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FROM DIGITAL MATURITY TO MANAGERIAL PERFORMANCE: A METHODOLOGY FOR EVALUATING DIGITAL TRANSFORMATION IN PRIVATE HEALTHCARE ORGANIZATIONS

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Abstract. Purpose. This article develops an integrated methodology that connects digital maturity with implementation quality, process change, managerial performance, and strategic value in private healthcare organizations. Design/methodology/approach. A structured integrative review and framework synthesis combined 27 substantive sources from digital-maturity research, implementation science, information-systems evaluation, health economics, and authoritative digital-health guidance; two additional publications informed the review method. Findings. The resulting Maturity-to-Performance Evaluation Framework (M2P-EF) distinguishes six evaluation layers: investment and digital assets, maturity capabilities, implementation quality, process and behavioral change, managerial performance, and strategic value. The layers are assessed across seven domains: strategic governance; data, infrastructure, interoperability, and cybersecurity; process integration and productivity; workforce capability; patient value, quality, access, and equity; financial and market sustainability; and resilience. The methodology also specifies indicator rules, noncompensatory safety and governance gates, an evidence ladder, economic analysis, and a seven-step decision protocol. Practical implications. M2P-EF can guide prospective evaluation, help managers distinguish implementation failure from value-proposition failure, and support transparent decisions to continue, modify, scale, pause, or discontinue digital initiatives. Research limitations/implications. The framework has not yet been empirically validated; content validation, feasibility testing, psychometric assessment, and longitudinal multisite evaluation are required before comparative use. Originality/value. The main contribution is to define digital maturity as an enabling capability rather than an organizational outcome and to measure it separately from performance.

Keywords: digital maturity; digital transformation; managerial performance; private healthcare; evaluation methodology; implementation; value realization

JEL Classification: M10, M15, I11, O33.

INTRODUCTION

Digital transformation has become a strategic priority for healthcare organizations, yet its evaluation remains conceptually inconsistent. Many assessments count installed technologies, record the existence of electronic systems, or assign an organization to a maturity stage. These approaches are useful for describing the digital starting point, but they do not by themselves demonstrate that

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management has become more effective. A private healthcare organization may possess an electronic health record, online scheduling, teleconsultation tools, analytical dashboards, and artificial intelligence applications while still experiencing fragmented workflows, duplicated data entry, weak accountability, growing staff burden, or an uncertain return on investment. Technology presence, therefore, is neither equivalent to organizational capability nor sufficient evidence of managerial performance.

This distinction is important because digital transformation is not a one-time acquisition decision. It is an ongoing reconfiguration of strategy, processes, roles, information flows, control mechanisms, and value creation. Vial (2019) conceptualizes digital transformation as an organizational response to digital disruption that alters value-creation paths and organizational structures. In healthcare, this transformation is further constrained by requirements for quality, safety, continuity, confidentiality, interoperability, and professional accountability. The World Health Organization (WHO, 2021) consequently emphasizes that digital health strategies must integrate technological, financial, organizational, and human resources rather than treat technology as an isolated input.

Earlier work has situated digital transformation within the broader healthcare system (Bachuk, 2024) and examined governance and sustainability challenges created by artificial intelligence in healthcare management (Bachuk et al., 2026). The present study extends this line of inquiry in a distinct direction: it develops an evaluation architecture for determining when digital capabilities produce managerial results, without limiting the analysis to a single technology or clinical specialty.

Digital maturity models address part of this problem by assessing whether an organization possesses the capabilities needed to use digital systems coherently. A systematic review of hospital maturity models identified recurring dimensions such as strategy, information technology capability, interoperability, governance, patient-centeredness, workforce skills, and analytics (Duncan et al., 2022). More recent comparisons show, however, that maturity assessments differ markedly across contexts, frequently rely on self-report, can be expensive to administer, and are rarely linked to independently measured organizational outcomes (Cresswell et al., 2025). The resulting methodological gap is not a lack of indicators as such. It is the absence of a defensible bridge between digital maturity and the results that matter to managers, owners, staff, patients, and regulators.

The gap is especially consequential in private healthcare. Private providers operate under the same clinical, ethical, and regulatory obligations as other healthcare organizations, but they must also preserve liquidity, allocate scarce investment capital, manage demand and capacity, maintain service differentiation, and justify recurring technology costs. A narrow financial return is nevertheless an inadequate measure of success: a digital initiative that reduces administrative cost while worsening access, safety, staff workload, or patient trust cannot be considered managerially effective. Evaluation must therefore combine commercial viability with balanced healthcare value and treat safety, privacy, and clinical governance as constraints rather than optional benefits.

Existing framework families answer different questions. Maturity models ask whether enabling capabilities are present. Implementation frameworks explain why an intervention is adopted, embedded, sustained, or abandoned. Information-systems success models examine system quality, information quality, use, satisfaction, and net benefits. Health-technology and economic evaluation compare costs and consequences. The quadruple and quintuple aims define balanced outcome directions, including patient experience, population health, cost, workforce experience, and equity (Bodenheimer & Sinsky, 2014; Nundy et al., 2022). Each family is valuable, but none alone provides a complete organizational methodology for tracing how digital capacity becomes managerial value in a private healthcare setting.

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LITERATURE REVIEW

From digitization to managerial performance

Evaluation begins with a clear conceptual boundary. Digitization converts analogue information into digital form. Digitalization uses digital technologies to improve or redesign particular activities. Digital transformation changes the organization more broadly by reconfiguring resources, processes, relationships, decision rights, and value propositions (Vial, 2019). These concepts describe progressively wider change, but they do not form an automatic sequence. A clinic can digitize documents without integrating workflows, and it can automate individual workflows without changing how managerial decisions are made.

Technology adoption is the decision or action to use a technology. Digital maturity is the degree to which the organization has developed the technical, human, organizational, and governance capabilities needed to use digital technologies in an integrated and sustainable manner. Implementation quality concerns how well a specific initiative is introduced and embedded, including acceptability, appropriateness, feasibility, fidelity, reach, implementation cost, penetration, and sustainability (Proctor et al., 2011). Information-system success concerns the performance and use of the system itself, including system, information, and service quality, user satisfaction, and net benefits (DeLone & McLean, 2003). These are related constructs, but they are not interchangeable.

Managerial performance is defined in this study as the demonstrated ability of a healthcare organization to convert resources into reliable processes and balanced organizational outcomes while meeting clinical, ethical, financial, and regulatory constraints. It includes the quality and timeliness of managerial decisions, coordination across units, capacity utilization, workforce conditions, financial sustainability, patient value, risk control, and organizational adaptability. This definition deliberately separates managerial performance from clinical effectiveness. A digital initiative may improve an administrative process without improving clinical outcomes, or it may support clinical quality while initially increasing operating cost. Both patterns require explicit measurement rather than an assumed overall benefit.

The dynamic-capabilities perspective explains why maturity should be treated as a mechanism rather than a final result. Organizations create sustained value when they can sense changes, seize opportunities, and reconfigure assets and routines (Teece, 2007). Digital maturity represents part of this capability base: interoperable data, competent staff, governance structures, and learning routines make transformation possible. Whether these capabilities produce results depends on implementation and process redesign. Thus, the theoretical relationship is conditional rather than deterministic: higher maturity increases the capacity to realize value, but results also depend on intervention fit, context, execution quality, and time.

Complementary evaluation traditions

Hospital and primary-care maturity research has established that digital capability is multidimensional. Duncan et al. (2022) consolidated seven recurrent dimensions across hospital models, while Neunaber et al. (2024) identified digitally supported processes, staff, organizational structures, technical infrastructure, benefits, and external conditions in general practice. Cross-national evidence from general practice also demonstrates that maturity depends on use, resources, individual and collective abilities, interoperability, evaluation routines, and perceived impact (Teixeira et al., 2023). Model-selection guidance further emphasizes alignment between an assessment's purpose, scope, evidence base, resource requirements, and intended decisions (Woods et al., 2022; Global Digital Health Partnership [GDHP], 2026). These studies expand assessment beyond technology counts, but most maturity instruments still describe organizational conditions rather than test a causal path to performance.

Empirical studies provide initial evidence that maturity and outcomes may be associated. Woods et al. (2023) found that staff in more digitally mature systems reported a broader set of positive impacts, although usability problems and change fatigue remained. Snowdon et al. (2024) identified

an association between advanced maturity and hospital quality and safety outcomes in a cross-sectional design. Hawrysz et al. (2025) linked digital maturity with managers' job satisfaction and organizational commitment in primary care facilities. These findings are important, but they do not eliminate selection bias, reverse causality, context effects, or the possibility that strong leadership drives both maturity and performance.

Implementation science provides a second analytical layer. The NASSS framework emphasizes the complexity of the condition, technology, value proposition, adopter system, organization, wider context, and interaction over time (Greenhalgh et al., 2017). TPOM examines technology, people, organizations, and the macroenvironment during formative evaluation (Cresswell et al., 2020). The updated Consolidated Framework for Implementation Research structures determinants related to innovation, outer and inner settings, individuals, and the implementation process (Damschroder et al., 2022). These frameworks explain why a digital initiative succeeds or fails in context, but they do not replace outcome measurement.

Information-systems research contributes measures of technical and informational success. The DeLone-McLean model is particularly useful for separating system quality, information quality, service quality, use, user satisfaction, and net benefits (DeLone & McLean, 2003). In a healthcare organization, these constructs help diagnose whether poor results arise from unstable technology, inaccurate or incomplete data, weak support, limited use, or a lack of organizational benefit. Nevertheless, a positive user-experience score cannot establish financial value, improved capacity utilization, or better patient outcomes.

Health-economic and health-technology assessment add the resource-allocation perspective. Digital interventions create distinctive challenges because they evolve after implementation, require complementary organizational investment, generate network effects, transfer costs between stakeholders, and may produce benefits only after adoption and learning (Gomes et al., 2022; Wilkinson et al., 2023). The Evidence Standards Framework issued by the National Institute for Health and Care Excellence (NICE, 2022) accordingly matches the strength of evidence to the function and risk of a digital technology. Economic analysis should therefore include implementation and maintenance costs, opportunity cost, budget impact, time horizon, uncertainty, and distribution of benefits, not only the purchase price.

Finally, balanced healthcare outcome frameworks prevent a commercially narrow interpretation of performance. The quadruple aim combines patient experience, population health, per-capita cost, and workforce experience (Bodenheimer & Sinsky, 2014). The quintuple aim adds equity (Nundy et al., 2022). For private providers, these outcome directions must be complemented by organizational sustainability and market viability. Their inclusion does not mean that a single index should merge all outcomes. It means that investment decisions must make trade-offs visible and must not allow an improvement in one area to conceal unacceptable deterioration in another.

The comparison in Table 1 shows why an integrated methodology is needed. Adoption, maturity, implementation quality, system success, managerial performance, and economic or strategic value are separate evaluation objects. Confusing them produces predictable errors: an installed system is treated as an implemented service; a high maturity score is interpreted as evidence of impact; positive user perception is presented as efficiency; or a short payback period is taken to justify risks that have not been controlled. M2P-EF retains the diagnostic value of each object while placing it within one causal and decision-oriented architecture.

Specific requirements of private healthcare organizations

Private healthcare organizations are heterogeneous. They include small outpatient practices, diagnostic centers, specialty clinics, multisite networks, and private hospitals. Their digital portfolios, regulatory exposure, capital structure, and data capabilities differ substantially. A useful methodology must therefore be modular: the core constructs should remain stable, while indicators and evidence designs should be calibrated to organizational size, service model, technology risk, and data availability.

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Table 1

Distinct evaluation objects and their methodological roles

Evaluation object	Key question	Indicative measures	Primary limitation	Role in M2P-EF
Technology adoption	Is the technology present and used?	Installed functions; active users; digital transaction share	Does not show capability, implementation quality, or benefit	Starting condition
Digital maturity	Can digital resources be used coherently and sustainably?	Strategy; governance; skills; interoperability; analytics	Often self-reported and weakly linked to outcomes	Enabling capability
Implementation quality	Was this initiative embedded as intended?	Acceptability; appropriateness; feasibility; fidelity; penetration; sustainability	Can explain delivery without proving organizational value	Activation mechanism
Information-system success	Do the system and information work for users?	System, information, and service quality; use; satisfaction; net benefits	Net benefit may remain broad or perception-based	Technical and user diagnostic
Managerial performance	Did management processes and balanced results improve?	Cycle time; capacity; decision latency; workforce; quality; patient value; finance	Attribution is vulnerable to confounding and time effects	Outcome vector
Economic and strategic value	Are benefits worth resources and risks over time?	Total cost; budget impact; NPV; resilience; option and market value	Long horizon, uncertainty, and cost or benefit transfers	Portfolio decision

Source: developed by the author from DeLone and McLean (2003), Proctor et al. (2011), Duncan et al. (2022), Gomes et al. (2022), and Cresswell et al. (2025).

Four characteristics shape evaluation in this sector. First, investment discipline is explicit. Capital and recurring software expenditure compete with workforce, equipment, facilities, and service-development needs. Second, revenue and demand are sensitive to patient access, reputation, payer relationships, retention, and service differentiation. Third, operational productivity is inseparable from clinical quality because scheduling, documentation, diagnostics, billing, and follow-up are interdependent. Fourth, risk has asymmetric consequences: a cybersecurity event, incorrect decision support, prolonged outage, or loss of patient trust can outweigh incremental productivity gains.

These characteristics imply three methodological requirements. Performance should be assessed through a balanced dashboard rather than a single financial ratio. Safety, privacy, cybersecurity, and regulatory compliance should function as noncompensatory gates, meaning that strong financial or operational results cannot offset failure below a minimum acceptable threshold. Finally, value realization should be assessed over time. Digital initiatives often impose early training, migration, and workflow costs before benefits stabilize; a single post-implementation measurement may therefore misclassify both temporary disruption and unsustained early success.

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PAPER OBJECTIVE

The aim of this article is to develop an integrated methodology for evaluating digital transformation in private healthcare organizations by linking digital maturity to implementation quality, process change, managerial performance, and strategic value. The study addresses four research questions:

1. Which evaluation objects must be distinguished to avoid treating technology adoption or digital maturity as evidence of organizational success?
2. Which assessment domains and indicators can connect digital capabilities with managerial performance in private healthcare organizations?
3. Which data sources and research designs provide progressively stronger evidence that observed results are associated with a digital initiative?
4. How can evaluation findings be converted into transparent decisions to continue, modify, scale, pause, or discontinue an initiative?

The article contributes the Maturity-to-Performance Evaluation Framework (M2P-EF). The framework contains a six-layer causal architecture, seven assessment domains, a measurement and scoring protocol, an evidence ladder, and a seven-step decision cycle. Its central proposition is that digital maturity is an intermediate organizational capability: it enables value realization but is not itself an outcome. The proposed methodology is analytical and developmental. It is not presented as a validated instrument, and its future psychometric and field validation is specified as a separate research agenda.

METHODOLOGY

Review design and source selection

The study used a structured integrative review and framework synthesis. An integrative design was chosen because the research question spans management theory, digital maturity, implementation science, information-systems evaluation, healthcare outcomes, and economic evaluation. This approach supports the combination of conceptual, empirical, and institutional sources while preserving differences in what each source is designed to explain (Whittemore & Knafl, 2005; Snyder, 2019). The study is not presented as a systematic review of intervention effects and does not make a PRISMA-style claim of exhaustive retrieval.

Searches and source verification were conducted during July-August 2026, with a final update on 3 August 2026. PubMed/MEDLINE-indexed records, DOI-resolved journal pages, and the official repositories of WHO, NICE, GDHP, and the World Bank were searched. Search strings combined the following terms: "digital maturity" OR "digital transformation" with healthcare OR hospital OR "primary care" and evaluation OR performance OR outcome OR value OR implementation; and "digital health" with "economic evaluation," "implementation framework," or "maturity assessment." Backward reference checking was used to identify seminal frameworks.

Sources were included when they met at least one of four criteria: they defined or operationalized organizational digital maturity; linked maturity or digitalization with organizational outcomes; provided an implementation, information-system, or economic evaluation framework applicable to healthcare; or specified authoritative requirements for digital-health governance, evidence, monitoring, privacy, or cybersecurity. The main publication window was 2016 through August 2026. Earlier sources were retained when they provided foundational constructs that remain directly relevant, including dynamic capabilities, information-system success, implementation outcomes, and balanced healthcare aims.

Sources were excluded when they focused solely on algorithmic accuracy, a single clinical procedure without organizational implications, patient-only application usability, digital education

without an organizational evaluation component, or technology adoption without operationalizable constructs. Commercial maturity tools were used only when their content was described in peer-reviewed or authoritative comparative sources. The final substantive corpus contained 27 sources: 21 peer-reviewed publications and six institutional frameworks or guidance documents. Two additional methodological publications guided the integrative-review procedure.

Analytical procedure

Each substantive source was entered into a concept matrix containing: evaluation object; unit of analysis; theoretical mechanism; domains and constructs; proposed indicators; data source; temporal orientation; treatment of context; treatment of cost and risk; evidence design; and stated limitations. The synthesis proceeded in five stages.

5. Constructs were coded according to whether they represented inputs, capabilities, implementation processes, process changes, organizational outcomes, or strategic effects.
6. Overlapping constructs were consolidated while preserving conceptually distinct objects. For example, actual use was not merged with maturity, and implementation cost was not merged with total economic value.
7. Gaps were identified by tracing whether each framework could explain a complete pathway from digital investment to managerial results.
8. The consolidated constructs were adapted to private healthcare through a balanced performance logic that included financial sustainability and market performance alongside patient, workforce, quality, and resilience outcomes.
9. Measurement, evidence, and decision rules were added to convert the conceptual model into an operational evaluation protocol.

The synthesis was governed by seven design criteria: conceptual separation, causal plausibility, measurability, data triangulation, temporal sensitivity, decision relevance, and risk proportionality. No construct was retained solely because it appeared frequently. It also had to clarify a decision, diagnose a mechanism, or define a boundary condition. Particular weight was given to recurrent limitations in the literature, including self-report bias, inconsistent indicator definitions, limited outcome linkage, weak longitudinal tracking, and the difficulty of evaluating a moving technological target (Cresswell et al., 2023, 2025).

Status of the proposed methodology

M2P-EF is a conceptual-methodological output of the synthesis. It has not been tested with organizational data and should not be described as validated. The proposed domains and indicators are candidate components for subsequent content validation, feasibility testing, reliability analysis, construct validation, and longitudinal criterion validation. No human participants, patient records, or clinical data were used in this study; consequently, research ethics approval was not required for the present methodological development.

RESULTS AND DISCUSSION

The Maturity-to-Performance Evaluation Framework

M2P-EF organizes evaluation as a six-layer value-realization chain: digital investment and assets; maturity capabilities; implementation quality; process and behavioral change; managerial performance; and strategic value. The layers are connected but analytically separate. Context and governance act across the chain, while evidence strength determines how confidently a manager can attribute observed changes to the digital initiative.

The first layer includes the resources committed to transformation: technology acquisition, integration work, data migration, training, process-redesign time, internal staff effort, vendor support, and governance capacity. Treating only the license or equipment price as the investment base underestimates the true cost of transformation.

The second layer consists of maturity capabilities. These are relatively durable organizational abilities that make coherent digital work possible, such as strategic alignment, interoperable infrastructure, data governance, digital competence, change leadership, cybersecurity, and routines

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for learning from performance data. Maturity is assessed at the organizational or business-unit level and should be measured independently of the outcomes it is expected to enable.

The third layer is implementation quality. It captures whether a specific initiative is acceptable, appropriate, feasible, adopted, used as intended, supported, integrated, and sustained. This layer is initiative-specific: an organization may have high general maturity but implement a particular system poorly, or it may compensate for low maturity through intensive support during a narrowly scoped project.

The fourth layer covers observable changes in processes and behavior. Examples include shorter information-search time, fewer manual handoffs, higher completion of digital documentation, reduced duplicate entry, better schedule adherence, faster managerial reporting, and more consistent use of decision-support rules. These proximal changes are the immediate mechanisms through which capabilities and implementation are expected to affect results.

The fifth layer is managerial performance. It includes operational productivity, quality and reliability of management processes, resource use, workforce outcomes, patient value, financial sustainability, risk control, and resilience. Performance measures should be defined before implementation and, where possible, should use routinely generated data rather than retrospective opinion.

The sixth layer is strategic value. It concerns sustained competitive and organizational effects such as scalable service models, improved adaptability, stronger patient trust, better market positioning, organizational learning, and the option value of a reusable digital platform. Strategic value is typically slower to emerge and more difficult to attribute than proximal process change. It therefore requires longer observation, explicit assumptions, and scenario analysis.

The framework includes a feedback loop because realized or unrealized value should change the next investment decision. An initiative that produces benefit but creates unacceptable risk should be redesigned rather than automatically scaled. An initiative that produces no measurable effect may still warrant continuation if implementation is incomplete and the causal mechanism has not yet been activated. Conversely, a technically successful implementation should be discontinued when the value proposition is no longer defensible.

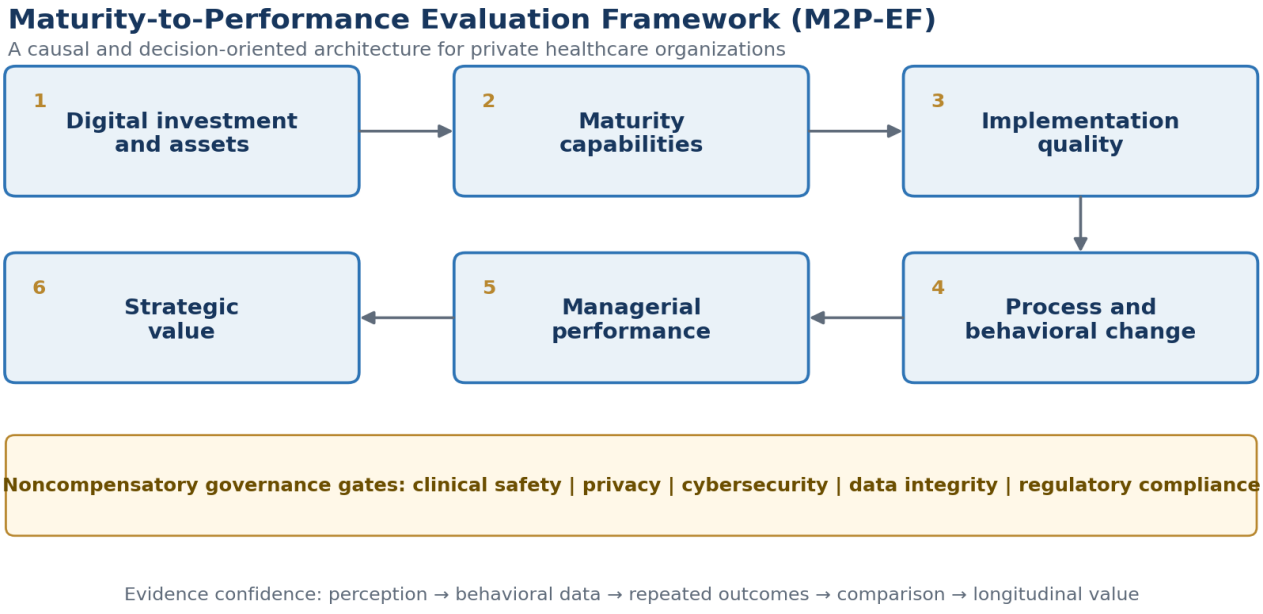


Figure 1. Maturity-to-Performance Evaluation Framework (M2P-EF)
Source: developed by the author.

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Assessment domains and candidate indicators

The value-realization chain is assessed across seven domains. The domains are not maturity stages and should not be interpreted as a universal sequence. They are areas in which capabilities, process changes, and outcomes can be specified for the initiative under evaluation.

Table 2

M2P-EF assessment domains, candidate indicators, and evidence sources

Assessment domain	Capability and implementation indicators	Managerial outcome indicators	Preferred evidence sources
1. Strategic alignment and governance	Accountable owner; defined problem and value proposition; decision rights; portfolio review; benefit owner	Decision latency; benefit realization; project reprioritization; governance exceptions	Strategy and investment records; governance minutes; benefit register
2. Data, infrastructure, interoperability, and cybersecurity	Availability; interface coverage; data completeness; access control; backup and incident readiness; supplier assurance	Downtime; failed transactions; reconciliation work; security events; data-supported decisions	System and interface logs; data-quality audits; incident and access records
3. Process integration and operational productivity	Workflow mapping; digital handoffs; automation coverage; standard work; support response	Cycle and waiting time; appointment utilization; no-shows; rework; billing delay; reporting latency	Administrative records; timestamps; process mining; task observation
4. Workforce capability and change absorption	Role-based competence; training; participation in redesign; support; role clarity; change-load monitoring	Task time; help-desk demand; workload; satisfaction; turnover; absence; adoption persistence	Training and support records; logs; staff survey; time-motion data; HR records
5. Patient value, quality, access, and equity	Patient involvement; accessible channels; consent and escalation rules; quality monitoring	Access time; continuity; follow-up; experience; complaints; defects; subgroup differences; digital abandonment	Patient and episode records; PREMs; complaints; quality audit; subgroup analysis
6. Financial sustainability and market performance	Approved business case; total-cost model; benefit owner; cost and revenue tracking	Cost per episode; contribution margin; payback; budget impact; capacity revenue; retention	General ledger; contracts; payroll; billing; volume and retention data
7. Resilience and adaptive capacity	Tested fallback; recovery plan; vendor alternatives; modular architecture; learning routines	Recovery time; service continuity; supplier concentration; modification speed; improvements triggered by data	Continuity tests; outage records; vendor register; change logs; improvement records

Source: synthesized by the author. Indicator selection must be tailored to the initiative, organization, risk, and available data.

Strategic alignment and governance determine whether the digital initiative has an accountable owner, a defined problem, a target population or process, a business case, decision rights, and a

monitoring plan. The key performance question is not whether a digital strategy exists, but whether priorities, resources, responsibilities, and review mechanisms are aligned with the organization's service and business model.

Data, infrastructure, interoperability, and cybersecurity form the technical-governance foundation. Capability indicators include system availability, interface coverage, data completeness, master-data governance, identity and access control, backup testing, incident response, and supplier risk management. Performance indicators include downtime, failed transactions, reconciliation workload, security incidents, and the proportion of decisions supported by timely and complete data. The WHO cybersecurity maturity guide reinforces the need to assess both maturity and risk-reduction action rather than equate compliance documentation with effective control (WHO Regional Office for Europe, 2025).

Process integration and operational productivity evaluate whether technology changes how work is coordinated. Relevant measures include patient-cycle time, waiting time, appointment utilization, no-show rate, documentation turnaround, billing-cycle time, rework, duplicate entry, handoff failures, and managerial reporting latency. Denominators and case mix must be specified so that an apparent productivity gain is not merely a change in volume or service mix.

Workforce capability and change absorption cover competence, workload, role clarity, participation in redesign, support availability, psychological safety for reporting problems, and change fatigue. Digital transformation can shift work rather than reduce it; therefore, time saved in one role should be checked against added work in another. Objective or behavioral measures, such as training completion, help-desk demand, task time, turnover, and sickness absence, should complement staff perceptions.

Patient value, quality, access, and equity capture service consequences. Indicators may include access time, continuity, completion of follow-up, patient-reported experience, complaints, digital-channel abandonment, quality defects, and differences across relevant patient groups. In private healthcare, patient acquisition or retention can be assessed, but it should not substitute for care quality, accessibility, or informed choice.

Financial sustainability and market performance include total cost of ownership, implementation cost, recurring operating cost, cost per completed service episode, contribution margin where appropriate, revenue-cycle performance, payback, budget impact, retention, and the financial effect of capacity changes. Costs and benefits should be assigned to the stakeholders who incur or receive them. A provider may realize administrative savings while shifting time or expense to patients or clinicians; such transfers must be made visible.

Resilience and adaptive capacity evaluate whether the organization can maintain safe services, respond to disruption, and reconfigure processes as demand, technology, or regulation changes. Measures may include recovery time, continuity of critical workflows, proportion of processes with tested fallback arrangements, speed of system modification, dependency on a single supplier, and the frequency with which performance data trigger documented improvement action.

Indicator specification and scoring rules

Every indicator should be recorded in an indicator specification register before data are examined. The minimum fields are: construct; operational definition; numerator and denominator; direction of improvement; data source; responsible data owner; measurement frequency; baseline period; target; subgroup or case-mix requirements; known data-quality limitations; and the management decision the indicator is intended to inform. This step prevents post hoc selection of favorable metrics.

Measures should be organized by level. Capability indicators describe readiness; implementation indicators describe delivery; process indicators describe proximal mechanisms; performance indicators describe organizational results; and strategic indicators describe sustained value. At least one indicator from each relevant level should be used for a major initiative. A

dashboard containing only maturity scores cannot establish results, while a dashboard containing only distal outcomes cannot explain why results occurred.

When indicators use different scales, a transparent normalization can support within-domain comparison. For a positively directed indicator, the normalized value can be calculated as:

$$z_i = (x_i - L_i) / (U_i - L_i)$$

For an indicator in which lower values are better, the direction is reversed:

$$z_i = (U_i - x_i) / (U_i - L_i)$$

Here, x_i is the observed value and L_i and U_i are prespecified lower and upper reference points. Reference points should come from regulatory thresholds, internal historical performance, credible external benchmarks, or explicit managerial targets. They should not be derived from the same observed sample merely to create a favorable distribution.

A domain score may be calculated as a weighted sum when the indicators demonstrate adequate content validity and reliability:

$$D_j = \Sigma_i w_{ij} z_i, \text{ where } \Sigma_i w_{ij} = 1$$

Weights should be established before outcome analysis through expert consensus, analytic hierarchy procedures, or a documented equal-weight rule. Sensitivity analysis should show whether decisions change under plausible alternative weights. Until validation is completed, domain scores are best interpreted as structured summaries rather than precise latent measures.

An overall maturity score is optional. If used, a weighted geometric mean is preferable to a simple arithmetic average because it reduces the ability of a very high score in one domain to conceal a serious weakness in another. Even then, cybersecurity, privacy, clinical safety, data integrity, and regulatory compliance should remain noncompensatory gates. If any gate is below the minimum threshold, the recommendation cannot be unconditional scale-up regardless of the composite score.

Managerial performance outcomes should not be included in the maturity score. They must be reported as a separate result vector. This separation protects the causal logic: maturity is an explanatory capability, while performance is the outcome to be explained. Change should be reported in absolute units and, when meaningful, as relative change. Confidence intervals and distributional measures should be used where participant- or episode-level data are available.

Attribution requires a counterfactual question: what would likely have happened without the initiative? A simple before-after comparison is vulnerable to seasonality, demand changes, workforce changes, and concurrent improvement projects. Stronger designs include repeated interrupted time series, matched comparison units, stepped implementation, and difference-in-differences. For two comparable units, the basic difference-in-differences estimand is:

$$\Delta Y = (Y^T_{post} - Y^T_{pre}) - (Y^c_{post} - Y^c_{pre})$$

where T denotes the unit receiving the initiative and C the comparison unit. The design still requires assessment of baseline trends, concurrent changes, spillovers, and case-mix differences. Where a comparator is not feasible, multiple pre- and post-implementation observations, process tracing, and qualitative explanation are more credible than a single post-implementation survey.

Economic assessment should distinguish total cost of ownership, budget impact, and economic value. Net present value may be calculated as:

$$NPV = \Sigma_{t=0}^{n} (B_t - C_t) / (1 + r)^t$$

where B_t and C_t are benefits and costs in period t and r is the discount rate. The analysis should include acquisition, configuration, integration, migration, training, workflow disruption, governance, cybersecurity, maintenance, upgrades, support, and decommissioning. Nonmonetized outcomes should remain visible beside NPV, and best-case, base-case, and worst-case scenarios should test uncertainty in adoption, time savings, volume, and maintenance cost (Gomes et al., 2022; Wilkinson et al., 2023).

Evidence and design ladder

Evidence strength is not identical to data quantity. A large manager survey can remain weak evidence of organizational impact if it uses only perceptions and has no baseline, comparator, or

objective outcome. M2P-EF therefore classifies evidence according to its ability to support progressively stronger decisions.

Table 3

Evidence ladder for claims about managerial performance

Tier	Evidence base	Suitable designs and data	Defensible claim and management use
1	Perception and document review	Manager self-assessment; interviews; policy and process review	Diagnose readiness and generate hypotheses; do not claim impact
2	Behavioral and process verification	System logs; audit trails; workflow audit; task observation; implementation measures	Confirm use and proximal mechanism; continue or modify implementation
3	Repeated local outcome tracking	Defined baseline; multiple pre/post observations; routine operational, workforce, patient, and financial KPIs	Establish a plausible temporal association; support local continuation or limited rollout
4	Comparative or quasi-experimental evidence	Matched comparison; interrupted time series; stepped rollout; difference-in-differences; adjusted analyses	Strengthen attribution; support conditional scale-up with stated uncertainty
5	Longitudinal value realization	Multisite replication; sustained outcomes; economic evaluation; subgroup and risk analysis; sensitivity scenarios	Support large-scale investment, portfolio reallocation, or discontinuation

Source: developed by the author from WHO (2016), NICE (2022), Cresswell et al. (2023), and Wilkinson et al. (2023).

Tier 1 evidence is suitable for diagnosis and hypothesis generation. Tier 2 can verify whether the technology is being used and whether intended process mechanisms are occurring. Tier 3 can support local continuation or adjustment when changes are temporally plausible and triangulated. Tier 4 strengthens attribution through comparison or quasi-experimental logic. Tier 5 provides the strongest practical basis for scale, investment, or portfolio reallocation because it shows sustained, balanced outcomes and economic consequences across time or settings.

Not every initiative requires Tier 5 evidence. The proportionality principle applies: evidence requirements should rise with investment size, clinical risk, irreversibility, scale, and uncertainty. A low-risk scheduling reminder can be evaluated with routine data and a controlled rollout; an AI-supported clinical or resource-allocation system requires stronger governance, subgroup analysis, monitoring for drift, and a more demanding evidence design. The NICE framework similarly links evidence standards to technology function and risk (NICE, 2022).

Seven-step evaluation protocol

M2P-EF is operationalized through a seven-step protocol that begins before procurement and continues after implementation. The protocol is designed to make evaluation part of management rather than an external retrospective exercise.

The first three steps establish the causal logic before data collection. The organization defines the problem, identifies the relevant capability and implementation mechanisms, and specifies balanced outcomes. The next two steps select indicators and an evidence design proportionate to the decision. The sixth step integrates cost, risk, uncertainty, and subgroup effects. The seventh step converts evidence into a documented portfolio decision.

Table 4

Seven-step protocol for evaluating a digital-transformation initiative

Step	Management question	Required output	Decision rule
1	What problem and decision are being addressed?	Initiative boundary; process or population; decision owner; baseline problem	Do not evaluate an undefined solution or a technology category in general
2	How is the initiative expected to create value?	Logic model linking investment, capability, implementation, process change, and outcomes	Every outcome must have a plausible mechanism and time horizon
3	Which balanced outcomes and gates matter?	Operational, workforce, patient, financial, resilience outcomes; safety and governance thresholds	A failed gate blocks unconditional scale-up
4	Which indicators and data can measure the model?	Indicator register with definitions, denominators, sources, frequency, owner, target, and limitations	Define indicators before examining results
5	Which design is proportionate to the decision?	Baseline and follow-up plan; comparator where feasible; qualitative process explanation	Evidence strength rises with investment, risk, scale, and irreversibility
6	What do cost, risk, uncertainty, and distribution show?	Total cost; budget impact; scenarios; subgroup effects; unintended consequences	Report trade-offs and transfers; do not hide them in one average score
7	What action follows from the evidence?	Documented continue, modify, scale, pause, or stop recommendation with confidence rating	State evidence boundary, residual uncertainty, owner, and next review date

Source: developed by the author.

Four decision outcomes are recommended. Continue is appropriate when the mechanism is functioning, benefits are emerging, and risks are controlled. Modify is appropriate when the value proposition remains plausible but implementation, workflow, data quality, or user support is limiting results. Scale is appropriate only when benefits are reproducible, operational capacity exists, economic consequences are acceptable, and all noncompensatory gates pass. Pause or stop is appropriate when the value proposition is unsupported, harms or risks remain unacceptable, costs exceed plausible benefit, or the initiative no longer aligns with strategy.

Decisions should be accompanied by an evidence confidence rating. A useful statement has the form: "The initiative is recommended for limited scale-up with moderate confidence because objective process and financial improvements were sustained for six months, but patient-experience and subgroup effects remain uncertain." This format is more informative than a single traffic-light score because it makes the strength and boundary of the evidence explicit.

Proposed validation agenda

The methodology requires sequential validation. Phase 1 should establish content validity through a multidisciplinary Delphi process involving private healthcare managers, clinicians, health informatics specialists, economists, patient representatives, cybersecurity specialists, and regulators. Experts should assess relevance, clarity, completeness, and redundancy of domains and candidate indicators.

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Phase 2 should test feasibility and interpretability through cognitive interviews and pilot application in organizations of different sizes and specialties. This phase should document completion time, data availability, disagreement between respondents, missingness, and the cost of collecting objective evidence. Indicators that cannot be defined consistently or obtained at reasonable cost should be revised or removed.

Phase 3 should assess measurement properties. Multi-item capability scales require internal-consistency and test-retest analysis, while inter-rater reliability is needed when maturity is assessed by more than one respondent or by external reviewers. Exploratory and confirmatory factor analysis can test whether the proposed domains are empirically distinguishable. Measurement invariance should be examined before comparing small clinics, multisite networks, or different specialties.

Phase 4 should test construct and criterion relationships. Maturity scores should correlate with implementation and process measures in theoretically expected directions without becoming indistinguishable from them. Predictive validity should be examined by testing whether baseline capability measures forecast subsequent implementation quality and balanced managerial outcomes.

Phase 5 should use longitudinal, multisite designs to assess sensitivity to change, causal mechanisms, and transferability. Repeated observations are necessary because digital transformation is dynamic: technologies, workflows, staff capabilities, and external conditions evolve. Validation should therefore be treated as an ongoing program rather than a one-time certification of the framework.

Theoretical contribution

The principal contribution of M2P-EF is the explicit separation of capability, implementation, mechanism, result, and value. This addresses a recurring weakness in maturity research: the tendency to interpret a descriptive maturity score as evidence that a digital investment has improved organizational performance. Duncan et al. (2022) identified limited triangulation between maturity and outcomes, and Cresswell et al. (2025) highlighted self-report bias, measurement cost, and weak long-term tracking. M2P-EF responds by requiring separate indicators and evidence claims at each layer of the causal chain.

The framework also clarifies the relationship between digital maturity and dynamic capabilities. Maturity represents the organization's capacity to mobilize digital resources, but performance emerges only when that capacity is activated through implementation and process change. This resolves an apparent contradiction in the literature: digitally mature organizations may have better outcomes on average, yet maturity does not guarantee success in every initiative. Strong governance, workforce capability, and data infrastructure can enable results, while poor intervention fit or execution can still block them.

A second contribution is the integration of complementary frameworks without collapsing their constructs. NASSS, TPOM, and CFIR are used to diagnose context and implementation; DeLone-McLean constructs diagnose system and information success; maturity models describe organizational capability; balanced healthcare aims define outcome directions; and economic evaluation addresses resource trade-offs. The synthesis does not propose another universal maturity ladder. It provides a logic for selecting and connecting measures according to the decision being made.

A third contribution is the use of noncompensatory governance gates. Composite indices are attractive because they simplify reporting, but they can create a false impression that strengths and weaknesses are fully substitutable. In healthcare, they are not. Excellent financial performance cannot compensate for unacceptable privacy, cybersecurity, data-integrity, or clinical-safety risk. Treating these domains as gates preserves managerial accountability and prevents a high average score from concealing a critical vulnerability.

Relevance to private healthcare management

The methodology adapts evaluation to the private sector without reducing healthcare value to profitability. Financial sustainability and market performance are included because they determine

whether a private provider can maintain and scale a service. At the same time, patient value, workforce effects, quality, access, equity, and resilience remain distinct outcome domains. This creates a balanced value proposition: a digital initiative is managerially successful when it supports sustainable organizational performance within healthcare obligations.

The framework is scalable. A small clinic can use a minimum viable evaluation consisting of a defined problem, a short logic model, several routinely available process and outcome indicators, a baseline, a phased rollout, total-cost tracking, and documented safety gates. A multisite network can add matched comparisons, interrupted time series, patient-level or episode-level analysis, subgroup assessment, and portfolio optimization. The underlying logic remains the same even when the sophistication of the evidence differs.

M2P-EF also helps managers avoid sunk-cost reasoning. When implementation is weak, the correct response may be targeted modification rather than immediate abandonment. When implementation is strong but outcomes do not improve, the value proposition itself should be reconsidered. When outcomes improve but costs or risks are unsustainable, the initiative should not be scaled without redesign. Separating layers makes these different failure modes visible.

For Ukrainian private healthcare organizations and other resource-constrained or disrupted settings, the evidence ladder is particularly relevant. Complete data warehouses, stable comparison groups, and long pre-implementation series may not be available. The framework allows managers to begin with transparent lower-tier evidence while specifying how confidence can be strengthened over time. It also gives resilience a formal place in evaluation, recognizing that continuity, fallback capacity, vendor dependency, and recovery time can be strategic outcomes rather than technical afterthoughts.

Implications for future empirical research

The first empirical task is not to calculate a national maturity ranking. It is to determine whether the proposed constructs are understood consistently and can be measured with acceptable burden. Content validity and feasibility should therefore precede large-scale surveys. The second task is to test the causal sequence: whether stronger baseline capabilities predict higher implementation quality; whether implementation quality predicts process change; and whether process change predicts balanced managerial outcomes.

Future studies should collect data from multiple organizational roles because a single manager may not accurately assess interoperability, workforce burden, cybersecurity, and patient value. Surveys should be triangulated with system logs, administrative records, financial data, incident registers, time-motion observations, and patient or staff measures. Where rollout timing differs across sites, quasi-experimental designs can produce substantially stronger evidence than cross-sectional maturity correlations.

Research should also test heterogeneity. The relationship between maturity and performance may differ by organizational size, specialty, ownership structure, urban or regional location, technology type, and baseline capability. Threshold effects are plausible: advanced analytics may create little value until data quality and workflow integration reach a minimum level. Conversely, a simple, well-targeted intervention may generate value in a low-maturity organization when implementation support is strong. M2P-EF provides a structure for testing these contingencies rather than assuming a linear universal relationship.

Limitations

This article has four limitations. First, the source review was structured and transparent but purposive rather than exhaustive; relevant models may have been missed. Second, the framework integrates literature developed largely in hospitals and public health systems with evidence from primary care and management research. Its transfer to different forms of private healthcare requires empirical examination. Third, the candidate indicators are illustrative. Definitions, reference ranges, weighting, and data-collection burden must be adapted and validated before comparative scoring. Fourth, the causal chain simplifies feedback, emergence, and unintended consequences. Digital

transformation is dynamic, and relationships may be reciprocal: performance can finance further maturity, while external shocks can alter both implementation and outcomes.

These limitations define the appropriate claim. M2P-EF is a theory-informed methodology for organizing evaluation and designing future research; it is not a validated scale, a proven causal model, or evidence that digital maturity automatically improves performance.

CONCLUSION

Digital maturity and managerial performance should not be treated as synonyms. Maturity describes the capabilities that make coherent digital work possible; managerial performance describes whether those capabilities, through successful implementation and process change, generate balanced organizational results. Evaluation becomes misleading when it stops at technology adoption, relies only on self-assessment, or combines readiness and outcomes in a single score.

The proposed M2P-EF links six analytical layers: investment and assets, maturity capabilities, implementation quality, process and behavioral change, managerial performance, and strategic value. It applies these layers across seven domains and adds explicit indicator specifications, noncompensatory safety and governance gates, an evidence ladder, economic analysis, and a seven-step decision protocol. The framework is tailored to private healthcare by combining operational and financial sustainability with patient value, workforce conditions, quality, equity, cybersecurity, and resilience.

The methodology can support better research and better management before complete clinical datasets are available. It helps organizations state what they expect a digital initiative to change, select evidence proportionate to the decision, distinguish implementation failure from theory failure, and document whether an initiative should continue, be modified, be scaled, be paused, or be discontinued. Its next stage is empirical: multidisciplinary content validation, feasibility testing, psychometric assessment, and longitudinal multi-organization evaluation are required before the framework can be used as a comparative measurement instrument.

DECLARATIONS

Ethics statement. The study used publicly available academic and institutional sources and did not involve human participants, patient records, or clinical data. Ethics approval was therefore not required.

Data availability. No new dataset was generated or analyzed. The sources used in the framework synthesis are listed in the References.

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ВІД ЦИФРОВОЇ ЗРІЛОСТІ ДО УПРАВЛІНСЬКОЇ РЕЗУЛЬТАТИВНОСТІ: МЕТОДОЛОГІЯ ОЦІНЮВАННЯ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ У ПРИВАТНИХ ЗАКЛАДАХ ОХОРОНИ ЗДОРОВ'Я

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У статті розроблено інтегровану методологію, яка поєднує цифрову зрілість із якістю впровадження, змінами процесів, управлінською результативністю та стратегічною цінністю у приватних закладах охорони здоров'я. Проведено структурований інтегративний огляд та синтез концептуальної моделі на основі 27 основних джерел із досліджень цифрової зрілості, науки про впровадження, оцінювання інформаційних систем, економіки охорони здоров'я та авторитетних рекомендацій у сфері цифрової охорони здоров'я; ще два додаткові джерела використано для обґрунтування методики огляду. Запропонована модель оцінювання «зрілість – результативність» (Maturity-to-Performance Evaluation Framework, M2P-EF) передбачає шість рівнів оцінювання: інвестиції та цифрові активи; спроможності цифрової зрілості; якість впровадження; зміни процесів і поведінки; управлінська результативність; стратегічна цінність. Оцінювання здійснюється за сімома напрямами: стратегічне управління; дані, інфраструктура, інтероперабельність і кібербезпека; інтеграція процесів і продуктивність; компетентності персоналу; цінність для пацієнтів, якість, доступність і справедливість; фінансова та ринкова стійкість; стійкість до кризових ситуацій. Методологія також визначає правила формування показників, обов'язкові критерії безпеки та управління, ієрархію доказовості, економічний аналіз і семикроковий протокол прийняття рішень. Практичне значення. M2P-EF може використовуватися для перспективного оцінювання, допомагати менеджерам розмежовувати проблеми впровадження та проблеми ціннісної пропозиції, а

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також підтримувати прозоре прийняття рішень щодо продовження, коригування, масштабування, призупинення або припинення цифрових ініціатив. Запропонована модель ще не пройшла емпіричної валідації; перед її використанням для порівняльного оцінювання необхідні перевірка змістової валідності, тестування практичної здійсненності, психометричне оцінювання та лонгітюдне багатосайтове дослідження. Основний внесок дослідження полягає у визначенні цифрової зрілості як спроможності, що створює передумови для досягнення результатів, а не як результату діяльності організації, а також у її окремому вимірюванні відносно показників результативності.

Ключові слова: цифрова зрілість; цифрова трансформація; управлінська результативність; приватна охорона здоров'я; методологія оцінювання; впровадження; реалізація цінності.