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Original Research Article

Risk-Based Quality Assurance and Performance Optimization in Multi-Disciplinary Construction Projects: A Framework for Saudi Vision 2030

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Abstract: Multidisciplinary construction projects can satisfy individual inspection plans and still produce a system that fails when civil, mechanical, electrical and controls packages are brought together. This paper proposes a risk-based quality assurance framework that makes those interfaces a distinct unit of assurance. It combines requirement traceability, consequence-based prioritization, inspection and test planning, evidence-based release and performance feedback. A structured narrative review of construction rework, quality management, project risk and digital coordination informs the design. An illustrative pump station scenario demonstrates how the framework addresses concealed interfaces, late design changes and schedule pressure. A comparative pilot is proposed to test whether the framework improves first-pass acceptance and reduces repeat defects while preserving required inspections. The framework supports Saudi Vision 2030 through traceable infrastructure handover. Field validation requires contractor and owner project records.

Keywords: Risk-Based Quality Assurance, Construction Interfaces, Inspection Planning, Rework, Quality Performance, Saudi Vision 2030.

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1. INTRODUCTION

Construction quality is often assessed through discipline-specific checklists. A structural inspector may confirm a plinth, a mechanical inspector may verify equipment alignment and an electrical inspector may accept a cable installation. Each decision can be defensible within its assigned scope. A system can still fail during commissioning if the plinth position leaves too little access for adjustment, the access route conflicts with a cable tray or the controls sequence assumes a sensor response that the installed arrangement cannot deliver. The cost of that failure reflects more than the repair itself. Temporary protection, access reinstatement, retesting and interruption to adjacent trades can multiply the consequences.

The organizational structure of major projects makes this problem persistent. Designers work with information at different levels of maturity. Procurement may award packages before certain interfaces have been coordinated. Subcontractors are measured against installation quantities and completion dates. Quality personnel often inherit inspection plans after those decisions have established the main sources of exposure. A register that merely restates generic risks such as poor workmanship gives them limited guidance on which activity to examine before the next irreversible step.

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Saudi Vision 2030 provides a policy context for examining this delivery problem. Infrastructure, logistics and industrial development depend on assets that can enter service with verified performance and maintenance information. At the project level, the pathway from quality assurance to these outcomes is practical. Earlier interface verification can reduce avoidable opening up of completed work. A reliable handover record can make it easier for operators to locate the equipment, approved changes and tests that define their maintenance baseline. Developing local competence in coordination and inspection can help retain that capability across projects. These relationships are mechanisms to investigate, and their strength will depend on the projects studied.

AIM AND OBJECTIVES

The aim is to develop a practical framework for directing quality assurance effort toward the most consequential failure modes in multidisciplinary construction. The objectives are to identify common mechanisms of interface failure, define how quality risks become controlled work and release decisions, specify performance measures that distinguish delivery improvement from changes in inspection intensity, and design a pilot for evaluating the framework in Saudi construction. The focus is on owner and contractor decisions from design coordination through commissioning and handover.

Research Questions

How should teams identify and prioritize quality risks that extend across contracts or disciplines? What evidence should be available before a work front advances past a consequential or irreversible stage? Which measures can show improvement while accounting for differences in scope, workload and detection opportunity? How can a Saudi owner introduce the framework without creating a parallel quality management system that duplicates existing approvals?

2. REVIEW METHODOLOGY

This paper uses a structured narrative review to build a framework. It draws on studies of rework, quality defects, construction risk, building information modelling and field verification, alongside quality and information management standards and Saudi policy documents. The material was selected for its ability to explain how failures originate, how they are detected and how a control can be translated into an inspectable decision. Foundational studies were retained where their contribution remains applicable to fragmented design and construction delivery. Standards and policy documents serve different purposes from empirical studies and are interpreted accordingly.

Three themes guided synthesis. The first concerned defect pathways, including unclear requirements, design change, poor field execution and incomplete transfer of information. The second concerned assurance mechanisms and the point at which intervention remains possible. The third concerned performance measurement and the possibility that improved detection can initially increase reported defects. The proposed workflow was checked against a hypothetical pump station to expose missing roles, weak release rules and limitations of the scoring approach. This design exercise provides internal consistency checks. It cannot establish effectiveness in a live project or estimate a population-wide effect.

The unit of analysis is an interface or activity that can be linked to a defined release decision. That unit may be a single penetration, an equipment assembly or a sequence linking several subsystems. Project-wide findings from case studies can inform the selection of plausible failure pathways, but their reported rework percentages are sensitive to procurement, reporting practices and the allocation of indirect costs. For that reason the framework uses those studies to identify mechanisms and measurement issues rather than importing published cost values as Saudi forecasts.

3. Thematic Review and Critical Analysis

Defect Generation at Interfaces

Rework studies distinguish errors already present in the design from deviations introduced during construction. At an interface, both can occur together. A drawing can give conflicting datum information while an installer independently adopts the wrong revision. A checklist that records dimensional compliance against the drawing in hand may miss the combined cause. Investigation needs to identify the controlling requirement, how it reached the work front and what decision authorized the next trade to proceed.

Responsibility can be equally consequential. A package may specify supply of a fire-rated product while another package owns installation and a third controls access for inspection. Evidence can disappear when the installer assumes the supplier's product certificate also proves suitability of the assembled configuration. Assigning an interface owner gives the project a named person to coordinate evidence across packages. It does not remove the technical responsibilities of those who design, install or independently accept the work.

Fault trees can help teams identify where several conditions must align before a failure occurs. For a concealed penetration, the initiating conditions might include an undocumented service substitution

and an inspection scheduled after closure. Addressing either condition can reduce exposure. Yet fault trees become difficult to maintain if built for every routine installation. They are most useful for critical, recurrent or disputed failure pathways, where the additional effort clarifies which control actually breaks the chain.

Digital Coordination and Physical Verification

A coordinated model helps teams see clashes and communicate dependencies, particularly where drawings represent the same space from different perspectives. Its value depends on agreed coordinates, publication status and the maturity of each discipline's model. Apparent absence of a clash can be misleading when access envelopes, insulation, temporary works or permissible tolerances are missing. A clash report should therefore document what was checked and which model versions were suitable for that check.

A field observation answers a different question. It shows what was measured or observed at a specific place and time, under stated conditions. A point cloud may confirm geometry where visibility and accuracy are adequate. It cannot establish a material property, the condition of a surface hidden behind equipment or the correct operation of an interlock. The inspection plan should pair each requirement with evidence suited to the relevant property. A link from the model to a test record is useful if the team can verify the test's identity, authority and outcome.

Digital adoption has a cost. Smaller subcontractors may operate effectively with controlled offline forms and scheduled synchronization. Forcing them to maintain duplicate data entry can produce inconsistent records and delayed closure. A common evidence structure matters more than a common screen. The owner can specify minimum identifiers, decision fields and export formats while allowing contractor systems to produce those records through a controlled mapping.

Quality Risk and Measurement

Likelihood and consequence scores help teams agree where to allocate effort, but ordinal scales can disguise disagreement. A moderate numerical product can arise from a severe event judged rare or from frequent defects judged easy to recover. Treating both cases alike overlooks the owner's duty to protect critical functions and the uncertainty behind a rare-event estimate. A prioritization method should separate consequence overrides from ordinary ranking and make the basis for each score visible.

Quality outcomes also depend on surveillance. When a project adds a targeted inspection, the recorded nonconformity count can rise because previously missed defects become visible. If the project rewards the lowest number of reports, supervisors have an incentive to suppress observations or redefine them. First-pass acceptance, repeat defects and escaped defects each answer a different question. Interpretation requires stable definitions, denominators and information on which opportunities were actually inspected.

4. PROPOSED QUALITY ASSURANCE FRAMEWORK

Establish the requirement baseline

Start with an interface register linked to the approved design, applicable contract clauses and governing technical requirements. For each consequential interface, record location, involved packages, design revision, asset or system identifier, inspection stage, acceptance criterion, evidence type and release authority. The record should distinguish who provides the evidence from who accepts it. An interface can remain open while design work advances, provided its unresolved status is visible and the next affected release has a clear restriction.

A change to any referenced requirement triggers an impact review. The reviewer identifies installed work that could be affected, inspections that may have relied on superseded values and downstream work already released. The project retains the prior decision and records whether its evidence remains usable, needs supplementing or must be replaced. A new drawing revision should never silently convert an earlier acceptance into proof that the changed requirement was met.

Requirement ownership is especially important in design and build arrangements. If the nominated design authority and field release authority disagree, the item remains open until the appropriate decision is documented. The work front can continue on other segments if they are separable, formally released and protected from the unresolved change. Defining that separation avoids an informal whole-site stoppage while preserving the boundary around uncertain work.

Prioritize the Exposure and Assign Controls

The risk record describes a specific failure mode, its initiating conditions and what happens if it passes the proposed decision point undetected. Consequence considers safety, intended function, access after installation, potential cost and schedule disruption. The highest relevant consequence governs criticality when a severe outcome would otherwise disappear in a combined score. The team records its basis for likelihood, drawing from design maturity, past defects, supplier history, complexity

and inspection results. Where evidence is sparse, uncertainty is recorded and may justify additional review.

A three-tier operating model keeps the decision usable. Critical items include failures with serious consequences or important evidence that would become inaccessible. They require an approved verification step before release and documented authority. Elevated items receive targeted checks at a suitable stage, with escalation when failures recur. Routine items use the project's normal inspection plan. Any check mandated by contract, code or approved procedure remains in force across all tiers. The framework determines how to add attention where exposure warrants it.

Review frequency depends on how quickly conditions change. A stable repetitive process can be reviewed periodically using recent results. An unfamiliar supplier, revised method or large influx of subcontract labor warrants earlier reconsideration. A previously routine issue can become elevated when defects cluster across lots or when its effect on another system becomes apparent. Tier changes should preserve their date, evidence and approving authority so that later analyses can reconstruct the applicable control.

Table 1: Risk tiers and release controls

Risk tier	Typical trigger	Verification and release
Critical	Serious consequence or evidence lost after concealment	Verify at the approved gate. Record the authorized disposition.
Elevated	Uncertain execution or a recurring defect	Add a targeted check and escalate repeated failures.
Routine	Stable process and readily recoverable deviation	Apply the approved inspection plan and monitor trends.

These tiers supplement mandatory inspection and test requirements.

Plan Verification before Release

Each gate answers a decision question. A design release might ask whether the equipment envelope and embedded supports use compatible dimensions. A pre-concealment gate asks whether the installed arrangement satisfies approved requirements while evidence is still accessible. A commissioning gate asks whether the completed system delivers the intended function under the authorized test conditions. Assigning these questions prevents routine paperwork from being mistaken for verification of a different property.

The gate record should contain the observation or test result, the acceptance basis, the instrument or method where relevant, the inspection date and the authorized disposition. Where an inspector finds a defect, the disposition and verification of corrective work are separate events. An approved technical concession must record its scope, conditions and dependencies. Schedule milestones should recognize the difference between installed quantity and work authorized to advance.

A missed hold point is itself a condition requiring controlled resolution. The decision maker assesses whether alternative evidence can support an engineering evaluation, whether opening up is necessary and whether the original acceptance route permits the proposed disposition. This avoids using an incomplete digital record as a proxy for physical verification. Decisions should be traceable to the requirements that governed the work at the time.

Close the Feedback Loop

Track both the immediate defect and its recurrence pathway. An individual misalignment may be corrected by adjusting the installed item. Preventing repetition may require a revised survey handoff, a different positioning fixture or earlier confirmation of an equipment vendor dimension. A closure record should distinguish these levels and specify how the team will test whether the corrective action persists in later work.

Use short quality reviews with production and design teams to examine repeated mechanisms rather than read the entire defect register. The agenda can focus on newly exposed critical items, open cross-package decisions and recurring failures with sufficient evidence for action. Shared ownership matters because the team that incurs rework may have little authority to change the upstream decision that created it. Escalation through the owner or program management office can resolve that imbalance when the remedy spans contracts.

5. ILLUSTRATIVE APPLICATION

Pump Station Interface before Concrete Placement

Consider a hypothetical pump station with separate packages for reinforced concrete, mechanical equipment, power distribution and controls. The civil team prepares the pump bases using a released layout. A vendor submittal revises the footprint of a motor assembly and changes the preferred orientation of its service connection. The cable team has also identified a conflict between the planned entry and a support bracket. These

observations must be assessed together before the base geometry and embedded items become difficult to modify.

The interface register links the equipment identifier, vendor drawing, civil setting-out information and cable entry detail. The owner assigns an interface coordinator to bring together the designer, vendor representative and package supervisors. The coordinator records that a late correction could require drilling or rebuilding a base, impair alignment or delay adjacent installation. The item receives critical treatment because placement would conceal some evidence and constrain correction. A surveyed record, coordinated revision and responsible engineering approval are needed before release.

Suppose the base is ready for placement and the revised layout is approved, but the survey identifies an embedded assembly outside the approved tolerance. A foreman proposes recording the discrepancy for later action so the pour can proceed. Under the framework, the interface stays open. The team can correct the item and verify it before the pour, or seek a documented technical disposition under the approved procedure. A release based solely on the future possibility of adjustment would leave downstream teams exposed to a condition they have not accepted.

System Commissioning and Evidence Transfer

At commissioning, an operator observes that local equipment status and the control room display disagree under an authorized test sequence. The earlier civil and mechanical evidence remains valid for the properties it verified. The issue is logged against the controls interface and the approved functional requirement. The commissioning team identifies which downstream acceptance activities rely on that signal and restricts their release until correction and retesting are complete.

The handover package includes the final equipment identity, current approved documents, completed inspections, relevant deviations and retest outcomes. It also records any formally accepted outstanding item and its owner. Operations can then distinguish the design and maintenance baseline from records retained for history. This example illustrates how a single interface chain can span separate acceptance decisions while preserving accountability for each.

6. PERFORMANCE EVALUATION

Indicators and Interpretation

First-pass acceptance is the number of distinct items accepted at their initial eligible inspection divided by the number receiving an eligible initial inspection. Resubmitted records do not create extra opportunities. The denominator excludes cancelled inspections and distinguishes partial inspections from completed ones. Report the measure by discipline, criticality and work type because a program-wide average may improve when the project simply moves into less complex work.

Repeat defect rate measures verified recurrences of an agreed failure mode per comparable opportunity after a corrective action takes effect. Escaped defects measure defects first detected after the stage at which the plan intended to detect them. A critical escape can justify an investigation even when the count is low. Inspection coverage indicates whether the project examined enough of the eligible population for the reported results to be interpreted. Where coverage differs materially, a simple comparison of defect rates is weak evidence of improvement.

Rework effort can be tracked using direct labor hours and separately disclosed material, access and retest costs. Quality teams should avoid counting a schedule delay as a direct rework cost unless the cost allocation is defined. A decision-time metric from complete evidence submission to authorized disposition can show whether the gate structure creates unnecessary waiting. Report both the central tendency and upper tail because a small number of long delays can disrupt an entire sequence.

Table 2: Illustrative pilot indicators

Indicator	Baseline	Pilot
First-pass acceptance	84 of 100 (84%)	96 of 120 (80%)
Pre-concealment coverage	70 of 100 (70%)	114 of 120 (95%)

The hypothetical figures show why acceptance and coverage need separate interpretation. Compare similar interfaces and check for defects discovered after concealment.

Comparative Pilot Design

Select repeated work packages with similar technical scope and obtain a baseline using the existing inspection process. Introduce the framework at planned points across packages, retaining comparison packages under the existing process where practical. Before launch, define the outcomes, eligibility rules, intervention start and treatment of deviations. Record contractor changes, design churn and workload, since each can influence quality performance independently of the new framework.

A retrospective comparison is useful for identifying hypotheses. A planned staggered rollout offers better control of coincident shifts, provided the implementation sequence does not merely assign the strongest contractors first. If sufficient observations exist, estimate differences in outcome changes and show uncertainty intervals. Inspection events are clustered by crew and work front, so an analysis that assumes each event is independent can overstate precision. Where data are sparse, use descriptive results and document plausible rival explanations.

Review a sample of source records independently to verify consistent coding and identify missing evidence. Include false closure, such as a defect marked resolved when the required retest was absent. Interview inspectors and supervisors about workarounds and whether the process moved decisions earlier. Qualitative evidence can explain why the framework worked in one package and stalled in another without being treated as proof of a program-wide effect.

7. DISCUSSION

The framework places responsibility for evidence at the same level as responsibility for production. Its value comes from recognizing that a civil item, equipment arrangement and controls requirement can interact even when each contract is managed separately. The more explicitly an owner specifies its interface requirements during procurement, the less time field personnel spend deciding who owes a document or who can authorize a release. However, detailed contractual requirements remain useful only if the project can maintain them as design and suppliers change.

A lean implementation would begin with one or two difficult interfaces where failures are observable and the owner can compare ordinary and enhanced assurance. Work packages with repetition offer a better basis for learning than isolated flagship activities. The project can start with a controlled register and existing inspection forms, then connect those records to the common data environment after identifiers and decision rights are stable. Scaling software before resolving terminology can make inconsistent practice appear uniform.

A trade-off arises when more gates improve visibility but delay work. The appropriate comparison is the value of earlier detection and reliable release against the burden of generating, checking and holding evidence. The cost of an additional review is more defensible at a point where the team can prevent costly closure or avoid repeating a defect across several locations. Routine, low-consequence work remains subject to its ordinary assurance process so scarce technical review capacity can be directed to items that justify it.

Saudi owners can translate Vision 2030 alignment into procurement and workforce practices that can be observed. For example, tender requirements can specify evidence formats, demonstrated coordination competence and a method for handing over approved deviations. Project teams can track whether Saudi inspectors and engineers participate in interface reviews and acquire authority commensurate with demonstrated competence. Skills development should be assessed through the quality of decisions and evidence, while broader local participation metrics remain a separate program concern.

At procurement, the owner can request a sample interface record and require bidders to show how a late design change reaches field inspectors. This tests the proposed handoff before the project relies on it for an actual release decision.

8. LIMITATIONS AND FUTURE RESEARCH

The review uses a purposeful selection of studies and documents. It does not represent a systematic search of every relevant database or establish pooled effects. The illustrative scenario uses no project measurements. The severity tiers are designed to support discussion and traceability, and the final decision criteria must be adapted to the owner's technical and contractual requirements. Variation in reporting culture and access to contractor records may constrain comparisons across projects.

Future work should examine whether organizations assign criticality consistently, which interfaces account for the largest share of avoidable late failures and how changes in inspection coverage affect trends. Studies can compare controlled document workflows with model-linked evidence under similar project conditions. Analysis of operational maintenance records could investigate whether better construction traceability makes subsequent work orders easier to resolve. That relationship requires a clear link between construction records, asset identity and operating history.

9. CONCLUSION

Multidisciplinary construction quality depends on decisions made between packages and at the points where evidence becomes harder to obtain. The proposed framework connects those decisions to a defined requirement, credible failure modes, an appropriate inspection stage and accountable release authority. It preserves mandatory inspections and gives teams a basis for adding effort to consequential

interfaces. Separate indicators for inspection coverage, first-pass acceptance, recurrence and escaped defects support a more credible evaluation than raw defect counts. A comparative pilot would establish whether the approach improves project performance in practice and where its workload is justified. Within Saudi Vision 2030, the intended contribution is infrastructure that enters service with verifiable quality and usable handover information.

REFERENCES

- Akinci, B., Boukamp, F., Gordon, C., Huber, D., Lyons, C., & Park, K. (2006). A formalism for utilization of sensor systems and integrated project models for active construction quality control. Automation in Construction, 15(2), 124–138. https://doi.org/10.1016/j.autcon.2005.01.008
- Aljassmi, H., & Han, S. (2013). Analysis of causes of construction defects using fault trees and risk importance measures. Journal of Construction Engineering and Management, 139(7), 870–880. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000653
- Azhar, S. (2011). Building information modeling (BIM). Trends, benefits, risks, and challenges for the AEC industry. Leadership and Management in Engineering, 11(3), 241–252. https://doi.org/10.1061/(ASCE)LM.1943-5630.0000127
- Bosché, F. (2010). Automated recognition of 3D CAD model objects in laser scans and calculation of as-built dimensions for dimensional compliance control in construction. Advanced Engineering Informatics, 24(1), 107–118. https://doi.org/10.1016/j.aei.2009.08.006
- Bryde, D., Broquetas, M., & Volm, J. M. (2013). The project benefits of building information modelling (BIM). International Journal of Project Management, 31(7), 971–980. https://doi.org/10.1016/j.ijproman.2012.12.001
- Burati, J. L., Farrington, J. J., & Ledbetter, W. B. (1992). Causes of quality deviations in design and construction. Journal of Construction Engineering and Management, 118(1), 34–49. https://doi.org/10.1061/(ASCE)0733-9364(1992)118:1(34)
- Eastman, C., Lee, J.-M., Jeong, Y.-S., & Lee, J.-K. (2009). Automatic rule-based checking of building designs. Automation in Construction, 18(8), 1011–1033. https://doi.org/10.1016/j.autcon.2009.07.002
- Hoonakker, P., Carayon, P., & Loushine, T. (2010). Barriers and benefits of quality management in the construction industry. An empirical study. Total Quality Management & Business Excellence, 21(9), 953–969. https://doi.org/10.1080/14783363.2010.487673
- Hwang, B.-G., Thomas, S. R., Haas, C. T., & Caldas, C. H. (2009). Measuring the impact of rework on construction cost performance. Journal of Construction Engineering and Management, 135(3), 187–198. https://doi.org/10.1061/(ASCE)0733-9364(2009)135:3(187)
- International Organization for Standardization. (2018). Guidelines for auditing management systems (ISO 19011:2018). https://www.iso.org/standard/70017.html
- International Organization for Standardization. (2018). Organization and digitization of information about buildings and civil engineering works, including building information modelling — Information management using building information modelling — Part 1. Concepts and principles (ISO 19650-1:2018). https://www.iso.org/standard/68078.html
- International Organization for Standardization. (2018). Organization and digitization of information about buildings and civil engineering works, including building information modelling — Information management using building information modelling — Part 2. Delivery phase of the assets (ISO 19650-2:2018). https://www.iso.org/standard/68080.html
- International Organization for Standardization. (2018). Quality management — Guidelines for quality plans (ISO 10005:2018). https://www.iso.org/standard/70398.html
- International Organization for Standardization. (2018). Risk management — Guidelines (ISO 31000:2018). https://www.iso.org/standard/65694.html
- International Organization for Standardization. (2026). Quality management systems — Requirements (ISO 9001:2026). https://www.iso.org/standard/9001
- Josephson, P.-E., & Hammarlund, Y. (1999). The causes and costs of defects in construction. A study of seven building projects. Automation in Construction, 8(6), 681–687. https://doi.org/10.1016/S0926-5805(98)00114-9
- Kingdom of Saudi Arabia. (2016). Saudi Vision 2030. https://www.vision2030.gov.sa/en/

- Kingdom of Saudi Arabia. (n.d.). National Industrial Development and Logistics Program. https://www.vision2030.gov.sa/en/explore/programs/national-industrial-development-and-logistics-program
- Love, P. E. D., & Edwards, D. J. (2004). Forensic project management. The underlying causes of rework in construction projects. Civil Engineering and Environmental Systems, 21(3), 207–228. https://doi.org/10.1080/10286600412331295955
- Love, P. E. D., & Li, H. (2000). Quantifying the causes and costs of rework in construction. Construction Management and Economics, 18(4), 479–490. https://doi.org/10.1080/01446190050024896
- Sacks, R., Koskela, L., Dave, B. A., & Owen, R. (2010). Interaction of lean and building information modeling in construction. Journal of Construction Engineering and Management, 136(9), 968–980. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000203
- Saudi Building Code National Committee. (n.d.). Saudi Building Code. https://sbc.gov.sa/
- Succar, B. (2009). Building information modelling framework. A research and delivery foundation for industry stakeholders. Automation in Construction, 18(3), 357–375. https://doi.org/10.1016/j.autcon.2008.10.003
- Turkan, Y., Bosché, F., Haas, C. T., & Haas, R. (2012). Automated progress tracking using 4D schedule and 3D sensing technologies. Automation in Construction, 22, 414–421. https://doi.org/10.1016/j.autcon.2011.10.003
- Zou, P. X. W., Zhang, G., & Wang, J. (2007). Understanding the key risks in construction projects in China. International Journal of Project Management, 25(6), 601–614. https://doi.org/10.1016/j.ijproman.2007.03.001.