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Aligning Medical Assets with Strategic Health Objectives: An Evidence-Informed Constructivist Framework Integrating BPMN

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Abstract: Medical assets contribute to healthcare only when their management supports the clinical and health-service objectives for which they are deployed. Yet medical asset management often remains fragmented across acquisition, operation, maintenance, financing, risk management, and replacement functions. This paper proposes an Evidence-Informed Constructivist BPMN Framework linking medical asset management to strategic health objectives at hospital, regional, or national level.

The framework begins with two complementary inputs: the strategic health or medical objectives relevant to the assets under consideration and a structured assessment of current asset-management capability. Assessment evidence is collectively interpreted by clinical, technical, managerial, financial, and other relevant stakeholders. Collaborative leadership enables this process by facilitating knowledge sharing, constructive management of divergent perspectives, joint prioritization, and shared accountability. Through evidence-informed deliberation, stakeholders identify gaps between the capabilities required to achieve health objectives and those currently provided by the asset-management system. These strategic capability gaps are prioritized and transformed into context-specific asset-management strategic axes.

Strategic axes are therefore treated as outputs of evidence-informed stakeholder construction rather than predefined components. BPMN subsequently translates agreed strategic objectives into operational processes, responsibilities, decision gateways, controls, and escalation mechanisms. Performance outcomes are reassessed against asset-management indicators and the health objectives initially pursued, creating a recursive learning process supported by collaborative review.

The framework positions medical asset management as an enabling capability of healthcare strategy and BPMN as the operational bridge between collectively constructed strategic priorities and action. It provides a scalable conceptual approach applicable to hospitals, regional health networks, and national medical asset management systems.

Keywords: *Medical Asset Management; BPMN; Constructivism; Collaborative Leadership; Strategic Alignment; Healthcare Technology Management; Stakeholder Participation; ISO 55000; Strategic Capability Gap; Health-System Governance.*

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I. INTRODUCTION

Healthcare delivery increasingly depends on medical technologies whose availability, safety, reliability, and appropriate utilization influence the capacity of health organizations to achieve their clinical objectives [1–5]. Medical asset management should therefore extend beyond engineering and maintenance functions to ensure that assets provide the capabilities required to support healthcare objectives throughout their lifecycle [6–10].

ISO 55000:2024 reinforces this strategic perspective by connecting asset management with organizational objectives, value realization, lifecycle thinking, and continual improvement [11–13]. This raises a fundamental question for healthcare organizations: to what extent does the existing medical asset management system enable achievement of the strategic medical or health objectives for which those assets are required?

Answering this question requires more than technical evidence. Asset availability, maintenance, infrastructure, workforce capability, utilization, financing, information quality, procurement practices, and replacement planning collectively influence the capability delivered by medical assets [3–5,14–20]. Moreover, clinicians, biomedical engineers, managers, finance professionals, procurement specialists, and policymakers may interpret the same evidence differently according to their responsibilities and professional knowledge.

Participatory healthcare research demonstrates the value of combining different forms of professional and experiential knowledge [21–24]. Healthcare leadership literature similarly highlights the relevance of collective or shared approaches where complex decisions require interaction among multiple professional groups [25–28]. In medical asset management, this makes collaborative leadership particularly important for facilitating dialogue, managing divergent interpretations, coordinating expertise, and maintaining shared accountability without eliminating professional responsibilities.

This paper proposes an Evidence-Informed Constructivist BPMN Framework for Strategic Medical Asset Management. It combines strategic health objectives, current-state assessment, stakeholder interpretation, collaborative leadership, and BPMN operationalization. Strategic axes emerge from evidence-informed stakeholder deliberation rather than being predetermined.

The framework establishes a continuous line of sight from hospital, regional, or national health objectives to asset-management evidence, collaboratively constructed strategic priorities, operational processes, and measurable outcomes.

II. CONCEPTUAL FOUNDATIONS

- *Medical Assets as Enablers of Health-System Objectives*

Medical technologies derive their strategic significance from the health services they enable. An imaging system, laboratory platform, ventilator, surgical technology, or radiotherapy system has limited organizational value when considered independently from the clinical capability it is expected to provide.

Asset-management performance should therefore be evaluated relative to the objectives of the organization or health system governing the assets [11–13]. At hospital level, these may include improving diagnostic capacity, reducing treatment delays, strengthening patient safety, or maintaining continuity of critical services. At regional level, objectives may concern referral capacity, geographical coverage, or service-network resilience. At national level, medical assets may support broader priorities such as universal health coverage, cancer control, laboratory strengthening, maternal health, emergency preparedness, or equitable access to essential technologies.

The framework consequently distinguishes health strategic objectives, which exist upstream, from asset-management strategic axes, which emerge from analysis of how effectively the medical asset system supports those objectives.

- *Current Asset-Management Capability*

Medical asset capability results from interactions across the lifecycle. Needs assessment, technology selection, procurement, installation, commissioning, utilization, maintenance, information management, risk management, financing, replacement, and decommissioning are interdependent activities [1–10].

A technically functional device does not necessarily provide the required clinical capability. Inadequate infrastructure, insufficient user competency, unavailable consumables, weak maintenance support, inappropriate deployment, or deficient information systems may substantially reduce its contribution to healthcare delivery.

The framework therefore begins with a Current-State Asset Management Assessment (CSAMA) examining governance, lifecycle processes, equipment performance, maintenance, risk, workforce capability, infrastructure, information systems, financing, and replacement planning.

Its purpose is not simply to assess conformity with predetermined technical requirements, but to establish the current capability of the asset-management system to support relevant health objectives.

- *Evidence-Informed Constructivism*

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The framework adopts an evidence-informed constructivist position. Assessment data provide an empirical starting point, while their organizational and strategic significance is interpreted through stakeholder knowledge and context.

Three complementary forms of evidence are considered: objective evidence, including availability, downtime, maintenance compliance, utilization, age, cost, and other measurable indicators; organizational evidence, concerning responsibilities, processes, governance, budgeting, information flows, and decision mechanisms; and experiential evidence, reflecting professional experience, user knowledge, operational constraints, and perceived consequences for clinical services.

Different stakeholders may legitimately interpret the same evidence differently. Rather than treating such divergence as an obstacle, the framework considers it a source of knowledge. Structured deliberation allows assumptions to be examined, additional evidence to be requested, trade-offs to be discussed, and shared interpretations to emerge [21–24].

➢ *Collaborative Leadership in Medical Asset Governance*

Hospital medical asset management operates across professional and organizational boundaries. Clinical, technical, managerial, financial, procurement, quality, and information-system actors hold different forms of expertise and decision authority. No single professional group can therefore fully interpret the relationship between asset performance and healthcare value.

Collaborative leadership provides the enabling mechanism through which these distributed forms of knowledge and responsibility can contribute to strategic decision-making [25–28]. Within this framework, collaborative leadership is defined as the shared process through which relevant stakeholders jointly interpret asset-management evidence, manage divergent perspectives, negotiate priorities, coordinate responsibilities, and maintain alignment between asset decisions and health-service objectives.

Collaborative leadership does not imply the absence of formal authority or accountability. Certain decisions may remain the responsibility of designated clinical, technical, financial, or executive authorities. Its function is instead to ensure that strategic decisions are informed by the relevant expertise before authority is exercised.

The framework therefore distinguishes four complementary functions:

Stakeholder participation identifies who contributes; constructivist deliberation explains how different interpretations are examined; collaborative leadership enables convergence, coordination, and shared accountability; and BPMN translates agreed strategic choices into operational action.

This distinction is particularly relevant in hospital environments, where rigid professional boundaries or unclear responsibilities may otherwise fragment asset-related decisions.

➢ *BPMN as an Operationalization Mechanism*

BPMN provides a standardized language for representing activities, events, actors, responsibilities, information exchanges, and decision gateways [29–31]. Its use in healthcare has expanded substantially, particularly for clinical pathways and healthcare process analysis [32–35].

In the proposed framework, BPMN does not determine strategy. It intervenes after evidence has been interpreted and strategic priorities collectively established.

Its function is to translate agreed objectives into operational logic:

Who acts? → On what evidence? → At what threshold? → Who decides? → What happens when conditions are not met? → Who receives escalation? → How is the outcome verified?

The distinction is fundamental: evidence informs the process, stakeholders construct meaning, collaborative leadership enables convergence and shared accountability, and BPMN translates the resulting strategic choices into operational action.

III. METHODOLOGY

➢ *Conceptual Framework Development Approach*

This study adopts a theory-informed conceptual framework development methodology. Its purpose is not to estimate intervention effects, but to integrate complementary theoretical and applied knowledge into a strategic decision architecture for medical asset management.

Framework development followed four interconnected phases.

- Phase I – Theoretical grounding. Relevant literature published between 2010 and 2026 was examined across strategic asset management, healthcare technology management, constructivism and co-design, collaborative and collective leadership in healthcare, BPMN, risk management, and lifecycle decision-making [11–39].
- Phase II – Current-state assessment architecture. Medical equipment management and lifecycle literature informed identification of the domains required to characterize current asset-management capability [1–20].
- Phase III – Evidence interpretation, collaborative deliberation, and strategic axis formation. Participatory, co-design, and collaborative leadership literature informed the mechanism through which stakeholders interpret assessment evidence, address divergent perspectives,

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establish shared problem definitions, and prioritize strategic capability gaps [21–28].

- Phase IV – BPMN operational translation and recursive learning. Business-process literature informed translation of emergent strategic objectives into activities, decision gateways, responsibilities, indicators, escalation mechanisms, and feedback processes [29–35].

The resulting framework is conceptual and requires empirical validation. The assessment, stakeholder deliberation, collaborative leadership mechanisms, and BPMN processes described below represent a proposed application methodology rather than completed empirical interventions.

IV. CONSTRUCTIVIST STAKEHOLDER DELIBERATION AND COLLABORATIVE LEADERSHIP

➢ *Stakeholder Interpretation of Evidence*

Assessment findings are presented to stakeholders whose roles are relevant to the assets and strategic health objectives under consideration. Depending on scale, participants may include clinicians, nurses, biomedical engineers, medical physicists, hospital managers, procurement and finance professionals, quality and safety teams, IT specialists, regional authorities, policymakers, and other relevant actors.

Stakeholders initially interpret evidence from their respective professional perspectives. Low equipment availability, for example, may indicate insufficient maintenance capacity to biomedical engineering, interrupted clinical services to clinicians, inefficient resource allocation to finance, and increased patient risk to quality and safety teams.

These interpretations should not be regarded as competing errors. They represent complementary perspectives on a multidimensional asset-management problem.

➢ *Collaborative Leadership as an Enabling Mechanism*

Diverse stakeholder participation does not automatically produce collaborative decision-making. Differences in professional authority, organizational hierarchy, technical knowledge, priorities, and access to information can influence whose interpretation dominates the discussion [25–28].

Collaborative leadership is therefore required to create the conditions for meaningful deliberation. Its role is to ensure that relevant expertise is heard, evidence remains central to discussion, disagreements are made explicit, and responsibility for decisions is clearly maintained.

The framework does not require leadership to be equally distributed in every decision. Instead, leadership may shift according to the nature of the problem. Clinical actors may lead interpretation of consequences for patient care, biomedical engineers may lead technical reliability analysis, finance professionals may lead affordability assessment, while executive management retains authority where organizational trade-offs require formal arbitration.

Collaborative leadership is thus dynamic and expertise-sensitive rather than authority-free.

➢ *Divergence, Deliberation, and Convergence*

Where stakeholder interpretations differ, the framework introduces a Constructivist Collaborative Convergence Loop:

Evidence → Multiple interpretations → Divergence identification → Collaborative deliberation → Additional evidence where required → Negotiation/trade-off → Convergence or formal arbitration → Shared problem definition.

➢ *A Central Decision Gateway Asks:*

Has sufficient stakeholder convergence been achieved to define the strategic problem?

- If yes, the issue proceeds to strategic prioritization.
- If no, the process returns to evidence review, additional information gathering, facilitated deliberation, or appropriate governance arbitration.

Consensus is therefore not treated as an end in itself. Legitimate disagreement can remain documented, particularly where clinical, technical, financial, or ethical considerations cannot be fully reconciled.

➢ *Strategic Prioritization and Shared Accountability*

Once strategic capability gaps have been collectively defined, stakeholders prioritize them using context-appropriate criteria such as clinical impact, patient risk, asset criticality, service continuity, equity, financial implications, urgency, and feasibility [36–39].

Collaborative leadership remains important during this stage because prioritization necessarily involves trade-offs. The purpose is not simply to aggregate individual preferences but to establish priorities that remain traceable to evidence and to the health objectives under consideration.

Each validated priority should therefore have both shared strategic ownership and clearly assigned operational accountability.

V. EMERGENT STRATEGIC AXES

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➢ *Strategic Axes as Collaboratively Constructed Outputs*

A defining characteristic of the framework is that asset-management strategic axes are not predefined components. They emerge from the interaction between strategic health objectives, current-state evidence, stakeholder interpretations, and collaborative prioritization.

The framework therefore does not prescribe identical axes for every hospital or health system.

Depending on context, the process may generate axes such as:

- Critical Technology Availability and Clinical Service Continuity
- Risk-Based Maintenance and Patient Safety
- Sustainable Lifecycle Investment and Replacement
- Equitable Access to Medical Technology
- Medical Asset Information and Digital Governance

These examples illustrate possible outputs rather than mandatory framework dimensions.

Collaborative leadership provides continuity between deliberation and strategic commitment by ensuring that the resulting axes are understood across professional groups and connected to appropriate decision authority.

➢ *From Strategic Axis to Accountable Strategic Objective*

Each validated strategic axis is translated into measurable asset-management objectives with explicit responsibility. For example:

- Strategic health objective: Improve timely access to emergency diagnostic imaging.
- Strategic capability gap: High downtime and insufficient maintenance capacity for critical imaging assets.
- Emergent strategic axis: Critical Diagnostic Technology Availability and Resilience.
- Asset-management strategic objective: Maintain defined availability and restoration-time targets for critical imaging capability.
- Collaborative accountability: Clinical, biomedical engineering, operational, and financial actors jointly monitor achievement, while specific operational responsibilities remain formally assigned.

This progression establishes a clear line of sight from healthcare strategy to accountable asset-management action.

VI. REASSESSMENT AND COLLABORATIVE CONSTRUCTIVIST LEARNING LOOP

➢ *Implementation does not Terminate the Framework.*

Performance and health-service outcomes are reassessed against the strategic objectives that initiated the process. The central question is:

- *Has the Asset-Management Intervention Improved the Capability Required to Support the Relevant Health Objective?*

If performance improves, the BPMN process may continue under routine monitoring.

If improvement is insufficient, stakeholders reconvene to examine whether the problem arose from implementation failure, incorrect assumptions, inadequate resources, inappropriate process design, or changes in the strategic environment.

Collaborative leadership supports this reassessment by preventing performance review from becoming the responsibility of a single technical function. Clinical consequences, technical performance, financial sustainability, operational constraints, and organizational outcomes are interpreted together.

The framework therefore establishes the recursive cycle: Strategic health objectives → Current-state assessment → Evidence → Stakeholder interpretation → Collaborative convergence → Strategic capability gaps → Emergent strategic axes → BPMN operationalization → Outcomes → Collaborative reassessment → Strategic reconstruction.

This Collaborative Constructivist Learning Loop recognizes that neither strategic priorities nor stakeholder interpretations remain permanently fixed. New evidence, technologies, risks, resources, or health priorities may require the organization to reconstruct both its strategic axes and the processes through which they are implemented.

VII. DISCUSSION

The proposed framework differs from conventional medical equipment management approaches in four important respects.

First, it begins with health-system purpose rather than the asset itself. Medical equipment performance becomes strategically relevant according to its contribution to hospital, regional, or national health objectives. This reinforces the value and alignment principles of ISO 55000 [11–13].

Second, the framework distinguishes evidence from interpretation. Current-state assessment establishes an empirical basis, while stakeholder deliberation determines how

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that evidence should be understood within clinical, technical, organizational, and financial contexts.

Third, it introduces collaborative leadership as the enabling mechanism between stakeholder diversity and strategic convergence. Healthcare leadership research supports the relevance of shared and collective leadership approaches in complex multidisciplinary environments, although evidence regarding their direct effect on clinical outcomes remains limited [25–28]. The framework therefore does not assume that collaborative leadership automatically improves patient outcomes. Rather, it proposes that collaborative leadership facilitates knowledge integration, coordination, negotiation, and shared accountability in strategic medical asset decision-making.

Fourth, BPMN is repositioned from a descriptive process-mapping technique to an operational bridge between collaboratively constructed strategy and organizational action. It translates strategic priorities into explicit responsibilities, evidence requirements, decision rules, escalation mechanisms, and measurable processes.

These mechanisms are particularly relevant to hospital environments, where expertise and authority are distributed across professional groups. They may also be applied at regional or national level, where collaboration must extend beyond individual organizations to health authorities, facilities, technical services, financing bodies, and other stakeholders.

VIII. PRACTICAL AND RESEARCH IMPLICATIONS

Implementation should begin with a defined health objective and a manageable asset class, clinical service, region, or national priority. Current-state assessment should remain proportional to the strategic question and avoid collecting data that do not contribute to decision-making.

Stakeholder selection and collaborative leadership arrangements require particular attention. Participation should reflect the clinical, technical, organizational, financial, and policy dimensions relevant to the assets under study. Facilitation mechanisms should prevent professional hierarchy from systematically suppressing relevant evidence or expertise while preserving formal accountability for decisions.

Future empirical studies should examine not only equipment outcomes but also the functioning of the collaborative process itself. Relevant questions include whether collaborative leadership improves evidence integration, stakeholder convergence, decision transparency, implementation ownership, and the alignment of asset decisions with health-service objectives.

Research should also examine situations in which collaborative leadership is ineffective. The available healthcare evidence remains insufficient to conclude that collective leadership consistently improves clinical outcomes [25–28]. This limitation creates an important empirical research agenda for application of the proposed framework.

IX. LIMITATIONS

The framework is conceptual and has not yet been empirically validated as an integrated intervention. Relationships between current-state assessment, collaborative leadership, stakeholder deliberation, strategic alignment, BPMN operationalization, and health-service outcomes should therefore be treated as propositions requiring testing.

The framework also assumes that stakeholders can participate meaningfully in evidence interpretation. Professional hierarchies, unequal access to information, organizational politics, weak facilitation, or unclear authority may limit genuine collaboration.

Collaborative leadership should consequently not be interpreted as a guarantee of consensus or superior decisions. Evidence from healthcare remains mixed regarding its direct effects on clinical outcomes [25–28]. Its proposed value in this framework lies primarily in facilitating multidisciplinary knowledge integration, transparent deliberation, coordinated action, and shared strategic accountability.

Finally, health systems vary substantially in governance, financing, regulation, technological capacity, and organizational maturity. The framework therefore provides an adaptable decision architecture rather than a universal leadership structure or standardized workflow.

X. CONCLUSION

Medical assets create value when they provide the capabilities required to achieve healthcare objectives. Strategic medical asset management should therefore begin by determining what the hospital or health system seeks to accomplish and whether its current asset-management capability can support those objectives.

The proposed Evidence-Informed Constructivist BPMN Framework connects strategic health objectives, current-state assessment, evidence, stakeholder interpretation, collaborative leadership, strategic capability gaps, emergent strategic axes, BPMN operationalization, and outcome reassessment within a recursive decision process.

Its central proposition is that strategic asset-management priorities should neither be predetermined nor derived mechanically from technical indicators. They should emerge from structured interpretation of evidence by relevant stakeholders. Collaborative leadership enables these different forms of expertise to be transformed into coordinated strategic choices while preserving clear decision authority and accountability.

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BPMN subsequently translates these choices into operational processes. Reassessment closes the loop by determining whether asset-management actions have strengthened the health-service capability they were intended to support and whether new evidence requires strategic reconstruction.

The framework thus provides a pathway from health objectives to evidence, from evidence to collaborative strategic construction, and from collectively constructed strategy to accountable operational action.

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