankan construction SMEs, rather than to develop or test a functional software prototype. Questionnaire and interview evidence was used to examine prevailing practices, diagnose control-related weaknesses, and establish implementation considerations relevant to SME operations. The objectives are to identify the major problems in resource and financial management, examine the effectiveness and limitations of existing management practices, and propose an SME-oriented approach for improving decision support in construction SME operations.

The scope of the study is limited to resource management, procurement coordination, supplier-payment visibility, budgetary control, and cash-flow monitoring within Sri Lankan construction SMEs.

2. LITERATURE REVIEW

The literature emphasises that effective coordination of procurement, inventory, site operations, and accounting information is critical to construction project performance (World Economic Forum, 2016). This requirement is particularly important for SMEs, as they commonly operate with limited managerial capacity, informal administrative processes, restricted digital capability, and reliance on tacit knowledge (Gessa et al., 2023). Although such practices may be manageable in small-scale projects, they become less effective when project complexity, transaction volume, and external market uncertainty increase.

2.1 OVERVIEW OF CONSTRUCTION SMES IN SRI LANKA

In the construction industry, especially in the economies of the developing world, construction SMEs contribute significantly to employment creation, economic development, and project delivery (Bandaranaike et al., 2024). Despite their significance, these companies generally have less financial capacity, operational flexibility, and managerial resources than large construction organisations (Nuwandhara et al., 2024).

Construction SMEs in the Sri Lankan context are typically affected by limited access to finance, poor cash-flow management, labour shortages, supply-chain disruptions, and low levels of technology adoption, which reduce productivity and business resilience (Weerakoon et al., 2023). These conditions increase their exposure to project delays, cost escalation, and weak coordination between site-level activities and financial-control processes (Madhavika et al., 2025).

2.2 MAJOR ISSUES IN SMES

SMEs face a wide range of challenges related to finance, resource management, operations, legal matters, and risk management. These issues affect the day-to-day functioning and long-term sustainability of SMEs in different business settings.

Table 1: Major issues in SMEs

Category	Main Issues	References
Financial	Cash-flow problems, limited finance access, rising costs, and weak financial control	(1), (2), (3), (4), (5), (6),(7)
Resource Management	Skilled labour shortages, poor training, supply delays, and weak resource coordination	(1), (3), (4), (5), (8),(9),(10),(11)
Operational	Project delays, budget overruns, low productivity, poor quality, and safety control issues	(1), (3), (4), (5), (12)
Contractual/Legal	Contract issues, approval delays, compliance burden, dispute risk	(1), (3), (4), (5), (14), (15), (16)
Risk Management	Late payments, theft/losses, economic downturns, and weak contingency planning	(1), (5), (13), (17), (19), (18)

(1)-(Bandaranaike et al., 2024), (2)-(Hailu & Tshehla, 2025), (3)-(Ranadewa et al., 2018), (4)-(Nuwandhara et al., 2024),(5)- (Dodanwala & Santoso, 2024),(6)-(Uwonda & Okello, 2015),(7)-(Odio et al., 2021),(8)-(Whyman et al., 2015),(9)-(Casalino et al., 2015),(10)-(Madzimure et al., 2020),(11)-(Fanelli, 2021),(12)-(Madhavika et al., 2025),(13)-(Weerakoon et al., 2023),(14)-(Ratnayake et al., 2025),(15)-(Akinboye et al., 2025),(16)-(Escrivão et al., 2017),(17)-(Perera & Dewagoda, 2021),(18)-(Wickramansinghe & Sharma, 2005),(19)-(Mafimisebi et al., 2025)

As shown in Table 1, SMEs face interconnected challenges across financial, resource-management, operational, contractual/legal, and risk-management areas. However, financial and resource-management issues are more frequently emphasised in the reviewed literature because they directly affect cash-flow stability, labour availability, material coordination, and project continuity. Financial constraints reduce the ability of SMEs to maintain stable business activities, while resource-related limitations such as labour shortages, poor training, supply delays, and weak coordination further affect performance and growth. Therefore, greater attention should be given to improving financial capacity and strengthening resource management in SMEs (Ranadewa et al., 2018; Bandaranaike et al., 2024).

2.3 RESOURCE MANAGEMENT CHALLENGES IN CONSTRUCTION SMES

The visibility of material requests, receipts, issues, and returns is vital to construction performance because these records link physical production with cost control (World Economic Forum, 2016). This is particularly important when stores and procurement

records are maintained through manual logs or independent spreadsheets, as reconciliation becomes time-consuming, irregular, and dependent on manual effort (Olanipekun & Sutrisna, 2021).

Delays in GRNs, delivery notes, and stock updates limit managers' ability to track consumption, manage wastage, and validate supplier claims (Perera & Dewagoda, 2021). This weakens replenishment planning and increases the likelihood of stock mismatches, unplanned purchasing, and avoidable project delays (Ratnayake et al., 2025).

2.4 FINANCIAL MANAGEMENT, CASH-FLOW AND PAYMENT DELAYS

Cash flow in construction is structurally imbalanced because contractors incur continuous expenditure on labour, materials, and subcontractors, while revenue depends on valuation, certification, and payment-release cycles (Perera & Dewagoda, 2021). Compared with larger companies, SMEs are more exposed to delayed payments and short working-capital cycles. Therefore, real-time visibility of cost commitments and payables is strategically important (Gessa et al., 2023).

Stand-alone accounting packages may support statutory reporting, ledger maintenance, and invoice processing. However, they do not always preserve the operational context associated with purchase orders, partial deliveries, site transfers, and committed costs (Monk & Wagner, 2008). As a result, budgetary pressure may become visible to managers only after supplier invoices have been entered into the accounts or after cash-flow constraints have already affected site operations (Chathuranga et al., 2000).

2.5 INTEGRATED MANAGEMENT FRAMEWORK REQUIREMENT

Construction SMEs require a real-time platform because many current practices depend on spreadsheets, manual updates, and disconnected systems that restrict timely decision-making and operational efficiency (Gessa et al., 2023). Poor integration among material records, procurement activities, and financial-control processes contributes to supplier-payment delays, cash-flow uncertainty, stock variances, and limited cost visibility in the Sri Lankan construction context (Bandaranaike et al., 2024). A conceptual management framework can improve visibility, coordination, and control by identifying the required connections between materials, payments, budgets, and site activities (Ranadewa et al., 2018). For SMEs, such a framework should define platform requirements that are affordable, practical, and easy to implement in daily project operations (Gessa et al., 2023).

2.6 EXISTING DIGITAL TOOLS AND DIGITAL-MATURITY INDICATORS

Existing digital tools used by construction SMEs commonly include spreadsheets, manual records, stand-alone accounting packages, project management applications, procurement systems, inventory systems, and ERP systems. Spreadsheets and manual records are widely used because they are low-cost, flexible, and familiar to users, but they often create duplicated data entry, delayed reconciliation, weak audit trails, and limited real-time visibility (Ranadewa et al., 2018). Stand-alone accounting packages can support ledger recording, invoice processing, payment tracking, and statutory reporting, but they may not fully capture site-level operational transactions such as purchase orders, GRNs, material issues, delivery records, and site transfers (Monk & Wagner, 2008). ERP systems provide broader integration between operational and financial functions, but their cost,

complexity, training needs, and implementation requirements can limit adoption among SMEs (Gessa et al., 2023). Therefore, construction SMEs require an intermediate platform that is more integrated than spreadsheet-based control but more affordable and practical than full enterprise system implementation. Based on this literature, ERP integration, site-finance linkage, duplicate data entry, and Excel-based material tracking were selected as digital-maturity indicators because they reflect the extent to which SMEs can capture, connect, and use operational and financial information for decision-making. These indicators informed the questionnaire design and helped assess the level of information integration required for the proposed conceptual management framework. This comparison shows that existing tools either support isolated functions or require substantial implementation capacity. Accordingly, the proposed framework addresses the gap between fragmented low-cost tools and complex enterprise systems by identifying practical platform requirements for integrated resource and financial control in construction SMEs.

3. RESEARCH METHODOLOGY

This study adopted a sequential explanatory mixed-method research design to develop a conceptual management framework for Sri Lankan construction SMEs (Creswell, 2014). A structured questionnaire survey was first conducted among construction practitioners engaged in procurement, stores management, quantity surveying, site management, project management, and finance. The final dataset consisted of 30 usable responses, which were used to identify current practices, site-finance integration issues, resource and financial control problems, real-time information requirements, desired platform characteristics, adoption barriers, and enabling conditions.

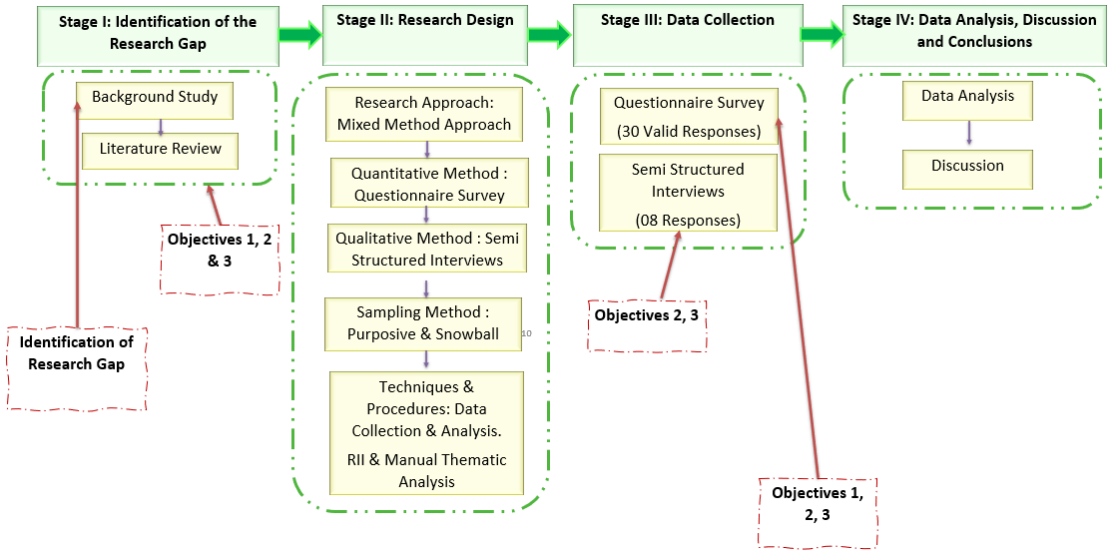

Figure 1: Research process framework

The sample size was considered appropriate for the exploratory nature of the study because the objective was to rank key issues and develop a conceptual management framework rather than to make population-level statistical generalisations. The 30 questionnaire responses provided the basis for RII-based prioritisation, while the eight semi-structured interviews strengthened the interpretation of the findings by explaining practical requirements and implementation conditions. The interview data were analysed

thematically. This approach was appropriate because the study aimed to prioritise key issues and translate them into an SME-relevant framework.

3.1 QUANTITATIVE ANALYSIS

The quantitative questionnaire data were analysed using the RII. RII was applied to determine the relative significance of the identified resource-management challenges, financial-control issues, platform requirements, adoption barriers, and enabling conditions. This method was appropriate because the study aimed to rank the factors according to their perceived importance among respondents.

The RII was calculated using the following formula:

$$RII = \frac{\sum W}{A \times N} \qquad (01)$$

W = Weight assigned by respondents

A = Highest weight on the scale

N = Total number of respondents

3.2 QUALITATIVE ANALYSIS

The interview data were analysed using thematic analysis to identify key suggestions and practical recommendations. The interview responses were reviewed, coded, categorised, and synthesised into themes related to improving financial and material management in construction SMEs.

The questionnaire findings guided the qualitative analysis. Since the survey had already identified the main resource and financial management issues, the interviews focused on exploring practical solutions and implementation requirements. Accordingly, the qualitative data were organised into solution-oriented themes to support the formulation of the proposed conceptual management framework.

4. RESULTS AND DISCUSSION

4.1 RESPONDENT PROFILE AND CURRENT DIGITAL MATURITY

The questionnaire dataset consisted of 30 usable responses. Quantity Surveyors represented the largest respondent group at 66.7%, followed by site engineers at 20.0%, material controllers at 6.7%, and project management and other roles at 3.3% each as shown in Figure 2. This respondent profile indicates that the analysis was informed mainly by practitioners who are directly involved in cost control, procurement coordination, material management, and site reporting.

The findings indicate a high level of digital fragmentation among the surveyed organisations. Among the 30 valid responses relating to ERP adoption, 82.8% indicated that their organisations did not have a fully integrated ERP system, while 17.2% reported the use of a fully integrated system. Only 16.7% reported that site records were fully connected with financial records, while 83.3% indicated that such records were either partially connected or not connected. Regarding duplicate data entry, 70.0% of respondents answered “yes,” while a further 26.7% answered “sometimes”. Excel-based material tracking was reported by 76.7% of respondents, indicating that spreadsheet-based or semi-manual control remains common among construction SMEs

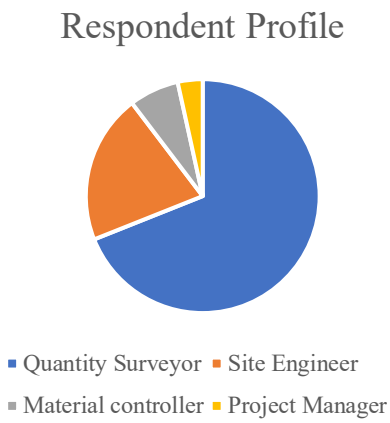

Figure 2: Respondent profile

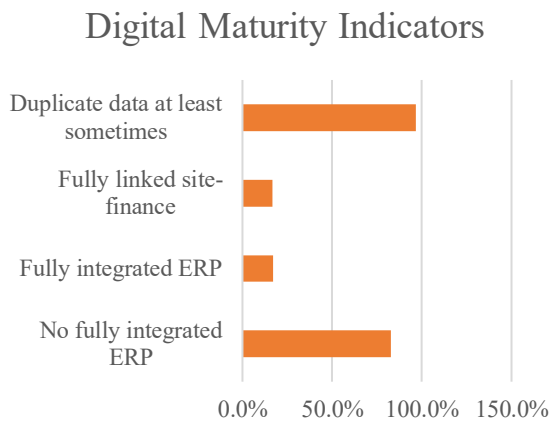

Figure 3: Digital maturity indicators

4.2 PRIORITY PROBLEMS

The RII analysis was used to rank all identified resource-management and financial-control problems. Figure 4 presents the highest-ranked problem themes only to maintain visual clarity and avoid overcrowding the figure. The highest-ranked problem theme was budget overruns (RII = 0.887), followed by wastage (RII = 0.873), stock mismatch between site and store records (RII = 0.853), cash-flow uncertainty (RII = 0.853), and poor cost visibility (RII = 0.847). These findings indicate that the most critical problems are concentrated around budgetary control, material wastage, stock reconciliation, cash-flow uncertainty, and cost visibility.

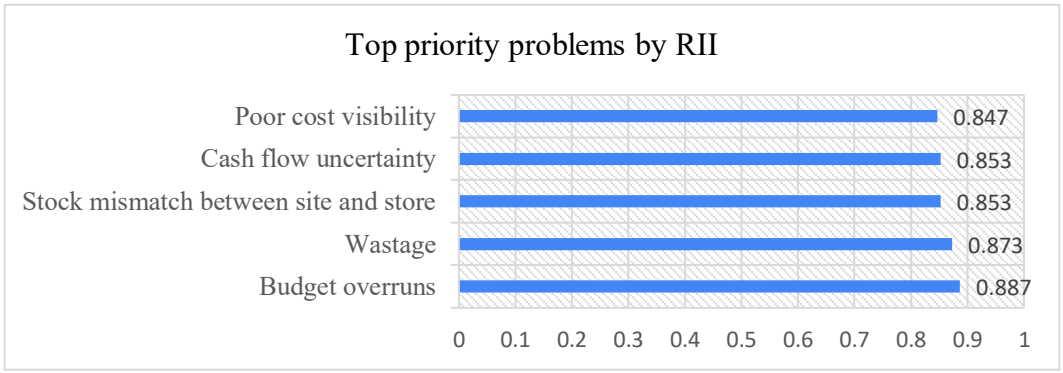

Figure 4: Top priority problems by RII

Other problem items were also included in the RII analysis but obtained comparatively lower values than the main themes shown in Figure 4. These included over-ordering, inaccurate stock records, invoice-matching issues, delayed supplier payments, duplicated data entry, project delays, theft or loss, difficulty tracking committed cost through purchase orders, payment delays affecting work progress, late GRNs or delivery notes, missing invoices, late deliveries, price variations not captured early, payment-approval delays, and disputes with suppliers or subcontractors. These issues remain relevant to the proposed framework.

4.3 PLATFORM REQUIREMENTS

The RII analysis was also used to rank all identified platform requirements. Figure 5 presents the highest-ranked platform requirement themes only to improve visual clarity.

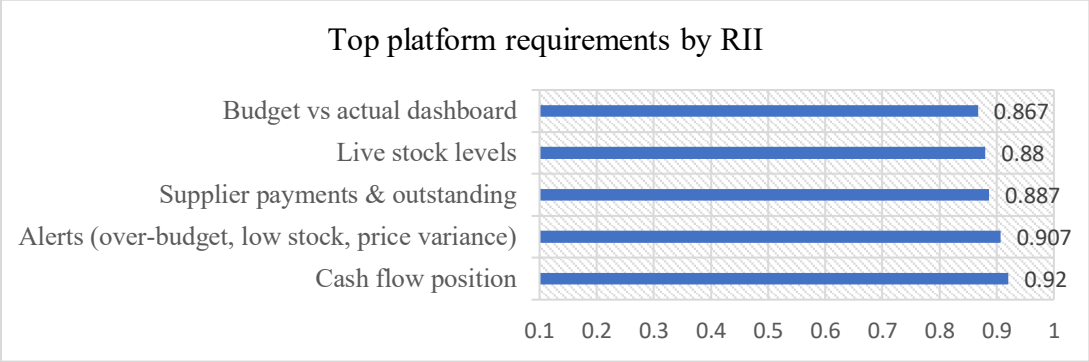

Figure 5: Top requirements by RII

The highest-ranked requirement was real-time cash-flow position (RII = 0.920), followed by exception alerts for over-budget conditions, low stock, and price variance (RII = 0.907), supplier-payment and outstanding-balance visibility (RII = 0.887), livestock levels (RII = 0.880), and budget-versus-actual dashboards (RII = 0.867). These findings show that respondents prioritised practical decision-support functions related to cash-flow monitoring, exception alerts, supplier-payment tracking, stock visibility, and budget control.

Other platform requirements were also included in the analysis but obtained comparatively lower RII values. These included inventory and stores control, delivery-status tracking, supplier outstanding information, committed cost visibility through purchase orders not yet invoiced, approvals and audit trail, cost-code and budget-control functions, cost-code spending visibility, and mobile site-data capture. These lower-ranked requirements were not excluded from the analysis; rather, they were treated as supporting requirements that may be incorporated in subsequent stages of the proposed real-time management framework.

4.4 ADOPTION BARRIERS AND ENABLERS

The RII analysis was further used to assess the barriers influencing the adoption of the proposed conceptual management framework. Cost was the highest-ranked adoption barrier (RII = 0.907), followed by training time (RII = 0.833), staff resistance or attitude (RII = 0.807), fear of monitoring (RII = 0.773), data privacy concerns (RII = 0.707), and internet or device limitations (RII = 0.500). These findings indicate that affordability, training requirements, and user acceptance are the main issues that should be considered during implementation.

The adoption-enabler results further support this interpretation. Training support was the highest-ranked enabler (RII = 0.900), followed by low subscription cost (RII = 0.893), simple user interface (RII = 0.867), SME-specific templates (RII = 0.800), role-based access (RII = 0.793), offline mode with synchronisation (RII = 0.647), and local language support (RII = 0.620). These findings suggest that the platform framework should be cost-sensitive, simple to use, supported by training, and suitable for the operational capacity of SMEs.

Overall, the quantitative findings indicate that the proposed conceptual management framework should initially prioritise core resource and financial-control functions before progressing towards advanced enterprise-level integration. The most important areas are budget control, material wastage reduction, stock reconciliation, cash-flow visibility, supplier-payment monitoring, exception alerts, and live material information. The findings also show that implementation success depends on affordability, training support, user acceptance, and simplicity of use.

4.5 THEMATIC ANALYSIS

The interview data were analysed using thematic analysis to identify recurring suggestions and practical recommendations. The responses were coded, categorised, and grouped into themes that informed the development of the proposed conceptual management framework.

4.5.1 Theme 1: Requirement for Real-Time Financial Visibility and Control

The interviewees emphasised the need to access financial data in real time. They explained that problems such as delayed supplier payments, cash-flow uncertainty, and budget overruns could be reduced if managers had access to real-time information on cash position, payment schedules, supplier-payment status, and budget performance. This indicates that financial monitoring should be one of the core functions of the proposed management framework. This theme supports the questionnaire findings, where cash-flow visibility and supplier-payment tracking were identified as important platform requirements.

4.5.2 Theme 2: Requirement for Improved Material Follow-up and Operational Organization

The participants highlighted the need to improve material control across procurement, delivery, utilisation, and stock recording. They observed that delayed updates and separate record-keeping practices can create stock mismatches, inaccurate records, and weak coordination between site and office teams. Therefore, the interviewees suggested features such as live inventory updates, delivery-status tracking, and electronic GRN recording. This theme supports the survey finding that inventory control and delivery visibility are priority requirements for the proposed management framework.

4.5.3 Theme 3: Requirement to Integrate and Eliminate Redundant Data Entry

The recurring theme was the need for an integrated system that reduces duplicate data entry and fragmented information flows. The participants noted that spreadsheets, paper-based records, and disconnected tools create inconsistencies and delays in decision-making. They suggested a centralised platform framework that connects material management, cost tracking, supplier payments, and reporting. This finding is consistent with the questionnaire results, where duplicate records and weak site-finance integration were identified as significant operational issues.

4.5.4 Theme 4: Requirement for a Simple, Low-priced, and Usable System by SMEs

This theme concerned the implementation requirements of SMEs. Respondents emphasised that the platform framework should be affordable, easy to use, and suitable for daily project operations. Software cost, lack of training, and resistance to change were

identified as barriers to adoption. Consequently, the interviewees suggested a simple interface, low-cost implementation, and practical training support. This theme is consistent with the questionnaire findings on cost, training, and ease of adoption.

4.6 INTEGRATING QUANTITATIVE AND QUALITATIVE FINDINGS

The questionnaire and interview findings provide an empirical basis for the proposed management framework. The questionnaire phase identified and ranked the main resource and financial management issues, while the interview phase explained how these requirements could be translated into practical platform features for construction SMEs.

The findings indicate that the proposed framework should not function only as a financial reporting tool or a material-tracking application. Instead, it should integrate cost control, supplier payments, inventory status, delivery progress, and alert mechanisms. It should also reflect SME conditions, including limited resources, cost sensitivity, and the need for user-friendly tools.

This integration strengthens the practical relevance of the framework because it combines quantitatively ranked priorities with qualitatively identified implementation requirements.

5. CONCEPTUAL MANAGEMENT FRAMEWORK IMPLICATIONS

The survey findings indicate that the proposed conceptual management framework should prioritise transaction points where poor visibility creates the greatest operational and financial risk. These transaction points include requisitions, purchase orders, goods received notes, invoice processing, and payment authorisation. The proposed framework does not require SMEs to replace all existing systems. Instead, it links key operational functions through mobile site-data capture, procurement-to-payment validation, budget and cash-flow dashboards, and synchronised posting to the accounting ledger.

Three-way matching forms a central control mechanism within the framework because it compares the approved purchase order, GRN, and supplier invoice before payment is released. This can reduce the risk of mismatches, duplicate payments, and unrecorded liabilities (Doxey, 2021). Audit trails and exception alerts are also important because the survey findings indicate problems related to late goods received notes, stock mismatches, and payment-approval delays.

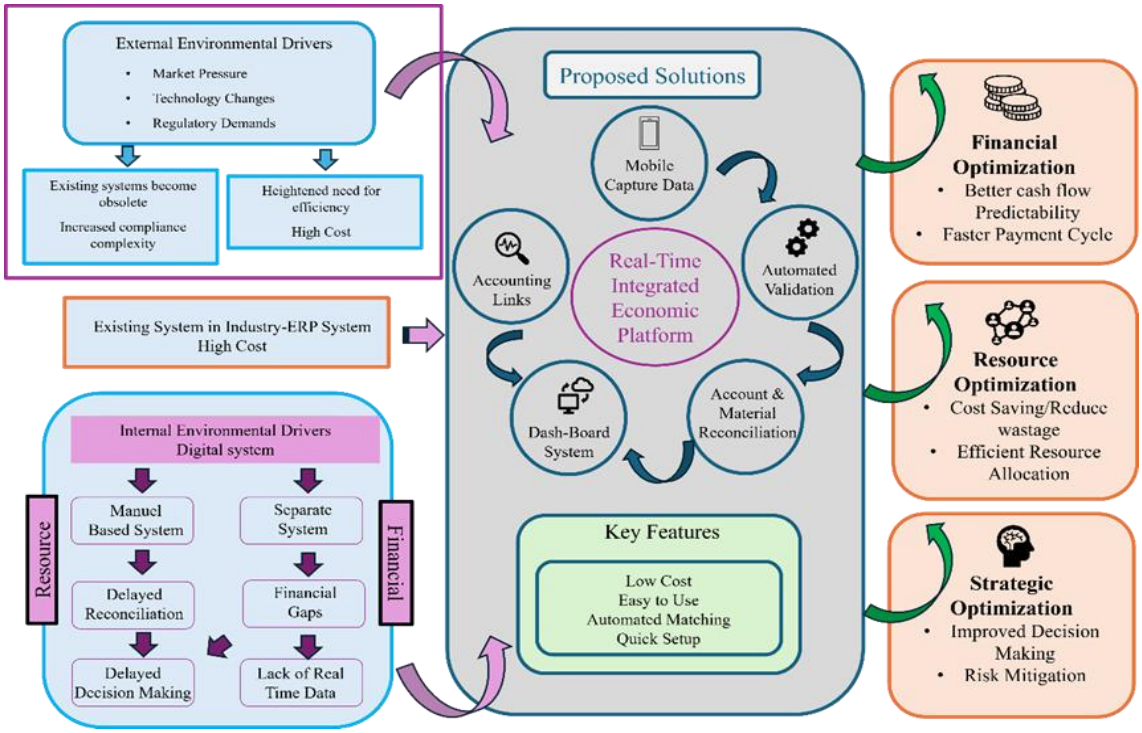

Figure 6: Conceptual management framework

The framework should be mobile-first, affordable, and modular to suit SME conditions. Mobile or tablet-based capture is required because primary operational evidence is generated at site level, while phased implementation can reduce cost and resistance to change (Radman et al., 2025).

6. CONCLUSIONS

This study developed a conceptual management framework for strategic resource and financial optimisation in Sri Lankan construction SMEs using 30 questionnaire responses and eight semi-structured interviews. The findings indicate that SMEs are affected by fragmented records, duplicated data entry, weak site-finance integration, and limited digital visibility. The RII analysis identified budget overruns, wastage, stock mismatches, cash-flow uncertainty, and poor cost visibility as the most critical issues.

Theoretically, the study contributes by linking digital transformation in construction SMEs with an integrated management framework that connects site-level resource evidence with financial-control requirements. Practically, the framework supports SMEs in identifying key information flows, validation controls, and decision-support functions for improving stock accuracy, supplier-payment monitoring, budget control, cost visibility, and cash-flow decision-making.

The study is limited to conceptual framework development and preliminary empirical investigation. It does not develop or test a fully operational software prototype. Future research should develop and evaluate a working prototype in live construction SME project settings.

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