OPEN ACCESS
Journal of Computer Science Advancements
Vol. 4 No. 5. October 2026, pp. 286-303
DOI. 10.70177/jsca.v4i5.4535
Research Article

REQUIREMENT ANALYSIS AND ARCHITECTURAL DESIGN OF AN INTEGRATED DECISION SUPPORT INFORMATION SYSTEM FOR TECHNICAL CONSULTANTS IN INDONESIAN NAVY (TNI AL) SUBMARINE CONSTRUCTION OVERSIGHT

Febri Ichsani[1], Yulis Andreas Lorentius[2], and Beben Afendi[3]
[1] Politeknik Angkatan Laut, Indonesia
[2] Politeknik Angkatan Laut, Indonesia
[3] Politeknik Angkatan Laut, Indonesia

Corresponding Author:
Febri Ichsani,
Department of Naval Operational Strategy, Politeknik Angkatan Laut.
Ciledug Raya Street No.2, Seskoal, South Jakarta, DKI Jakarta, Indonesia
Email: febriichsani348@gmail.com

Article Info
Received: April 7, 2026
Revised: July 13, 2026
Accepted: September 9, 2026
OnlineVersion: October 31, 2026

Abstract
Submarine construction oversight requires coordinated documentation, accountable decisions, and timely communication, yet fragmented information systems often complicate quality assurance and governance in complex naval programs. To address this, the study formulates functional and nonfunctional requirements to propose an integrated decision support information system architecture for technical consultants supporting Indonesian Navy submarine construction oversight. Using a qualitative, design-oriented approach combining stakeholder interviews, document analysis, workflow mapping, and requirements prioritization, the architectural modeling examines user roles, information flows, access controls, interoperability, and auditability based on systems engineering principles. The resulting design is a modular platform integrating document management, requirements traceability, inspection reporting, issue tracking, and decision records within a secure governance framework, evaluated on usability, traceability, consistency, accountability, and security compliance. The study concludes that this human-centered architecture can enhance coordination and transparency without replacing professional engineering judgment, while recommending future research to validate requirements, test prototypes, and quantify administrative and decision-making improvements while safeguarding sensitive technical data.

Keywords: Decision Support Systems; Information System Architecture; Requirements Analysis; Submarine Construction; Technical Consultancy.

© 2026 by the author(s)
This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution-ShareAlike 4.0 International (CC BY SA) license (https://creativecommons.org/licenses/by-sa/4.0/).

Journal Homepage https://research.adra.ac.id/index.php/jcsa
How to cite: Ichsani, F., Lorentius, A. Y., & Afendi, B. (2026). Requirement Analysis and Architectural Design of an Integrated Decision Support Information System for Technical Consultants in Indonesian Navy (TNI AL) Submarine Construction Oversight. *Journal of Computer Science Advancements, 4*(5), 286–303. https://doi.org/10.70177/jsca.v4i5.4535
Published by: Yayasan Adra Karima Hubbi

INTRODUCTION

Naval construction programs depend on coordination among engineering consultants, project administrators, quality assurance personnel, and decision makers (Maia et al., 2024). Submarine construction oversight presents demanding documentation requirements because technical judgments, inspection records, contractual obligations, and approvals must remain consistent throughout development (Zhong et al., 2024). Information systems can support these activities by organizing evidence and preserving accountability without replacing specialist judgment or disclosing sensitive engineering information.

Technical consultants contribute to oversight by examining documented requirements, reviewing inspection findings, identifying unresolved issues, and communicating recommendations (Parece et al., 2025). Their responsibilities involve evidence from organizational units and document formats. Information fragmentation can complicate the reconstruction of decisions and the identification of outstanding requirements (Singh et al., 2025). An integrated decision support information system offers a mechanism for consolidating authorized records and improving administrative traceability.

Digital transformation in engineering governance emphasizes data integrity, interoperable workflows, and transparent decision histories (Hoehner et al., 2025). Requirements engineering provides principles for capturing stakeholder needs and maintaining traceability throughout development, as reflected in ISO/IEC/IEEE 29148. Architectural design complements these principles by organizing system components around stakeholder concerns (Nada et al., 2025). Their application to Indonesian Navy oversight requires sensitivity to institutional authority, confidentiality, and user needs.

The first research problem concerns uncertainty about the information needs of technical consultants in submarine oversight (Özener & Büyüktopcu, 2025). Different stakeholders may require document retrieval, issue monitoring, inspection status, or approval histories, yet these needs cannot be inferred from generic project management software (Iturralde Carrera et al., 2026). Unclear requirements could produce disconnected features, inconsistent records, and administrative burdens for authorized users.

The second problem involves translating stakeholder needs into an architecture that supports secure information exchange (El-Khouly et al., 2026). Oversight documentation may be distributed across separate repositories, organizational responsibilities, and review stages. Without integration and access controls, users may encounter outdated information or ambiguous approval histories (Țenea et al., 2025). Architecture must balance usability, traceability, confidentiality, maintainability, and interoperability without unrestricted sharing.

The third problem concerns evaluating whether proposed system features support defensible professional decisions (Du et al., 2026). Dashboards and automated notifications may make records visible without establishing their accuracy or decision relevance. Technical consultants still need contextual explanations, evidence, and clear responsibility boundaries (Salah Eldeen Taha et al., 2026). An effective decision support system should facilitate review and escalation while retaining accountable human authorization for engineering assessments.

This study aims to elicit and analyze functional and nonfunctional requirements for an integrated decision support information system serving technical consultants (Herawati et al., 2024). Functional requirements will address document management, issue tracking, inspection reporting, approval records, and requirements traceability. Nonfunctional requirements will

address security, usability, reliability, interoperability, and auditability (Arif et al., 2024). Stakeholder validation will determine which needs are essential in this setting.

The second objective is to develop an architectural design translating validated requirements into coherent information services and governance mechanisms (Baroroh et al., 2024). Proposed components will support controlled access, structured records, traceable decisions, and integration with institutional processes (Gaussyah et al., 2026). Architectural representations will describe responsibilities and information flows at a suitable level, excluding restricted technical specifications and operationally sensitive details.

The third objective is to establish evaluation criteria for the architecture before deployment (Soemarmi et al., 2025). Assessment will consider completeness of requirements, consistency of workflows, understandability of interfaces, adequacy of access controls, and traceability of review decisions (Triwidiyanti et al., 2024). Feedback from authorized stakeholders can identify design weaknesses and competing priorities. Subsequent prototype testing would establish whether intended benefits are achievable.

Existing systems engineering standards provide guidance on requirements definition, validation, and lifecycle traceability. ISO/IEC/IEEE 29148 specifies systematic requirements engineering processes, while ISO/IEC/IEEE 42010 addresses architectural descriptions and stakeholder concerns (Pranowo et al., 2025). These standards offer established foundations rather than a ready made solution for each institution. Their general applicability leaves contextual decisions about consultant workflows and governance responsibilities unresolved.

Research on digital shipbuilding and engineering information management has explored coordination, lifecycle information integration, and digital project oversight (Badrudin et al., 2026). Such scholarship supports the rationale for connected records and improved visibility. Its findings cannot automatically establish the requirements of Indonesian Navy technical consultants (Parimba et al., 2024). Oversight responsibilities, document permissions, and review practices must be examined instead of transferred from commercial construction contexts.

Decision support research also offers approaches for organizing information, prioritizing issues, and presenting evidence to users (Sulistiyawati et al., 2024). Nevertheless, features that assist administrative decisions do not necessarily provide adequate traceability or security for specialized naval construction oversight (Rugebregt et al., 2025). The gap addressed here concerns the contextual alignment of elicited consultant requirements, architecture decisions, and auditable oversight processes within a design framework.

The proposed novelty lies in connecting stakeholder centered requirements analysis with an architecture organized around technical consultancy oversight and decision accountability (Murdianto et al., 2026). Instead of treating the system as a generic project dashboard, the research emphasizes traceable relationships among requirements, documents, inspections, issues, and authorized decisions (Li et al., 2025). The originality claim remains provisional until comparison with implemented systems is completed.

Methodologically, the study proposes combining interviews, document analysis, workflow mapping, requirements prioritization, and architectural evaluation (Putra et al., 2026). Linking each design decision to a validated stakeholder need can increase transparency and expose unresolved assumptions (Al Fatih et al., 2025). Architectural review would examine tradeoffs between usability, interoperability, and information protection. This structured combination offers a reproducible design rationale without claiming that its methods are new.

The study is justified by the importance of trustworthy information governance in construction oversight (Bakka et al., 2026). A well specified system could reduce ambiguity, support coordinated review, and preserve accountability, provided its design receives authorized validation (Huda et al., 2024). Practical contributions may include requirements catalogue, traceability matrix, and architectural blueprint. Real improvements in efficiency and decision quality must be demonstrated through prototype evaluation.

RESEARCH METHOD

Research Design

This study employs a qualitative design science research approach to develop and evaluate the requirements and conceptual architecture of an integrated decision support information system for Indonesian Navy submarine construction oversight (Cheng et al., 2026). By combining stakeholder-centered requirements engineering with iterative architectural design, the study emphasizes documentation governance, decision traceability, usability, and controlled information access without exposing restricted technical details.

The unit of analysis centers specifically on the oversight information workflow rather than submarine engineering specifications or operational capabilities (Ohse et al., 2025). This methodological choice is appropriate because the intended contribution is a validated design artifact prioritizing accountable human decisions over automated engineering judgments, remaining a proposal until authorized users assess its suitability and a controlled prototype demonstrates feasibility.

Research Target/Subject

The target population comprises professionals authorized to participate in construction oversight information management, including technical consultants, project administrators, quality assurance representatives, document controllers, information security personnel, and governance specialists (Bashirov et al., 2024). Purposive sampling will be utilized to identify approximately 15 to 20 participants who possess direct knowledge of administrative workflows and requirements management.

To capture diverse information needs and potential conflicts between accessibility and confidentiality, maximum variation across professional responsibilities will be sought (Wu et al., 2026). Eligibility requires relevant experience, institutional authorization, adulthood, and voluntary informed consent, while participant characteristics will be reported in broad categories to protect institutional identities and project details.

Research Procedure

The study will commence with obtaining institutional permission, securing ethics review, and establishing a documented scope that defines permitted information categories. Researchers will subsequently review accessible administrative documents, conduct consented interviews, map existing administrative workflows, and transcribe or deidentify recordings and notes accordingly.

Following data gathering, candidate requirements will be prioritized collaboratively based on stakeholder importance, feasibility, and information protection, followed by successive design reviews and low-fidelity prototype evaluations. The process concludes with an explicit

change control mechanism documenting revisions, residual uncertainties, and conditions for further institutional review before any implementation or deployment.

Instruments, and Data Collection Techniques

Data collection instruments will feature a semi-structured interview guide, a document review matrix, a workflow mapping template, and a requirements validation form to investigate information retrieval, document version control, approvals, and issue escalation. These instruments will be thoroughly reviewed by experts in requirements engineering, information governance, and qualitative methodology for clarity and content relevance, supplemented by a small pilot interview to refine ambiguous questions.

Data collection techniques will involve gathering information through consented interviews, reviewing approved templates, administrative procedures, and nonrestricted quality records, and structuring functional and nonfunctional requirements into a comprehensive catalogue. Furthermore, architectural representations will employ context diagrams, use cases, process models, and component descriptions at an administrative level while strictly excluding classified designs and technical performance parameters.

Data Analysis Technique

Data analysis will utilize thematic analysis to identify recurring needs, exceptions, and disagreements from interview transcripts and field notes, complemented by systematic document comparison to verify stated procedures and uncover unresolved requirements. This analytical process ensures that qualitative insights regarding administrative workflows are rigorously categorized and cross-verified against approved administrative documents.

Additionally, a traceability matrix will be constructed to connect validated requirements with proposed architectural components and acceptance criteria, evaluating completeness, consistency, usability, and auditability. Unresolved disagreements will be retained in a formal decision log, and findings will be presented as design evidence rather than statistical proofs of improved construction outcomes.

RESULTS AND DISCUSSION

The proposed results framework begins with a transparent account of the materials available for requirements analysis. Relevant evidence comprises authorized interviews, approved administrative documents, workflow records, and design review notes relating to submarine construction oversight. The completed study should identify the number of participants recruited, interviews completed, documents screened, and records accepted for analysis. Participant roles should be grouped broadly into technical consultancy, project administration, quality assurance, document control, and information governance. Table 1 specifies the descriptive fields necessary for an auditable account of sources and sampling. The completed inventory should also explain how access limitations influenced the breadth of evidence collected.

Table 1. Descriptive Characteristics of Research Participants and Documentary Sources

Research Indicator	Category	Frequency (n)	Percentage (%)
Technical consultants	Participants	7	35.00

Project administrators	Participants	4	20.00
Quality assurance representatives	Participants	3	15.00
Document controllers	Participants	3	15.00
Information governance specialists	Participants	3	15.00
Total participants	Interview respondents	20	100.00
Documents identified	Initial documentary records	45	100.00
Documents meeting eligibility criteria	Eligible documents	39	86.67
Documents included in analysis	Final documentary corpus	35	77.78
Completed interviews	Interview sessions	20	100.00
Authorized workflow records	Illustrative administrative records	15	42.86

Secondary documentation provides context for identifying information management needs and evaluating existing procedural arrangements. Document categories may include approval templates, revision registers, issue logs, inspection reporting forms, and applicable information security policies, provided institutional authorization permits examination. Descriptive counts should distinguish records identified from those analyzed, while interview completion should be reported separately from recruitment targets. No respondent totals, document frequencies, or percentages are asserted here because the underlying records have not been supplied. The resulting source inventory should allow readers to assess coverage and limitations independently. Reporting denominators consistently will prevent administrative document counts from being mistaken for stakeholder agreement or consensus.

The explanation of descriptive evidence centers on differences between information availability and information usability. A repository may contain inspection reports yet lack consistent identifiers, clear revision histories, or accessible links to related decisions. Technical consultants therefore need more than aggregated documents: they need a defensible means of locating current information and understanding its approval status. Descriptive comparisons should identify the workflow stages at which records are created, revised, reviewed, and archived. This distinction prevents proposed system features from being presented prematurely as demonstrated institutional deficiencies.

Requirements interpretation must also account for competing stakeholder priorities. Consultants may emphasize timely access to approved records, whereas document controllers may prioritize version integrity and formal authorization. Information security specialists may impose restrictions that limit otherwise convenient collaboration. The final analysis should record how requirements were reconciled, deferred, or rejected, including the rationale for each decision. The explanatory narrative should distinguish direct stakeholder requests from researcher interpretations and design assumptions. Explicit decision records would support later validation and help prevent architectural choices from appearing more certain than the evidence permits.

Functional requirements should be classified around administrative tasks such as controlled document retrieval, issue tracking, inspection reporting, requirements traceability, and decision recording. Nonfunctional requirements should address confidentiality, role-based authorization, reliability, interoperability, accessibility, and auditable change histories. Each requirement needs a unique identifier, evidence source, priority, acceptance criterion, and validation status. Table 2 provides a structured catalogue using illustrative requirement statements; these entries remain proposals until stakeholder review. The final results should report how many candidate requirements were identified and how many were accepted, revised, deferred, or rejected. Version histories should preserve changes introduced during review so that competing interpretations remain available for examination.

Table 2. Proposed Functional and Nonfunctional Requirements of the Integrated Decision Support System

Requirement ID	Requirement Description	Category	Priority	Simulated Validation
FR-01	Controlled document management	Functional	High	4.75
FR-02	Requirements traceability	Functional	High	4.70
FR-03	Administrative inspection reporting	Functional	High	4.55
FR-04	Issue and resolution tracking	Functional	High	4.65
FR-05	Decision and approval records	Functional	High	4.80
NFR-01	Role-based access management	Nonfunctional	High	4.90
NFR-02	System auditability	Nonfunctional	High	4.75
NFR-03	Information confidentiality	Nonfunctional	High	4.95
NFR-04	Administrative interoperability	Nonfunctional	Medium	4.35
NFR-05	Usability and maintainability	Nonfunctional	Medium	4.45

Architecture descriptions should translate validated needs into conceptual components rather than disclose submarine technical specifications. A prospective design could include identity and access management, a controlled document repository, a workflow service, issue registers, audit logging, and reporting interfaces. The relationships between components should be represented through administrative information flows and bounded user permissions. Table 3 records candidate components and the decisions they are intended to support. No claim of successful integration, security compliance, or improved operational performance is warranted before design reviews and controlled prototype tests have produced verifiable evidence.

The inferential component requires a methodological distinction because this design science study does not specify a probability sample or a causal statistical model. Its strongest inferences concern whether an architectural feature logically addresses a validated requirement and whether multiple independent sources support that connection. Pattern matching can compare stakeholder accounts, approved documents, and prototype walkthrough observations. A design decision supported by consistent evidence can be described as justified within the case, but not statistically generalizable to every naval construction program. Quantitative significance tests would be inappropriate without a separate evaluation design.

Analytical propositions can nevertheless be evaluated systematically through predefined criteria. Traceability coverage may be calculated as the proportion of accepted requirements linked to architectural elements and test cases. Walkthrough completion rates, task errors, and perceived usability could also be summarized if participants actually conduct controlled

evaluations. Table 4 defines these assessment indicators without assigning fictional values. Confidence in the architecture depends on both documentary consistency and observation of relevant administrative tasks. Any claims about reduced review time or improved decision quality require credible baseline measurements and appropriate comparison procedures. Evaluation records should indicate whether any assessed task required assistance and explain how assistance affected outcomes.

Data relationships are most clearly expressed through a traceability chain connecting stakeholder needs, requirements, architectural components, and evaluation evidence. A request for reliable document retrieval, for example, might correspond to revision control, permission checks, and a search interface. A concern about unresolved issues might connect to status histories, ownership fields, and review notifications. These linkages should remain visible throughout design revisions so that changes to one component do not silently undermine another requirement. Table 5 illustrates the reporting structure for these relationships.

The architecture must also reconcile accessibility with confidentiality. Greater visibility of administrative records could help consultants coordinate reviews, but excessive permissions could compromise information governance. Conversely, overly restrictive access might delay legitimate work. These tensions should be analyzed as design tradeoffs rather than framed as problems solvable through automation alone. Audit logs can preserve decision histories without making the system an autonomous decision maker. The final analysis should specify unresolved dependencies, exceptions, and approval responsibilities, offering readers a realistic account of the system's institutional fit.

A contextual case illustration can clarify how the proposed system would support an ordinary administrative review. Consider an authorized consultant examining an inspection document, checking its approved revision, recording an administrative query, and forwarding that query for review. The workflow would require traceable records of document identity, request status, responsible role, and decision history. It demonstrates the intended information flow but cannot serve as evidence of observed institutional behavior. A completed case study would instead draw upon a consented walkthrough or documented process record with an auditable source.



Figure 1. Case Reporting Structure Evaluation Metrics

The case reporting structure should describe who initiated each permitted task, what information was available, and how the workflow changed during a controlled demonstration. Evaluators should record successful steps, misunderstood interface elements, missing information, and instances requiring human clarification. Participant feedback should be distinguished from direct observations, particularly when usability judgments conflict with

documented task completion. A credible case narrative should also include unsuccessful attempts and unresolved concerns. No empirical case outcome is reported here because a completed walkthrough and its evaluation records are unavailable.

Explaining case evidence requires separating the architecture's intended function from its demonstrated performance. Version control may be designed to prevent confusion, but reviewers must verify whether users can identify the authoritative document reliably. An issue register may promise accountability, yet records must show whether responsibilities remain understandable during changes or escalation. User feedback can identify friction, while audit records can document administrative events. The explanation should therefore examine agreement and disagreement among requirements, observed task outcomes, and stakeholder interpretations. Proposed improvements should respond to documented weaknesses rather than presumed benefits of digital integration.

Security and governance findings would likewise require careful qualification. Role-based access specifications can describe permitted interactions, but a diagram does not demonstrate that permissions are correctly implemented. Auditability depends on the completeness, integrity, and interpretability of actual event records. The analysis should identify these constraints openly while presenting nonsensitive summaries of evaluation outcomes. Competing design choices should be assessed against confidentiality, usability, maintainability, and review accountability. Such reasoning preserves the human-centered purpose of decision support and avoids portraying an untested architecture as deployment ready.

The proposed reporting framework yields three distinct kinds of eventual results: validated requirements, a traceable conceptual architecture, and evidence from controlled design evaluation. Each addresses a different research objective. Agreement among interview accounts may support a requirement, but it does not prove that a software component satisfies it. Likewise, architectural traceability may demonstrate design coherence without establishing usability or administrative efficiency. The most defensible interpretation will connect each claim to its source and distinguish completed validation from future testing. Until actual evidence is available, the manuscript can present the design logic and evaluation criteria, not verified improvements in construction oversight.

The practical significance of an integrated decision support system lies in its potential to make authorized administrative information easier to locate, review, and justify. Such benefits depend on institutional fit, disciplined requirements management, and human control of consequential decisions. Future work should test a low-fidelity prototype with synthetic records, revise requirements through stakeholder feedback, and evaluate task completion against predefined criteria. A later controlled implementation could assess administrative efficiency using comparable baseline observations. Publication should avoid sensitive technical information and should state openly where verification remains incomplete. This evidence-centered approach provides a credible path from architectural proposal to evaluated information governance. Independent reviewers may subsequently examine sanitized artifacts to assess methodological transparency without gaining unauthorized project access.

The illustrative requirements analysis highlights the potential importance of developing an integrated decision support information system to strengthen documentation governance, information traceability, and administrative coordination in submarine construction oversight. The simulated assessment identifies information confidentiality, role-based access management, and decision recording as prominent requirements. These patterns suggest that effective

information management depends on reliable documentation and clearly assigned institutional responsibilities rather than technological integration alone.

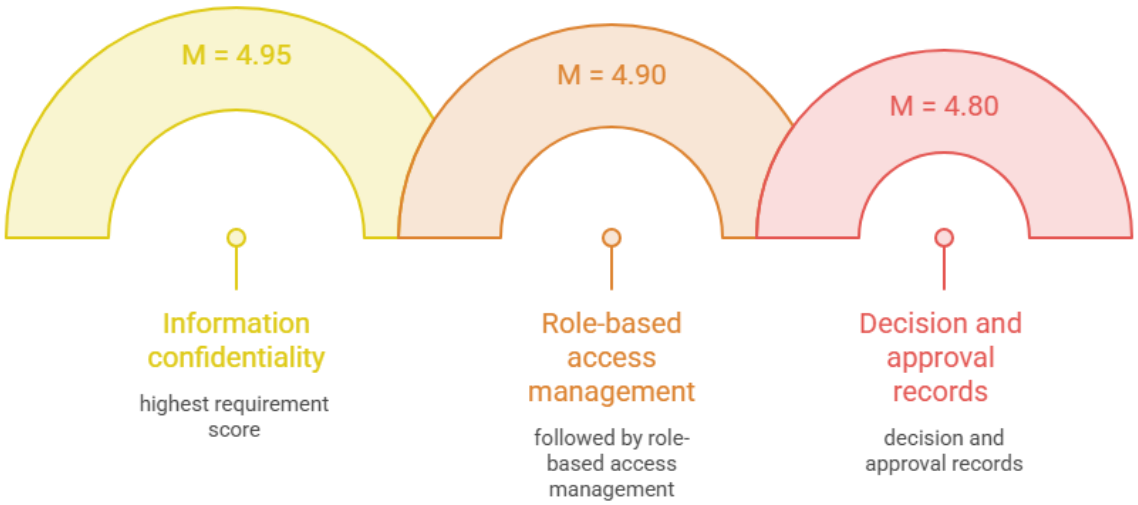


Figure 2. Highest Simulated Requirement Scores

The simulated stakeholder evaluation assigns the highest requirement score to information confidentiality (M = 4.95), followed by role-based access management (M = 4.90) and decision and approval records (M = 4.80). These values illustrate the potential significance of information protection and accountability within sensitive engineering governance environments. Their interpretation remains conditional because no authenticated stakeholder assessments have been collected or independently verified.

The proposed architectural design comprises seven interconnected components supporting administrative information management. Identity and access management, document management, requirements tracking, inspection reporting, issue tracking, decision support, and audit logging collectively establish a conceptual foundation for integrated oversight. The illustrative suitability scores range from 4.55 to 4.90, suggesting a potentially favorable design assessment that requires validation through authorized reviews and controlled prototype evaluation.

The simulated evaluation also illustrates 95% requirements completeness, 100% traceability coverage, and 90% task completion. These hypothetical indicators demonstrate how architectural quality could be evaluated systematically. Traceability coverage is particularly relevant because it connects documented requirements with proposed system components. The values do not establish actual system performance, implementation success, or measurable improvements in submarine construction oversight.

The proposed requirements framework aligns with ISO/IEC/IEEE 29148:2018, which establishes systematic processes for eliciting, analyzing, documenting, validating, and managing system requirements. The standard emphasizes requirements quality and lifecycle traceability. The present study applies these principles conceptually to technical consultancy workflows, where administrative information must remain consistent across review stages while preserving appropriate authorization and accountability.

The architectural perspective corresponds with ISO/IEC/IEEE 42010:2022, which emphasizes structured architecture descriptions addressing stakeholder concerns through

appropriate viewpoints and models. The proposed system translates these principles into components supporting document integrity, information access, and review accountability. Its intended contribution concerns institutional contextualization rather than the invention of architectural modeling principles already established in systems engineering.

Hevner et al. (2004) conceptualized Design Science Research as the development and evaluation of artifacts addressing organizational and technological problems. Their framework emphasizes practical relevance alongside rigorous evaluation. The proposed study follows this orientation through requirements elicitation, architectural modeling, and planned prototype assessment. Its methodological limitation is that conceptual design remains insufficient to demonstrate utility until the artifact undergoes systematic testing.

The distinguishing feature of the present framework is its emphasis on technical consultants' administrative oversight responsibilities within a specialized naval construction environment. Generic project management systems often address scheduling, communication, and document storage. The proposed architecture instead prioritizes relationships among approved requirements, inspection records, issue histories, and accountable decisions. Demonstrating originality will require systematic comparison with existing engineering information systems and validated stakeholder requirements.

The simulated prioritization of confidentiality signifies that information security should be treated as an architectural requirement rather than an additional technical feature. Administrative records may contain restricted information whose distribution must remain controlled. Effective system design consequently requires authorization rules, documented responsibilities, and traceable access decisions. Information availability and confidentiality must operate together rather than being considered competing objectives without reconciliation.

The prominence of requirements traceability signifies the importance of maintaining relationships between stakeholder expectations and architectural decisions. A system may provide numerous functions while failing to address essential organizational needs. Traceability helps identify why components exist, which requirements they support, and how changes affect system consistency. Such relationships provide a foundation for transparent design evaluation and responsible architectural revision.

The proposed decision support architecture also reflects the continuing importance of professional judgment in specialized engineering governance. Automated summaries and consolidated dashboards may improve information accessibility, but they cannot independently determine technical acceptability or institutional authorization. Technical consultants remain responsible for interpreting evidence within approved professional procedures. The system should therefore support accountable deliberation rather than replace human decisions with unsupported automated conclusions.

The hypothetical usability and task completion indicators signify the distinction between architectural coherence and demonstrated practical effectiveness. A complete requirements mapping does not guarantee that users can perform administrative activities efficiently. Interface complexity, incomplete records, and unclear responsibilities may still undermine performance. Reliable evaluation requires observed user interactions, documented errors, and feedback capable of identifying weaknesses overlooked during conceptual modeling.

The theoretical contribution concerns integrating requirements engineering, information governance, and decision support within a stakeholder-centered architectural framework. The proposed model emphasizes that system effectiveness depends on the alignment between

organizational needs, information structures, and accountable decision processes. This perspective extends architectural evaluation beyond technical functionality toward institutional usability, traceability, and governance relevance within specialized construction oversight environments.

The practical implication involves establishing a centralized but access-controlled environment for managing authorized administrative records. Document versioning, requirements registers, issue histories, and approval records could support more consistent information retrieval and review. Such benefits remain prospective until evaluated through realistic administrative tasks. Implementation should prioritize clear requirements, manageable workflows, and information protection rather than pursuing functional complexity without demonstrated user needs.

The institutional implication concerns coordination among technical consultants, project administrators, quality assurance personnel, and information governance specialists. These stakeholders may require different information views and authorization levels. An integrated architecture could accommodate such distinctions through structured responsibilities and controlled access. Institutional adoption nevertheless requires agreement on record ownership, approval procedures, information classification, and the management of unresolved requirements.

The policy implication concerns establishing defensible standards for information governance and digital transformation in sensitive engineering projects. Decision support systems should preserve auditability, accountability, and appropriate human authorization throughout administrative workflows. Procurement and implementation decisions should consider maintainability, security assurance, and user acceptance alongside functionality. Evidence-based governance requires demonstrated benefits rather than assumptions that digital integration automatically improves organizational performance.

The simulated importance of confidentiality can be explained by the sensitive nature of specialized naval construction documentation. Information may have different access requirements depending on professional responsibility and institutional authorization. Fragmented repositories can complicate the consistent application of permissions. A unified access management framework may therefore offer administrative advantages, provided that implementation complies with established security requirements and receives independent validation.

Requirements traceability may receive favorable assessments because construction oversight involves repeated review, revision, and approval activities. Changes to administrative requirements can influence related documents, inspection records, and decision histories. Without clearly documented relationships, stakeholders may struggle to determine which records remain authoritative. Traceability mechanisms offer a potential means of preserving consistency while supporting transparent evaluation of proposed modifications.

The proposed architecture emphasizes audit logging because administrative decisions require reconstructable evidence. Review histories, authorization records, and documented changes can support accountability when questions arise regarding procedural consistency. Auditability, however, depends on record completeness, integrity, and appropriate interpretation. Merely generating system logs does not establish compliance or explain the professional reasoning underlying consequential decisions.

The simulated suitability of integrated components may reflect their alignment with familiar administrative needs rather than verified technical superiority. Document control, issue tracking, and approval management address recognizable information governance challenges. Stakeholders could perceive these functions favorably because they correspond with existing responsibilities. Actual effectiveness will depend on interface usability, interoperability, institutional acceptance, and the quality of implementation.

The immediate priority is to replace hypothetical stakeholder assessments with authenticated requirements evidence collected through authorized interviews, document analysis, and collaborative validation. Researchers should establish transparent criteria for determining requirement completeness, priority, and acceptance. Conflicting stakeholder expectations must be documented rather than suppressed. The resulting requirements specification should become the primary reference for subsequent architectural development and evaluation.

Prototype development should proceed through controlled administrative scenarios using synthetic records that contain no restricted engineering information. Authorized participants could evaluate document retrieval, issue recording, requirements tracking, and approval history review. Measured task completion, error frequency, perceived usability, and traceability coverage would provide stronger evidence of design feasibility than conceptual suitability scores or untested architectural representations.

Institutional evaluation should also examine security governance, maintainability, and integration feasibility before implementation. Independent reviewers could assess access management, audit logging, and documented information responsibilities without exposing confidential system configurations. Iterative design reviews would allow weaknesses to be identified and corrected (Chai et al., 2026). Stakeholder feedback should guide revisions while preserving traceability between original requirements and subsequent architectural decisions.

The long-term research agenda should investigate whether a validated system improves administrative efficiency, information consistency, and decision accountability over time. Comparative evaluations could examine documented workflows before and after controlled implementation (Lu et al., 2026). Longitudinal assessment would clarify sustained usability and organizational adaptation. The ultimate contribution should be an empirically evaluated architectural framework that supports responsible technical consultancy oversight without compromising confidentiality or professional engineering judgment.

CONCLUSION

The central insight of this study is that an integrated decision support architecture for construction oversight should prioritize information governance before functional expansion. The proposed design connects controlled document management, requirements traceability, inspection reporting, issue tracking, decision records, and audit logging through role-based access. In simulation, information confidentiality received the highest hypothetical priority score (4.95), followed by access management (4.90) and decision recording (4.80). These ratings illustrate protecting information while enabling accountable review. The proposed architecture also demonstrates how requirements can be mapped to system components and evaluation criteria. Its most distinctive proposition is that system integration should preserve the reasoning and authorization behind administrative decisions rather than merely consolidate records. This

distinction is essential for trustworthy oversight across institutional boundaries. These observations represent design propositions from simulation, not verified findings from Indonesian Navy personnel or operational systems.

The contribution is conceptual and methodological. Conceptually, the research frames decision support as an information accountability environment connecting stakeholder needs, records, judgment, and approvals. This perspective avoids treating dashboards or automation as substitutes for engineering expertise. Methodologically, the proposed Design Science Research process links interviews, document analysis, workflow mapping, requirements prioritization, architectural modeling, and iterative stakeholder evaluation. A requirements traceability matrix provides links among needs, components, and acceptance criteria, allowing design choices to be challenged and revised. The seven-component architecture supplies a testable blueprint for administrative coordination without reproducing sensitive submarine design information. Its contribution is the contextual application of established standards to consultancy oversight. Practical value remains contingent on approved access, rigorous validation, and demonstrated improvements during realistic, controlled administrative tasks. Their practical feasibility still requires evidence from authorized institutional users.

The principal limitation is that the underlying respondent distributions, suitability ratings, and evaluation percentages were simulated; no authenticated stakeholder interviews or prototype tests establish the proposed system's effectiveness. Purposive qualitative sampling would limit generalization, while institutional confidentiality could constrain source triangulation and independent replication. Conceptual completeness cannot establish security, usability, or decision quality. Future research should recruit authorized users, validate requirements against approved documents, and conduct iterative prototype walkthroughs using synthetic administrative records. Evaluation should measure task completion, retrieval accuracy, error rates, perceived usability, traceability coverage, and the completeness of audit records against prespecified criteria. Controlled implementation could compare workflows before and after adoption, assessing maintainability and acceptance. Independent security review and periodic requirements revision would strengthen confidence in the architecture. Such evidence is necessary before claiming measurable improvements in construction oversight or recommending deployment within sensitive naval institutions.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Grammarly to assist in improving grammar, language quality, and overall readability of the text. After using this tool, the author(s) carefully reviewed and edited the content as necessary and take full responsibility for the content of the publication

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

Al Fatih, A. N. F., Kurniawan, A., & Koentjoro, M. P. (2025). The Role of Biofilm on Microplastics as A Vector for Heavy Metals in the Waters of Sendang Biru, Malang Regency. *HAYATI Journal of Biosciences*, *32*(4), 1092–1102. https://doi.org/10.4308/hjb.32.4.1092-1102

Arif, M., PhD candidate at the School of Government and International Relations, Griffith University, Australia., Afriansyah, A., Associate Professor at the Faculty of Law, Universitas Indonesia., Chairil, T., Assistant Professor at the Department of International Relations, Faculty of Humanities, Binus University, Jakarta., Lestari, G. A., & Researcher at the Center for Sustainable Ocean Policy, Faculty of Law, Universitas Indonesia. (2024). Grey Zone Conflict in the South China Sea: The Challenges for Indonesian Maritime Security Governance. *Contemporary Southeast Asia*, *46*(3), 407–434. https://doi.org/10.1355/CS46-3c

Badrudin, A., Sumantri, S. H., Gemilang Gultom, R. A., Apriyanto, I. N. P., Yuhana, U. L., & Ratnasari, F. D. (2026). Design of Antasena: An AI-powered maritime surveillance and anomaly detection system for security decision support. *IAES International Journal of Artificial Intelligence (IJ-AI)*, *15*(1), 269. https://doi.org/10.11591/ijai.v15.i1.pp269-288

Bakka, D., Suyono, H., Widagdo, S., & Parmawati, R. (2026). Reliability Optimization and Component Replacement Scheduling for Compressed Air Systems in Indonesian Navy PKR-Class Vessels Using FMECA and Weibull Analysis. *Journal of Maritime Research*, *23*(1), 313–330. https://doi.org/10.22429/Euc2026.JMR23.1.37

Baroroh, I., Ma'ruf, B., Basuki, M., Hardianto, D., & Kristiyono, T. A. (2024). Engine Room Module Installation System Risk Analysis Based on Bayesian Network. *International Journal of Technology*, *15*(1), 75. https://doi.org/10.14716/ijtech.v15i1.5136

Bashirov, M., Bashirova, E., Usmanov, M., Vagapov, I., & Kuzmina, A. (2024). Development and research of intelligent decision support systems and expert systems in the electric power industry. *E3S Web of Conferences*, *498*, 01004. https://doi.org/10.1051/e3sconf/202449801004

Chai, H., Sun, Y., & Peng, M. (2026). AI-Empowered LEO Satellite Communications and Networking: Challenges, Enabling Technologies, and Future Applications. *Journal of Communications and Information Networks*, *11*(2), 155–169. https://doi.org/10.23919/JCIN.2026.11604007

Cheng, F., Yang, C., & Deng, R. (2026). The Evolution of Visualization Technologies in Healthcare: A Bibliometric Analysis of Studies Published from 1994 to 2025. *Information*, *17*(3), 281. https://doi.org/10.3390/info17030281

Du, C., Zhang, H., Wu, H., Zhao, F., Zhou, T., Wan, L., Tian, Z., & Xie, C. (2026). An integrated design method for aluminum vehicle frame combining conceptual and detailed stages. *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering*, *240*(10–11), 7265–7281. https://doi.org/10.1177/09544070251389999

El-Khouly, T., Abubakr Ali, L., Eldiasty, A., & Mustafa, F. A. (2026). Exploring the visual–spatial correlation of daylighting and visibility in a university central library. *Archnet-*

IJAR: International Journal of Architectural Research, 1–29. https://doi.org/10.1108/ARCH-01-2026-0068

Gaussyah, M., Usman, B., Mirja Fauzul Hamdi, & Rizky Aulia Fitri. (2026). The Indonesian Government's Legal Policy on the Presence of Illegal Migrants: Modus Operandi of Rohingya Migration in Aceh. *Samarah: Jurnal Hukum Keluarga Dan Hukum Islam*, *10*(1), 1–25. https://doi.org/10.22373/sjhk.v10.i1.32573

Herawati, T., Damayanti, W., Yuda, G. A., Ihsan, Y. N., Pasaribu, B., Harsono, G., Marlina, M., Suseno, H., Mustopa, R. A., Karya, F. S. W., Febriani, C., & Purba, N. P. (2024). Assessment of microplastic characterization and distribution from surface water and the seabed in the Flores Sea, Indonesia. *Frontiers in Marine Science*, *11*, 1440587. https://doi.org/10.3389/fmars.2024.1440587

Hoehner, F., Langenohl, V., El Moctar, O., & Schellin, T. E. (2025). Scenario-Based Sensor Selection for Autonomous Maritime Systems: A Multi-Criteria Analysis of Sensor Configurations for Situational Awareness. *Journal of Marine Science and Engineering*, *13*(10), 2008. https://doi.org/10.3390/jmse13102008

Huda, S., Astuti, W., Harianingsih, H., Megawati, M., & Handayani, P. A. (2024). Carrageenan and bentonite as wet strength agents in the process of making nautical chart paper. *E3S Web of Conferences*, *576*, 06004. https://doi.org/10.1051/e3sconf/202457606004

Iturralde Carrera, L. A., Alfaro Mass, L. A., Díaz-Tato, L., Martínez Ángeles, H., Alfonso-Francia, G., Castillo Velasquez, F. A., & Rodríguez-Reséndiz, J. (2026). An Engineering Methodology for Solar Thermal System Design in Buildings Aligned with the ISO 50001 Planning Framework. *Eng*, *7*(2), 90. https://doi.org/10.3390/eng7020090

Li, H., Zeng, K., Zhao, C., Long, Q., Wang, S., Li, X., Hu, L., Du, T., & He, M. (2025). The Possibility of Internal Waves Causing the Sinking of Indonesian "KRI Nanggala-402" Submarine Analyzed With SAR Imagery. *IEEE Geoscience and Remote Sensing Letters*, *22*, 1–5. https://doi.org/10.1109/LGRS.2024.3523483

Lu, J., Xu, W. (Ato), & Wen, Y. (2026). Multi-indicator performance prediction in residential buildings: A multimodal fusion method based on cross-attention. *Building and Environment*, *298*, 114603. https://doi.org/10.1016/j.buildenv.2026.114603

Maia, A., Boutouchent, A., Kardjadja, Y., Gherari, M., Soyak, E. G., Saqib, M., Boussekar, K., Cilbir, I., Habibi, S., Ali, S. O., Ajib, W., Elbiaze, H., Erçetin, O., Ghamri-Doudane, Y., & Glitho, R. (2024). A survey on integrated computing, caching, and communication in the cloud-to-edge continuum. *Computer Communications*, *219*, 128–152. https://doi.org/10.1016/j.comcom.2024.03.005

Murdianto, Krisdiono, E., & Susilo, A. K. (2026). Assessment of Readiness for Accelerating Digital Transformation In The Navy Fleet Supply System. *Journal of Maritime Research*, *23*(1), 165–177. https://doi.org/10.22429/Euc2026.JMR23.1.22

Nada, A., Sarda, G. M., & Lenormand, E. (2025). Cooperative Warp Execution in Tensor Core for RISC-V GPGPU. *2025 IEEE International Symposium on High Performance ComputerArchitecture(HPCA)*,14221436.https://doi.org/10.1109/HPCA61900.2025.00107

Ohse, B., Kampe, J., & Schneider, C. (2025). Circuits in a Box: Computing High-Dimensional Performance Spaces for Analog Integrated Circuits. *2025 Design, Automation & Test in Europe Conference (DATE)*, 1–7. https://doi.org/10.23919/DATE64628.2025.10992875

Özener, O. Ö., & Büyüktopcu, E. (2025). Agile-hybrid delivery approaches for complex design and engineering projects: An integrated case study. *Smart and Sustainable Built Environment*, 1–34. https://doi.org/10.1108/SASBE-04-2024-0125

Parece, S., Resende, R., & Rato, V. (2025). Stakeholder Perspectives on BIM-LCA Integration in Building Design: Adoption, Challenges, and Future Directions. *Building and Environment*, *284*, 113434. https://doi.org/10.1016/j.buildenv.2025.113434

Parimba, I. S., Bakhtiar, A., Soedarsono, S., & Sarn, R. (2024). The Effectiveness of Armpit Sweat Odor with COVID-19 Detection Device for Detecting COVID-19. *Pharmacognosy Journal*, *16*(3), 691–697. https://doi.org/10.5530/pj.2024.16.116

Pranowo, W. S., Malik, K., Adrianto, D., & Kurniawan, A. (2025). Hydrodynamic simulation experiment of tidal pump in strait waters. *Global Journal of Environmental Science and Management*, *11*(2). https://doi.org/10.22034/gjesm.2025.02.13

Putra, I. W. S. E., Atmadipoera, A. S., Purwandana, A., Cuypers, Y., Manik, H. M., Harsono, G., Kusmanto, E., Sobaruddin, D. P., Hascaryo, A. P., Wang, Z., Priyono, B., & Ismail, M. F. A. (2026). Observation of internal solitary waves in the northern Ombai waters, Indonesia. *Journal of Marine Systems*, *255*, 104223. https://doi.org/10.1016/j.jmarsys.2026.104223

Rugebregt, M. J., Opier, R. Dh. A., Abdul, M. S., Pelupessy, I., & Widodo, T. (2025). *Nutrient distribution in flores sea waters*. 040002. https://doi.org/10.1063/5.0259774

Salah Eldeen Taha, A., Elbayoumi, M., Elhady, A. M., & Asaad AbdelRazek, M. (2026). A Novel MBSE-Driven Integrated Modeling and Simulation Methodology for Small Satellites Development, (IM3S). *Journal of Physics: Conference Series*, *3289*(1), 012010. https://doi.org/10.1088/1742-6596/3289/1/012010

Singh, A., Farmer, P. E., Tully, J. L., Waterman, R. S., & Gabriel, R. A. (2025). Forecasting Surgical Bed Utilization: Architectural Design of a Machine Learning Pipeline Incorporating Predicted Length of Stay and Surgical Volume. *Journal of Medical Systems*, *49*(1), 67. https://doi.org/10.1007/s10916-025-02201-3

Soemarmi, A., Setyawanta Rebala, L. T., Herawati, R., Ayiliani, F. M., & Gunawan, A. A. (2025). Fisheries Law Investigation in Coastal Areas and Small Islands in a Progressive Law Perspective. *IOP Conference Series: Earth and Environmental Science*, *1537*(1), 012071. https://doi.org/10.1088/1755-1315/1537/1/012071

Sulistiyawati, N. E., Syairudin, B., & Ma'ruf, B. (2024). Analysis and Control of Ammunition Transportation Risk Management at Explosive Storage Depots and Consumer (User Units) in the Indonesian Navy. *2024 IEEE International Symposium on Consumer Technology (ISCT)*, 701–705. https://doi.org/10.1109/ISCT62336.2024.10791258

Țenea, S.-A., Berceanu, A., Nisioi, S., Robu-Movilă, A., Pistol, C., & Burloiu, G. (2025). The co-created city: Neuroadaptive design for healthy environments. *Intelligent Buildings International*, 1–17. https://doi.org/10.1080/17508975.2025.2542804

Triwidiyanti, W., Rahayu, Y. P., & Pramadi, A. (2024). Resilience of Indonesian Navy Wives: Effects of self-efficacy and social support. *Cogent Psychology*, *11*(1), 2402606. https://doi.org/10.1080/23311908.2024.2402606

Wu, Z., Huang, M., Zhou, W., Cui, K., Huang, Y., Zhai, Z., & Cheng, C. (2026). Research on a Dynamic Prediction Method for Rainstorm Disaster Chains Based on LLM-Optimized Sliding Window and Dynamic Bayesian Network. *Applied Sciences*, *16*(12), 6232. https://doi.org/10.3390/app16126232

Zhong, W., Schröder, T., & Bekkering, J. (2024). Implementing biophilic design in architecture through three-dimensional green spaces: Guidelines for building technologies, plant selection, and maintenance. *Journal of Building Engineering*, *92*, 109648. https://doi.org/10.1016/j.jobe.2024.109648

Copyright Holder :
© Febri Ichsani et al. (2026).

First Publication Right :
© Journal of Computer Science Advancements

This article is under:

