CHAPTER 21

PROJECT, PROGRAMME, AND PORTFOLIO MANAGEMENT

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ABSTRACT

Enterprises increasingly accomplish strategic change through temporary initiatives, yet delivering a specified output within an approved budget does not guarantee useful, equitable or durable results. This chapter critically examines project, programme and portfolio management as interdependent mechanisms for selecting investments, organizing temporary work and realizing benefits within continuing enterprise systems. A transparent, purposive synthesis combines foundational scheduling research, theories of temporary organization, governance, agency and stewardship, real-options reasoning, contemporary empirical project scholarship, and official PMI and ISO guidance. Twelve approved domains address authorization and selection; life cycles and governance; scope, dependencies, schedules and cost; uncertainty and stakeholders; teams and procurement; predictive and adaptive delivery; benefits evaluation; and digitally assisted project control. Official documentation of Rwanda's Digital Acceleration Project and the United Kingdom's Crossrail programme supports a comparative analysis that distinguishes policy intentions from independently established outcomes. An explicitly constructed Kigali university-service transformation project provides an auditable charter, work breakdown structure, critical-path network, cost baseline, earned-value measures, decision log, risk register and benefits appraisal. The central argument is that project success should be evaluated as a conditional relationship between legitimate strategic selection, feasible delivery, accountable governance and observed post-handover value, rather than a simple function of time, cost and scope. The integrated framework is a scholarly synthesis proposed for testing, not a newly validated causal model.

Keywords: project governance; programme management; portfolio management; critical-path method; earned value management; project risk; agile and hybrid delivery; benefits realization; digital transformation; Rwanda.

LEARNING OUTCOMES AND CHAPTER ROADMAP

After studying this chapter, readers should be able to (LO1) distinguish projects, operations, programmes and portfolios and evaluate the governance consequences of their boundaries; (LO2) critically compare temporary-organization, agency, stewardship, contingency, real-options and value-realization approaches; (LO3) prepare and appraise a transparent project charter, business case, requirements baseline and work breakdown structure; (LO4) calculate and interpret network schedules, float, cost baselines, earned-value indicators and uncertainty scenarios; (LO5) design proportionate stakeholder, team, procurement, risk and escalation arrangements; (LO6) justify predictive, adaptive or hybrid approaches against uncertainty, technical constraints and rights; (LO7) construct and challenge a benefits-realization and post-project evaluation plan; and (LO8) defend a cross-functional Rwandan investment recommendation using documented evidence, reproducible arithmetic and appropriate international comparison.

The chapter first distinguishes temporary change from recurring enterprise work (21.1), then investigates selection and authority (21.2–21.3), requirements and technical planning (21.4–21.6), risk, participation and delivery capacity (21.7–21.9), tailoring and results (21.10–21.11), and digital infrastructures (21.12). A substantial Rwanda-centred

worked application, comparative documentary cases, integrative synthesis, glossary and assessment package follow (21.13–21.17). General competitive strategy remains within Chapter 6, routine production and service flow within Chapter 17, procurement award architecture within Chapter 18, quality management within Chapter 20, financial investment appraisal within Chapter 24 and enterprise-wide risk within Chapter 32. The present chapter concerns temporary initiatives that connect these enduring functions.

21.0 INTRODUCTION: WHEN FINISHING THE PROJECT IS NOT THE SAME AS CHANGING THE ENTERPRISE

Suppose a Kigali university authorizes a student-service portal to reduce queues, repeated visits and fragmented information. The software supplier completes the contracted configuration and the project manager announces delivery on the agreed date. Yet academic departments continue to maintain separate spreadsheets, student records are inconsistent, staff have not been granted authority to resolve exceptions, and applicants encounter inaccessible forms. The sponsor receives an apparently successful completion report while students experience little improvement. Alternatively, the portal might be accepted several weeks late because accessibility failures were identified and corrected, yet go on to create important long-term value. Neither result can be understood from schedule adherence alone. This opening case is hypothetical; it does not describe a particular university or measured outcome.

A project is a temporary, purposive arrangement established to create a specified change, output or capability under resource, institutional and temporal constraints. A programme coordinates related projects and other activities in pursuit of benefits that separate projects could not secure as effectively. A portfolio groups and prioritizes investments, which need not be mutually dependent, to serve strategic objectives and organizational capacity. Operations sustain recurrent service or production. These definitions are consistent with the contextual distinctions established by ISO 21500:2021, ISO 21502:2020, ISO 21503:2022 and ISO 21504:2022 (International Organization for Standardization [ISO], 2020, 2021, 2022a, 2022b). They are analytical categories, not necessarily separate organizational departments. In an SME, the owner may act simultaneously as sponsor, portfolio decision-maker and project manager; in a public programme, those authorities may be legally separated.

The chapter makes three propositions that require careful qualification. First, projects are mechanisms of intentional change embedded in enduring organizations, so outputs are only a possible antecedent of outcomes. Second, the apparent opposition between planning discipline and adaptability is misleading: both are responses to uncertainty, but they differ in what they assume can be known and fixed in advance. Third, neither commercial returns nor public-value claims can excuse deceptive forecasts, unsafe work, exclusion or weak accountability. Effective project management therefore links technical coordination to the right to authorize, challenge, alter, stop and evaluate investments. This interpretation builds upon the separation of governance from operational management (Too & Weaver, 2014) and the critique of schedule-cost-quality measures as complete proxies for success (Atkinson, 1999; Ika, 2009).

21.0.1 Research orientation, source hierarchy and limitations

This chapter employs a critical, purposive secondary-source synthesis rather than a registered systematic literature review, an enterprise survey or a field experiment. Literature was selected for theoretical difference and direct relevance to the approved twelve-section architecture. The inquiry prioritizes original studies of critical-path and probabilistic scheduling, foundational temporary-organization theory, peer-reviewed research on project governance, complexity and outcomes, and primary institutional publications for current standards and documented programmes. Targeted author-title and identifier checks covered Kelley and Walker (1959), Malcolm et al. (1959), Lundin and Söderholm (1995), Atkinson (1999), Shenhar et al. (2001), Ika et al. (2012), Too and Weaver (2014), Serrador and Pinto (2015), Joslin and Müller (2016), and pertinent ISO, PMI, APM, World Bank and UK National Audit Office publications. The evidentiary cut-off is 2 November 2026; the list is purposive, not exhaustive, and no unperformed database screening or numerical meta-analysis is claimed.

Evidence is interpreted according to its inferential strength. Standards prescribe terminology or recommended practice but do not demonstrate universal effectiveness. Cross-sectional perceptions reveal associations that may be subject to common-method bias and reverse causality. Government financing announcements establish approved

intentions, not verified benefits. Audit findings about a specific megaproject are contextually informative but not a representative estimate of project failure rates. All Kigali-case numbers are constructed to permit reproducible teaching calculations; they must not be cited as observed enterprise statistics. This hierarchy matters because project reports frequently conceal differences among promises, activities, outputs, outcomes and counterfactual claims.

21.0.2 Historical development and philosophical foundations

Modern project management formalized techniques that long predated the profession. Construction, military logistics and public works had required coordinated tasks for centuries, but twentieth-century operations research developed formal techniques for sequencing complex activities, allocating resources and monitoring progress. Kelley and Walker's (1959) critical-path account treated project delivery as a network of interdependent activities; Malcolm et al. (1959) developed PERT for uncertain research and development programmes. Their lasting contribution is to make sequencing assumptions explicit and analytically examinable. Their limitation is equally important: a mathematically coherent schedule may describe an unrealistic organization, neglect competition for scarce specialists or assume that observed precedence is technically immutable.

A second intellectual strand treats projects as social and political organizations rather than merely networks. Lundin and Söderholm (1995) emphasized time, team, task and transition in temporary organizations, drawing attention to the separation of temporary action from permanent institutions. Governance scholarship then questioned who authorizes and oversees those actions, while benefits scholarship challenged the idea that handover marks the end of meaningful evaluation (Too & Weaver, 2014; Serra & Kunc, 2015). Contemporary PMI and APM guidance consequently places project delivery within systems of value, stakeholders, uncertainty, sustainability and organizational learning, without abandoning formal scope, schedule and financial control (Association for Project Management [APM], 2025; Project Management Institute [PMI], 2025).

The underlying philosophy involves distinct forms of judgment. *Epistemic* judgment asks which requirements, durations, estimates and causal relationships are knowable. *Instrumental* judgment asks which feasible sequence, procurement, resource or delivery method advances declared objectives. *Normative* judgment asks whether those objectives and means are justifiable to affected persons. A complete business case cannot be produced by adding moral language to a discounted cash-flow model after authorization; the legitimate purposes, harms, alternatives, beneficiaries and distribution of burdens belong within the selection problem itself. Nor is a compelling social objective evidence that a particular intervention will work. The chapter therefore treats project decisions as conditional, revisable claims supported by transparent records rather than as exercises in prediction presented with false certainty.

21.1 PROJECTS VERSUS OPERATIONS: GOVERNING DIFFERENT FORMS OF WORK

The distinction between project work and business-as-usual (BAU) is meaningful but not absolute. A project introduces a specified change, while operations reproduce or adapt a continuing service. A school that routinely enrols students performs an operation; designing and commissioning a new admissions system is a project. The operation may itself be continuously improved, and the project may involve repeated testing, training and data cleaning. Temporary uniqueness therefore refers to the configuration of intended change and governance, not to every activity being unprecedented. ISO (2020) explicitly allows predictive, incremental, iterative, adaptive and hybrid delivery approaches, so the identity of a project must not be equated with a single scheduling methodology.

A programme is justified when related outputs jointly enable a benefit that cannot be realized by isolated projects. For example, a national digital-public-service programme might coordinate broadband access, digital literacy, interoperable identification and service redesign. A portfolio decision, by contrast, concerns which initiatives deserve scarce capital, executive attention and specialist time across otherwise dissimilar priorities. Programmes manage dependency and collective benefit; portfolios manage selection, balance and reprioritization; projects manage bounded change; operations sustain the resulting capability. Conflating them leads to governance defects: a project manager is unfairly made accountable for benefits outside the project's decision rights, or a portfolio committee approves too many projects for available capacity (ISO, 2021, 2022a, 2022b; Too & Weaver, 2014).

Authority is not created merely by assigning titles. The sponsor should own the continuing justification, protect access to organizational resources and settle escalation beyond the project manager's mandate. The project manager should coordinate the approved temporary work and disclose emerging deviations. A benefits owner, normally in the receiving operation, must be accountable for adoption and post-handover measurement. A steering group or portfolio body authorizes material investment changes and can terminate an initiative whose business case no longer withstands scrutiny. The governing board retains accountability for significant legal, financial or reputational exposure. Figure 21.1 locates these responsibilities along a chain from authorization to sustained outcomes.



Figure 21.1. *Accountability and benefits chain connecting enterprise strategy, temporary delivery and continuing operations.* Note. Original synthesis based on ISO (2020, 2021, 2022a, 2022b), Too and Weaver (2014) and Serra and Kunc (2015).

This separation also clarifies the status of a project management office (PMO). A PMO may provide methods, reporting, assurance, specialist support or portfolio information, but its existence does not establish effective governance. In a university with few simultaneous projects, a shared charter and monthly independent review may be more proportionate than a separate office. In a complex public investment portfolio, standardized controls can reduce informational fragmentation, provided they do not incentivize selective reporting or turn compliance into a substitute for judgment. The decisive question is whether the governance arrangement makes relevant information visible to people empowered to act.

21.1.1 The distinctive economic logic of programmes and portfolios

Programme management has a distinctive object of control: the interdependency among component initiatives and the organizational changes needed to realize combined benefits. A programme benefits map should therefore specify a higher-level outcome, the outputs and transition activities on which it depends, the order in which capabilities must become available, and the permanent owners who can make them work together. A digital education programme, for example, could require connectivity, accessible learning materials, student-record interoperability, training and continuing technical support. Completion of the connectivity project would be necessary but insufficient if lecturers lacked usable instructional tools. Programme progress is consequently measured not only by the sum of component milestones but also by interface readiness, dependencies removed, adoption capability, exposure shared among components and evidence that the intended combined outcome is emerging. This is why programme-level integration authority and change control should not be mistaken for an enlarged project manager's task list (ISO, 2022b; Serra & Kunc, 2015).

Portfolio management addresses a different form of scarcity. Organizations typically have more plausible initiatives than available financial resources, institutional attention, qualified personnel or tolerance for risk. A portfolio committee must compare proposals on strategic relevance, affordability, compulsory obligations, expected outcomes, resource correlation and the opportunity cost of foregone alternatives. Portfolio balancing is not equivalent to selecting the projects with the largest individual net present values: two investments can be attractive separately and infeasible together because both require the same implementation team during the same examination or agricultural season. The portfolio should be periodically rebalanced when conditions change, while preserving records that explain why investment was continued, reduced, sequenced or stopped. These decisions are especially important in

resource-constrained African enterprises, where an apparently small implementation commitment may consume scarce leadership capacity and working capital (ISO, 2022a; Too & Weaver, 2014).

21.1.2 A contingent accountability architecture

The distinction also has a normative consequence. Portfolio authorities answer for the legitimacy and comparability of investment priorities; programme sponsors answer for coordination of complementary outcomes; project managers answer for authorized delivery within their delegated control; permanent service owners answer for continuing operations and benefit evidence. This division does not eliminate overlap, but it makes accountability failures diagnosable. An annual portfolio review should ask whether the combined programme of initiatives remains financially and institutionally feasible, which benefits have actually materialized and who bears the costs of postponed maintenance, displaced services or inaccessible implementation. A small cooperative may perform these reviews in one documented committee meeting rather than establishing a formal PMO, provided independent challenge and conflicts of interest are addressed. Formal organizational complexity is not an end in itself; proportionate but effective answerability is.

21.2 PROJECT SELECTION AND BUSINESS CASES: INVESTMENT UNDER UNCERTAINTY

Project selection is an allocation decision among competing uses of limited resources, not simply a test of whether one proposal appears beneficial. A convincing business case identifies the problem, strategic or statutory rationale, feasible alternatives (including doing nothing or deferring), affected populations, assumptions, resource requirements, uncertain benefits, downside scenarios, distributional consequences and decision thresholds. Selection also requires attention to complementarity: a technically attractive software purchase may have negligible value unless data governance and staff capability are funded. Chapter 6 supplies the wider strategic frame; project selection translates that frame into contestable temporary investment commitments.

The project business case should distinguish affordability, economic value and legitimacy. Affordability asks whether cash can be mobilized at the required dates. Economic appraisal asks whether incremental benefits justify lifecycle costs compared with a credible alternative. Legitimacy asks whether the project conforms to applicable duties and substantively defensible treatment of stakeholders. Standard net present value is useful when cash-flow assumptions and timing can be stated, but its point estimate obscures uncertainty. For initial investment I, annual net benefit B_t, discount rate r and horizon T, $\mathrm{NPV} = -\mathrm{I} + \Sigma_{t=1}^{T} \mathrm{B}_t/(1+\mathrm{r})^t$. This is not an ethical welfare score: noncash benefits, irreversible harms, exclusion risks and distribution across stakeholders require distinct assessment.

Real-options reasoning adds a substantive insight. Irreversible investment under changing information can make waiting, piloting, staging or preserving a termination option valuable, although indefinite delay can also forgo important benefits (Dixit & Pindyck, 1994). A university may fund a small, privacy-preserving prototype before committing to campus-wide integration; an infrastructure authority may require design readiness before committing to politically attractive completion dates. Options reasoning is not a licence to avoid decisions. It requires an explicit account of the cost of learning, the cost of delay and which uncertainties can realistically be reduced before irreversible expenditure.

An auditable selection process consequently combines mandatory compliance screening; strategic and user-value tests; technical, organizational and supply-market feasibility; financial and wider social appraisal; risk scenarios; capacity conflicts; and final documented authorization. Weighted scoring may help compare proposals, but inappropriate weights can trade away non-negotiable legal or safety constraints. A useful hierarchy first rejects inadmissible alternatives, then applies transparent multicriteria comparison to feasible proposals, and finally challenges the preferred option through scenarios and independent review. Flyvbjerg (2009) documents why incentives to understate cost and overstate benefits can bias the initial portfolio before formal controls even begin. Reference-class comparison, where genuinely comparable projects exist, provides a corrective to isolated optimism, not an automatic forecast for a different country or technological environment.

21.2.1 A defensible selection instrument

Table 21.1. Project-selection decision record for an enterprise portfolio

Decision test	Evidence required	Governance response
Problem and strategic fit	Baseline, beneficiaries, alternatives, strategic linkage	Reject unclear purpose or document revision
Rights and legitimacy	Safety, accessibility, data, environmental and procurement duties	Mandatory gate; no weighted compensation for unlawful harm
Deliverability	Dependencies, available specialists, supplier market, calendar	Stage, redesign or defer infeasible scope
Lifecycle value	Cost and benefit ranges, owner, period, discount assumptions	Compare options and downside scenarios
Portfolio capacity	Competing demands for capital, people, systems and leadership	Sequence, reduce or cancel initiatives
Learning and stop rights	Pilot criteria, tolerances, independent challenge, exit costs	Authorize in stages with explicit review dates

Note. Original applied synthesis. The instrument is a decision aid, not a replacement for jurisdiction-specific approvals or a statistically validated selection model.

21.2.2 Competing criteria and the practical limits of appraisal

A project-ranking model should not disguise heterogeneous units as commensurable evidence. The expected financial return on a commercial warehouse investment is not the same construct as the social value of preserving access to student records or improving accessibility. Where monetization is appropriate, costs and benefits must be incremental to a plausible counterfactual, expressed over a consistent period and discounted on defensible assumptions. Economic analysis should distinguish real resource costs from transfers between stakeholders, and should disclose whether taxes, subsidies or existing staff time are included. Where monetization would falsely imply a market price for human rights or public trust, a multicriteria decision record can make the legitimate objectives explicit without pretending that weighted scores are objective facts. Requirements for compliance and essential safety remain constraints on admissible choices, not points that an attractive commercial return can offset.

Portfolio prioritization can be further strengthened by distinguishing mutually exclusive, contingent and complementary initiatives. A service-redesign option that avoids software procurement may compete directly with the proposed portal, whereas staff training is potentially a necessary complement. A low-cost pilot may generate decision-relevant evidence that justifies deferring an irreversible contract, but only if the pilot tests the uncertain mechanism rather than reproducing an already known interface. This is the practical significance of real-options analysis: the value of staging depends on the probability that new information will change a decision, the cost of acquiring that information and the damage caused by delay. Presenting the option to wait as inherently superior would be as misleading as presenting immediate capital expenditure as inherently decisive (Dixit & Pindyck, 1994).

21.3 PROJECT LIFECYCLE AND GOVERNANCE: FROM AUTHORIZATION TO HANDOVER

A project lifecycle describes how the work is conceptually organized, but it does not prescribe a universal sequence of identical phases. A predictive implementation may emphasize initiation, detailed planning, execution, control and closure; adaptive work may repeat discovery, design, demonstration and refinement. Both need a credible beginning, a justified authority to spend, decisions about changes and evidence of whether agreed acceptance conditions have been met. ISO 21502:2020 explicitly recognizes alternative lifecycle arrangements. APM (2025) similarly extends attention from the strategic case for change to delivery of benefits. In practice, initiation should establish the sponsoring problem and boundaries; planning should test feasibility; execution should produce and verify outputs;

closure should transfer responsibility and capture unresolved risks; post-project review should test intended outcomes rather than celebrate paperwork.

Governance occurs through decision rights, information and escalation, not just meetings. The sponsor approves charter and business-case changes; the delivery lead manages activity within delegated tolerances; an independent reviewer examines matters that cannot be credibly self-certified; operational owners sign off transition readiness; and affected users must have meaningful ways to report defects. Stage gates can prevent escalation of sunk-cost commitment, but an overly bureaucratic gate can delay an urgent public-service intervention. The appropriate review intensity depends on reversibility, public exposure, safety, funding conditions, novelty and the materiality of irreversible decisions (Too & Weaver, 2014; Joslin & Müller, 2016).

Agency theory provides one explanation for governance: sponsors and project managers may have unequal information and different incentives, creating possibilities for concealed overruns or optimistic reporting. Stewardship theory suggests a complementary mechanism: professional competence, identification with public purpose and stakeholder trust can support responsible discretion where exhaustive monitoring would be costly or damaging. Evidence from Joslin and Müller (2016) links stakeholder-oriented project governance with reported success in their sample, but the observational association does not establish that the same intervention will cause success everywhere. Good governance does not choose blindly between trust and verification. It provides competent discretion within explicit boundaries, independent scrutiny when material risk increases, and fair procedures for contesting decisions.

Closure must distinguish contract completion, acceptance, operational readiness and benefits realization. A vendor may deliver a portal, a university may accept it after security testing, staff may still need to change processes, and students may begin receiving improvements only later. A close-out record should preserve unresolved defects, warranties, access rights, intellectual-property permissions, cybersecurity obligations, training evidence, ownership of data and the schedule for benefit reviews. Where contractual defects or stakeholder harms remain, administrative closure does not extinguish responsibility.

21.3.1 Assurance, escalation and the problem of irreversible commitment

Governance arrangements should be differentiated by consequences rather than by ceremonial formality. A reversible prototype can be approved with a narrow delegated budget and frequent user review; a migration of sensitive records requires evidence of lawful authority, security assurance, reconciliation and a reliable rollback procedure before release. The relevant trigger for escalation is not always percentage budget deviation. A newly discovered exclusion risk, loss of a key permit or absence of independent testing may justify immediate suspension even when headline cost and schedule indicators remain favorable. Conversely, an unexpected expenditure supported by independently verified safety improvements may be defensible if authorized transparently. In both cases the governing forum must retain a record of evidence, alternatives, dissent, decision rights and consequences for the permanent operation.

Project assurance should distinguish the creator of evidence from its reviewer. Self-certification is appropriate for some routine technical tasks, but the same supplier should not alone determine whether a disputed security criterion was met where payment and liability depend on the finding. Independent challenge is not unlimited bureaucratic duplication: its scope should be proportionate to potential harm, risk concentration, contract incentive and the degree of irreversibility. This balances the monitoring concerns of agency theory with stewardship's recognition that competent professionals need discretion to solve unexpected problems (Joslin & Müller, 2016; Too & Weaver, 2014).

21.4 SCOPE AND REQUIREMENTS MANAGEMENT: DEFINING WHAT COUNTS AS DONE

Scope has at least three senses: the intended change or business outcome, the deliverable or product boundary, and the work required to create and verify that deliverable. Confusion among them is a recurrent source of unrecognized obligations. A university might announce an objective of faster services, procure a digital form and then discover that identity verification, accessible language, record correction and exception handling are essential to the intended

outcome. Requirements should therefore be elicited from actual use, including less powerful or digitally excluded stakeholders, not inferred solely from the sponsor's initial specification. The deliverable description should distinguish mandatory legal and safety requirements from negotiable preferences and explain how each will be verified.

A work breakdown structure (WBS) decomposes the complete agreed scope into manageable deliverables and work packages. Proper decomposition is neither an inventory of departmental job titles nor an unbounded list of activities. The familiar 100-percent rule expresses the requirement that the WBS cover the total authorized work without double counting. A work package requires a responsible party, acceptance condition, effort estimate, cost code and interface assumptions. ISO 21511:2018 supplies formal guidance for work breakdown structures in project and programme management (ISO, 2018). In the illustrative case presented in Section 21.13, the WBS separates requirements and process design, secure configuration, migration and integration, testing, training, and pilot acceptance; this makes risk ownership and budgeting traceable.

Table 21.2. Compact work breakdown structure for the illustrative Kigali university portal

WBS code	Deliverable/work package	Acceptance evidence
1.1	Requirements definition	Approved requirements, inclusion and exception scenarios
1.2	Process mapping and service design	Approved workflows, handoffs, accessible service journeys
1.3	Data-control and permission architecture	Reconciliation policy, access design and testable protection requirements
1.4	Portal configuration	Demonstrated functions against test cases
1.5	Data migration and integration	Reconciled records and controlled interfaces
1.6	Security, accessibility and acceptance testing	Signed defect log, independent control checks
1.7	Staff preparation and operational handover	Competency check, support owner and service plan
1.8	Pilot, stabilization and close-out	Acceptance record and benefits-review schedule

Note. Fully constructed teaching instrument; no university deployment is implied. WBS items describe the entirety of authorized change, while detailed activities and dependencies are analyzed separately.

Requirements quality depends on traceability as well as initial completeness. Each material requirement should link to a stakeholder need or obligation, a design decision, a verification method, an owner and an acceptance criterion. An untestable statement such as 'user-friendly portal' becomes more useful when translated into specified tasks, accessibility standards, response times, supported languages, exception processes and observable thresholds. Yet over-specification can freeze uncertain design prematurely. An agile backlog can allow progressive elaboration while retaining minimum requirements for privacy, safety and contractual conformance. Change control should capture the request, rationale, cost and schedule consequence, dependencies, rights implications, decision-maker and new baseline version. The purpose is not to prohibit learning but to prevent unexamined expansion and retrospective rewriting of success criteria.

21.4.1 Requirements traceability and disciplined change

The minimum traceability unit is a testable claim about what the deliverable must do, for whom and under what conditions. A requirements record should identify its origin and authorized owner, legal or service rationale, priority, design component, acceptance test, evidence of test completion and any approved variation. This is especially important when users with limited digital access are not represented in the initial specification. Traceability helps determine whether a change is a necessary correction of an omitted requirement or a discretionary enhancement: the first may reveal that the original baseline was defective, while the second requires an explicit choice about incremental time, funding and expected benefit. Both cases require a decision record; merely classifying every correction as scope creep can suppress legitimate user protection.

The WBS must reconcile with estimates and contractual packages without implying that they are identical views. Work breakdown identifies deliverable scope; scheduling identifies activities and dependencies; the cost breakdown assigns expenditure and control accounts; the responsibility structure identifies people authorized to deliver and accept the work. A robust management information system can trace these representations to one another, but a WBS item may contain several scheduled activities and one contract may support several work packages. The following teaching WBS explicitly distinguishes process mapping from data-control design, so that the eight major packages reconcile to the eight coded activities and cost estimates without falsely equating deliverables with individual tasks.

21.5 SCHEDULING AND CRITICAL PATHS: TIME AS A NETWORK CONSTRAINT

A schedule is a model of the dependency structure linking activities, resources and milestones. Its value lies less in the apparent precision of a finish date than in explaining why a finish date is plausible, which assumptions are fragile and which interventions can change it. Activity-on-node networks capture precedence, with finish-to-start relationships commonly used for foundational teaching; real schedules may also contain start-to-start dependencies, lags, deadlines, calendars and resource constraints. The critical-path method (CPM) identifies the longest-duration path through the precedence network under stated deterministic durations. If several equally long paths exist, several paths may be critical. The classical result is conditional on an acyclic, correctly specified network and available resources rather than a guarantee of real-world completion (Kelley & Walker, 1959; Kelley, 1961).

Forward-pass calculations set earliest start (ES) to the maximum earliest finish of predecessor activities, with earliest finish EF = ES + duration. Backward-pass calculations start at the project finish and derive latest finish (LF) as the minimum latest start among successor activities, then LS = LF − duration. Total float is LS − ES or LF − EF. Zero float under the specified network marks critical work. Float is a scheduling property, not a personal entitlement to delay. Multiple noncritical activities can consume slack and become jointly critical; resource leveling, supplier lead times or regulatory approvals may alter the precedence network. A misleading schedule often arises because activities were decomposed more carefully than the organizational authority needed to release them.

Table 21.3. Constructed precedence network and critical-path calculations

Activity	Work description	Predecessor(s)	Duration, weeks	ES–EF	LS–LF	Float
A	Requirements	None	2	0–2	0–2	0
B	Process mapping	A	3	2–5	2–5	0
C	Data controls	A	2	2–4	3–5	1
D	Portal configuration	B, C	5	5–10	5–10	0
E	Migration/integration	C	4	4–8	6–10	2
F	Security and testing	D, E	3	10–13	10–13	0
G	Staff training	D	2	10–12	11–13	1
H	Pilot and acceptance	F, G	2	13–15	13–15	0

Note. All durations and dependencies are hypothetical. Time zero denotes project commencement; durations are elapsed working weeks on a common calendar, without resource conflict. The critical path is A–B–D–F–H, totaling 15 weeks. ES, EF, LS and LF denote earliest and latest start and finish.

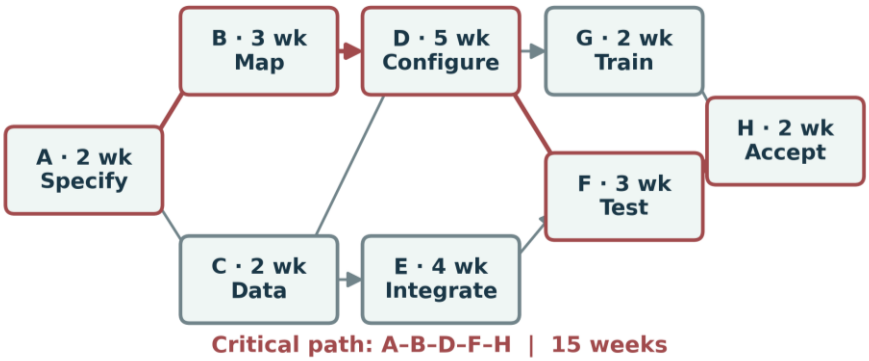


Figure 21.2. *Activity-on-node project schedule for the hypothetical portal; red-bordered nodes identify the zero-float path A–B–D–F–H.* Note. Original illustration derived from Table 21.3; all activity durations are illustrative.

For uncertain durations, the historical PERT approximation assigns optimistic (a), most likely (m) and pessimistic (b) activity estimates, with expected time approximately $(a + 4m + b)/6$ and variance approximately $[(b - a)/6]^2$ (Malcolm et al., 1959). If configuration activity D has assumed durations a = 3, m = 5 and b = 9 weeks, its three-point expectation is 5.33 weeks and variance 1.00 weeks squared. These are modeling approximations, not measured probabilities. A project's finish-time distribution cannot safely be inferred by summing variances along a fixed critical path when paths may change, durations are correlated or estimates are strategic. Monte Carlo simulation can improve visibility if input distributions and correlation assumptions are plausible; simulation cannot rescue invented evidence.

Schedule compression involves recognizable trade-offs. *Crashing* purchases additional capacity or changes technical means to shorten selected activities at additional cost; it should target the current critical path and re-evaluate the path after each change. *Fast tracking* overlaps activities formerly sequential, potentially shortening elapsed time while increasing rework, assurance and safety risks. Neither technique should be used to bypass legally necessary verification. Milestones should document accepted conditions rather than merely calendar points. A deadline is credible when the schedule has dependency logic, feasible staffing, a dated risk allowance, interfaces with procurement and operations, and a rule for revising public promises when evidence changes.

21.5.1 Resource feasibility, probabilistic forecasts and schedule reserves

Classical CPM produces an earliest finish for the assumed precedence graph, not necessarily a resource-feasible deadline. If the same ICT specialist is needed simultaneously for portal configuration and migration, a resource constraint may force activities that are logically parallel to become sequential. The correct response is to level or otherwise allocate resources against institutional calendars, then re-evaluate the controlling sequence. A baseline should state whether activity durations include weekends, procurement waiting time, testing cycles, public holidays and availability of named specialists. In a Rwandan university, even a sound technical estimate can fail because examination periods, institutional approvals or administrative closure reduce access to staff and students. These contextual assumptions should be modeled explicitly rather than hidden in a generic percentage contingency.

Probabilistic scheduling introduces a different source of insight. An independent three-point estimate for one activity does not determine the total project completion distribution when paths can switch, activities share common risk drivers or successive iterations produce correlated rework. Monte Carlo models can represent those relationships through a specified joint distribution and report percentile completion dates, provided there is credible evidence for inputs. Sensitivity to common causes should be analyzed explicitly; for example, an outage of a shared data environment could delay configuration, migration and testing simultaneously. A schedule confidence statement must disclose whether its percentile reflects statistical estimation, elicited expert judgment or purely illustrative assumptions. Neither a single PERT mean nor an arbitrary buffer can substitute for a defensible explanation of uncertainty (Malcolm et al., 1959; Geraldi et al., 2011).

Project leaders also need to distinguish total float from a management reserve of time. Float emerges from the specified network, whereas a schedule reserve represents deliberately allocated protection against uncertainty or

governance delay. Consuming float can be defensible, but it may expose a formerly noncritical branch to a shared-resource conflict or reduce flexibility for testing. A credible recovery proposal therefore identifies the current critical paths, validates the additional capacity offered by crashing, and calculates possible rework and safety consequences before committing to an accelerated date.

21.6 COST ESTIMATION, BUDGETING AND CONTROL: SEEING FINANCIAL PERFORMANCE IN CONTEXT

Cost estimation transforms an authorized scope and implementation method into a time-phased financial proposition. Analogous estimates draw on comparable completed work; parametric estimates scale known cost relationships; bottom-up estimates aggregate work-package resources; vendor quotations test market conditions; and three-point estimates examine uncertainty. Each method has a characteristic failure mode. Analogy may import irrelevant institutional differences, parametric models may confuse correlation with engineering necessity, bottom-up detail may conceal omissions, and vendor quotes may exclude taxes, maintenance, insurance, transition or risk allocation. Projects also require attention to opportunity costs when scarce staff are reassigned from recurring operations. Chapter 23 develops costing disciplines more fully; here costs serve temporary delivery authorization and control.

A cost baseline should distinguish planned authorized work from reserves and ultimate funding limits. The illustrative eight work packages total RWF 48.0 million; allocated project management and control add RWF 5.0 million, producing a performance baseline or budget at completion (BAC) of RWF 53.0 million. A separately governed contingency allowance of 10% of the RWF 53.0 million baseline adds RWF 5.3 million and an authorized funding ceiling of RWF 58.3 million. This simplified teaching arrangement treats the contingency as held outside BAC, so calculations must not mix the BAC and funding ceiling. A real organization’s contingency, management reserve, financing charges and earned-value conventions should be specified in its approved cost management plan. Cash-flow timing also matters: a project can remain within total budget while failing to meet supplier payment commitments.

Table 21.4. Constructed work-package budget and funding logic (RWF million)

Budget element	Amount	Interpretation
A. Requirements	3.2	Work-package estimate
B. Process mapping	4.5	Work-package estimate
C. Data controls	3.8	Work-package estimate
D. Portal configuration	13.0	Work-package estimate
E. Migration and integration	8.5	Work-package estimate
F. Security and testing	6.2	Work-package estimate
G. Staff training	3.8	Work-package estimate
H. Pilot and acceptance	5.0	Work-package estimate
Project management and assurance	5.0	Allocated baseline overhead
Budget at completion (BAC)	**53.0**	Performance measurement baseline
Separately controlled 10% contingency	5.3	Not earned-value budget in this example
Authorized funding ceiling	**58.3**	Maximum allocation before reauthorization

Note. Entirely hypothetical Rwandan-franc amounts. The table does not constitute an actual procurement plan, accounting entry or contract quotation.

Earned value management (EVM) relates authorized work, planned progress and actual expenditure using a consistent measurement basis. Planned value (PV) is the authorized budget for work planned by the reporting date; earned value (EV) is the authorized budget for work actually accomplished; actual cost (AC) records the cost incurred for that work. Cost variance CV = EV − AC and schedule variance SV = EV − PV are expressed in monetary units. Cost performance index CPI = EV/AC and schedule performance index SPI = EV/PV are dimensionless. A negative variance signals deviation under the model, but does not itself establish why the deviation occurred or whether the project remains socially valuable. ISO 21512:2024 provides implementation guidance for earned value management, while ISO 21508:2026 addresses EVM at the standard level (ISO, 2024, 2026a).

Suppose that at a week-10 checkpoint the illustrative baseline had PV = RWF 31.0 million, accepted work carried EV = RWF 27.0 million, and the actual accrued cost AC = RWF 30.0 million. Then CV = −3.0 million and SV = −4.0 million; CPI = 27/30 = 0.900; and SPI = 27/31 = 0.871. Under the deliberately strong assumption that cumulative cost efficiency continues unchanged, forecast final cost EAC = BAC/CPI = 53/0.9 = RWF 58.89 million. This exceeds the authorized RWF 58.3 million funding ceiling by about RWF 0.59 million. The to-complete performance index to recover the original BAC is TCPI = (BAC − EV)/(BAC − AC) = 26/23 = 1.130. Management should not disguise the pressure by releasing contingency automatically; it should first identify the work, contractual exposure, estimate reliability and changes needed to close the gap.

These metrics are diagnostic, not sufficient explanations. SPI based on budgeted work can behave poorly near project completion and does not directly measure calendar duration; earned schedule or explicit critical-path reforecasting can complement it. Reported EV may be inflated by crediting partially completed packages without objective acceptance evidence, while AC can be understated by omitting uninvoiced liabilities. Cash flow, contract variation, scope change, quality and safety therefore need separate controls. An EAC derived from one CPI assumes performance continuity; a credible oversight report also evaluates bottom-up remaining costs, risk exposure and different delivery scenarios (PMI, 2025; ISO, 2024).

21.6.1 Budget integrity and the limits of cost-performance indices

A reliable estimate at completion should be triangulated rather than mechanically extrapolated from a single cost performance index. The bottom-up method estimates the cost of all remaining approved work, including purchase commitments, defect correction, specialist effort and time-related overhead. The resulting EAC can then be compared with a trend-based estimate such as BAC/CPI and a risk-adjusted range. If the figures diverge, management should explain which assumptions changed. A time-phased cash forecast must be maintained separately because recognized expenditure, progress value, supplier invoices and available cash have different timing. A project can appear within BAC while remaining unable to pay wages or settle a milestone invoice; conversely, an early payment can depress cash without indicating that accepted work is above budget.

Reserve discipline is equally important. In this teaching model, the RWF 5.3 million contingency is separated from the RWF 53.0 million EVM performance baseline to make the arithmetic inspectable. In actual practice, contingency for identified risk may be included in an approved cost baseline, while management reserve is often controlled outside it; the reporting convention should be formally adopted and used consistently. An organization must not report the RWF 58.3 million authorization ceiling as earned work or treat unspent reserve as evidence of cost efficiency. When the forecast reaches the ceiling, further expenditure demands a documented value-and-rights decision rather than a retrospective change to the original denominator. The revised eighth-edition PMBOK Guide and ISO 21508:2026 support integrated rather than purely numerical control, whereas ISO 21512:2024 was originally written as implementation guidance to the preceding 2018 edition of ISO 21508 (ISO, 2024, 2026a; PMI, 2025).

21.7 PROJECT RISK AND UNCERTAINTY: PROTECTING THE ABILITY TO CORRECT

Project risk is not synonymous with a list of possible disasters. It describes uncertain events or conditions that could affect legitimate project objectives, positively or negatively. Some uncertainty is estimable through relevant frequencies; other uncertainty involves incomplete knowledge, ambiguity, novel interdependencies or political change. A risk register should specify cause, uncertain event, consequence, owner, current controls, response,

residual exposure and trigger. An assumption log records propositions treated as true for planning, such as data availability or staff participation, together with evidence and a date for challenge. Confusing risk with assumption permits major uncertainties to remain hidden because they are written into the baseline as uncontested facts.

Qualitative probability-impact categories are useful for triage when calibrated consistently, but multiplying arbitrary ordinal scales does not create a valid expected monetary loss. For quantifiable monetary effects, a simplified expected monetary value (EMV) may be calculated as Σ probability × consequence under explicit alternatives and independently defensible probabilities. Suppose a migration defect has a 20% estimated occurrence probability and would require RWF 6.0 million in remediation. A simple single-event expected cost is RWF 1.2 million, but this expectation cannot justify exposing sensitive student data if the consequence includes rights violations or irreversible harm. Financial EMV and minimum acceptable controls answer different questions. Where probabilities are conjectural, scenario ranges and transparent stress tests are more honest than spurious decimal precision.

Table 21.5. Illustrative project risk and escalation register

Exposure, trigger and consequence	Owner and preventive control	Response and escalation
Incorrect legacy records; failed reconciliation; student exclusion	Registrar/data lead; sample reconciliation, provenance and correction rights	Hold migration gate; escalate to sponsor for redesign
Integration failure; repeated interface errors; schedule slippage	ICT lead; interface prototypes and test environments	Use staged rollback; reforecast critical path
Vendor lock-in; unusable exports; long-run operating cost	Procurement/ICT; exit terms, interoperable data formats	Negotiate rights before award; reject unacceptable restriction
Low staff adoption; parallel spreadsheets; weak service benefit	Operations benefits owner; training and revised authority	Fund workflow changes; do not declare benefits at handover
Unauthorised disclosure; privacy harm	Data controller/security lead; least privilege, access testing	Contain, preserve evidence and follow applicable response duties
Scope growth; added features without financing	Sponsor; requirements traceability and change log	Stop unapproved work; formal impact decision

Note. Constructed risks, not assessed probabilities or findings from an actual Rwandan institution. Statutory incident obligations must be verified for the organization and applicable law at the time of implementation.

Response strategies include avoidance, mitigation, transfer, acceptance and exploitation of appropriate opportunities, but technical labels do not transfer moral responsibility. A supplier warranty can allocate financial costs without transferring the enterprise's duty toward students. Portfolio-level correlated risks deserve special attention: shared vendors, currency exposure, simultaneous procurement deadlines and scarce cybersecurity skills can affect multiple projects together. Complexity scholarship distinguishes structural scale, uncertainty, dynamics, pace and sociopolitical tensions, showing why risk treatment should be adapted to mechanisms rather than project size alone (Geraldi et al., 2011). Early challenge, independent review, staged commitments and protected staff reporting are safeguards precisely because the cost of correction usually rises after irreversible decisions.

21.7.1 Interdependent risk and the evidential status of estimates

The distinction between risk and uncertainty becomes practically consequential when a project has several pathways to loss. A privacy incident may directly injure a user, lead to legal obligations, delay acceptance, weaken trust and lower adoption. Treating each consequence as an independent event and adding separate probability-weighted amounts would overstate or misstate total expected exposure unless dependencies were modeled. Similarly, one contractual failure can simultaneously increase cost and extend the critical path. An analytically sound register therefore links causes, events and consequences, identifies conditional dependence and documents both the origin and reliability of each probability estimate. Where no credible probability can be assigned, a bounded scenario and explicit escalation threshold is preferable to a numerical score that conveys unwarranted confidence.

Risk responses have distributional implications that should be recorded before authorization. Delaying a launch may burden service users, while premature release may create disproportionate harm for students whose records cannot easily be corrected. These competing losses are not automatically resolved by maximizing expected monetary value. Constraints concerning security, lawful processing, worker protection and accessibility may impose admissibility thresholds before financial optimization. The residual risk decision should state who was consulted, what alternatives were considered, which residual exposure remains, who has authority to accept it and when it will be reviewed. A risk owner without the power or funds to implement the agreed response is a nominal rather than an effective owner.

21.8 STAKEHOLDER AND COMMUNICATIONS MANAGEMENT: INFORMING, LISTENING AND REMEDYING

Stakeholders are persons or institutions that can affect the project, are affected by it, or hold legitimate claims regarding its conduct and outcomes. Mapping only executive influence makes those with weak formal power disappear, including service users with disabilities, lower-income students, temporary workers or suppliers dependent on timely payments. A responsible analysis distinguishes influence from legitimacy and vulnerability, and examines whose evidence has been omitted. It also anticipates that stakeholder preferences may conflict: accelerated delivery can improve access while compromising an adequate security review; more comprehensive identity checks can strengthen integrity while excluding people with incomplete records. The proper response is reasoned, documented trade-off and, where rights are at stake, enforceable minimum protection.

Communications design begins with decisions rather than a calendar of presentation meetings. Sponsors need timely exception reporting and reasons for changed forecasts; technical teams need dependencies and acceptance evidence; finance needs commitments, liabilities and cash forecasts; users need understandable explanations of changed services and redress; public funders may require prescribed disclosure and audit trails. A practical communications matrix specifies audience, purpose, content, accessible channel, frequency, sender and feedback route. Status reports should disclose unfavorable data in the same units and against the same approved baselines as favorable data. A percentage ‘complete’ without objective work definition is especially prone to strategic interpretation, whereas a traceable requirements-test register makes claims more contestable.

Engagement is not a one-way persuasion activity. Discovery workshops, accessible prototypes, pilot observations, protected issue reporting and documented disagreement can reveal unusable processes before contractual acceptance. A project manager should record whether input was accepted, rejected or deferred and explain the grounds. Consultation cannot promise consensus or substitute for elected or statutory authority, but exclusion can invalidate the project team’s understanding of the problem it claims to solve. Joslin and Müller (2016) provide empirical motivation for stakeholder-oriented governance; their result should be interpreted as an association within studied governance settings, not a universal intervention guarantee.

Conflict requires attention to substantive interests and structural power. A vendor may demand payment for a variation; users may reject a proposed workflow; staff may fear automation; the sponsor may face a political deadline. Negotiation should distinguish legitimate contract interpretation, information gaps, decision rights and concerns about fairness. A clear escalation route preserves both speed and due process: the person closest to the issue proposes alternatives; an authorized owner resolves within tolerance; material cost, safety, legal or benefit changes move to sponsor or board scrutiny. Effective communication is thus an accountability capability, not an exercise in producing attractive dashboards.

21.8.1 Legitimate participation, communication failure and conflict

Effective stakeholder communication has a temporal logic. Before selection, information should support problem definition and legitimate consent or consultation; during design it should expose competing user requirements; during execution it should surface defects, deviations and unresolved dissent; and after handover it should permit complaints and correction against promised service outcomes. A project may report many workshops without engaging the people at greatest risk of exclusion. Evaluation should therefore examine not only attendance but also whose input changed a requirement, which disagreements remain unresolved and whether affected people can safely contest the final decision. Methods must be accessible in language, format, connectivity and time, and participation should not be equated with surrender of statutory authority.

When commercial disputes arise, the project team should separate factual disagreement about delivered work from conflicts over contractual interpretation, allocation of unanticipated risk and unequal bargaining power. A technically precise change order may still be unfair if its terms exploit a supplier's dependency or deprive end users of reasonable remedies. Conversely, a supplier cannot reasonably be required to absorb every scope revision without lawful authorization and payment. Credible conflict management combines evidence preservation, negotiated clarification, independent review where needed and proportionate escalation, allowing project delivery to continue without normalizing coercion or concealment.

21.9 TEAM AND PROCUREMENT MANAGEMENT: RESOURCES, CONTRACTS AND COLLECTIVE CAPABILITY

Projects concentrate specialist work over limited periods, often drawing employees away from ordinary operations. A resource plan should specify the competence required, available capacity, timing, decision rights, supervision, training and handover obligations. Assigning a nominal ‘50% ICT officer’ may be infeasible if the same officer must maintain critical university systems during examinations. Resource leveling converts an unrealistic resource-unconstrained schedule into a feasible sequence and may change the critical path. Workforce planning from Chapter 9 and organizational design from Chapter 7 are therefore prerequisites for credible project commitments, not matters to be addressed after a schedule is approved.

Temporary teams face distinctive problems of identity and knowledge. Members may report to functional managers, join at different stages and leave before defects or benefits become visible. Early agreement on working norms, accountable handoffs, technical review authority and documentation reduces avoidable ambiguity. A RACI allocation distinguishes who is responsible for execution, accountable for decisions, consulted for expertise and informed of consequences. It is best applied at consequential interfaces, such as data migration release or acceptance, rather than used as a ceremonial table for every minor task. Psychological safety and protected challenge matter because staff with relevant expertise may otherwise remain silent when powerful sponsors insist on improbable deadlines (Lundin & Söderholm, 1995; Geraldi et al., 2011).

Procurement management connects the temporary work with external suppliers through specifications, solicitation, contracting, delivery verification, payment and dispute mechanisms. Chapter 18 provides the detailed sourcing and public procurement architecture; the project lens asks how supplier lead times, contractual interfaces, change mechanisms, warranties, rights and risk allocation affect the project path. Fixed-price arrangements can improve cost predictability where outputs are specifiable but may invite claims when scope is uncertain. Time-and-materials arrangements can accommodate learning but require close oversight of effort and spending. Milestone payments should follow objectively verifiable deliverables and appropriate performance evidence, not merely the supplier’s claim that effort was incurred. Data access, open standards, export rights, security testing and transition assistance should be considered before a digital supplier becomes indispensable.

Rwanda’s legislative context illustrates the difference between general project technique and binding procedure. In February 2026, the Parliament of Rwanda reported a review of implementation of Law No. 031/2022 governing public procurement and identified concerns including delays in implementing regulations, weaknesses in project preparation and validation, and frequent contract amendments (Parliament of Rwanda, 2026). This official parliamentary report provides evidence of identified oversight concerns, not proof that every procuring authority exhibits them. A public university or donor-funded agency must therefore verify the current applicable law, financing agreement, approval thresholds and contractual requirements for its specific activity rather than assume that a generic project template or international standard overrides domestic requirements.

21.9.1 Resource loading and contractual interface risk

A team assignment is credible only when the required hours and concurrent operational commitments can be reconciled. In the teaching network, activity F cannot start before both configuration and migration are ready. If security reviewers are simultaneously responsible for daily incident response, the nominal three-week test duration may be infeasible. Resource-loaded planning should identify scarce skills, authorized substitutes, review lead times, availability during institutional peaks and the opportunity costs of withdrawing staff from normal services. Those constraints should be incorporated before calculating schedule confidence. For multi-contractor projects, an interface

register should identify which supplier delivers each prerequisite, who verifies it, who bears rework when interfaces fail and whose approval releases the successor task.

Contract strategy must also consider information asymmetry at handover. A low fixed price may conceal proprietary data formats, expensive future modifications or inadequately specified service levels, while a flexible time-and-materials contract may expose a constrained institution to uncontrolled effort claims. Selection should therefore compare whole-of-life cost, acceptance evidence, retention of records and intellectual assets, staff capability transfer and the practical cost of replacing the supplier. A lawful and economically sensible contract allocates risks to parties best placed to control them while retaining enterprise responsibility toward users and workers. Its success is demonstrated by tested performance and remedies, not only the absence of disputes at project close.

21.10 ADAPTIVE, PREDICTIVE AND HYBRID METHODS: TAILORING RATHER THAN TAKING SIDES

Predictive approaches establish relatively stable specifications and a planned sequence before substantial execution; adaptive approaches advance through bounded increments informed by frequent feedback; hybrid approaches combine controlled stages with iterative discovery or delivery. The choice depends on the *type* of uncertainty rather than organizational fashion. Bridge foundations, safety interfaces and statutory approvals generally demand substantial preconstruction assurance, although design alternatives may still be explored iteratively. Software interfaces or service journeys may require observation of real users before detailed functionality can responsibly be fixed. Highly regulated systems can accommodate iteration within approved security and assurance boundaries. Neither predictive planning nor agile iteration removes accountability for budget, scope, rights or post-handover performance (ISO, 2020; PMI, 2025).

The 2001 *Manifesto for Agile Software Development* was a critique of rigid software-development relationships, not a general theorem that documentation, contracts or planning are undesirable. Its values favor interaction, usable software, customer collaboration and responsiveness to change while explicitly recognizing the worth of the paired alternatives (Beck et al., 2001). The distinction matters when ‘agile’ is invoked to defend undocumented public expenditure or to suppress independent assurance. Conversely, a project may produce extensive documentation and still conceal untested assumptions. Serrador and Pinto (2015) reported a positive association between the extent of agile adoption and reported project success in an international survey, with stakeholder satisfaction among the relevant dimensions; self-report, selection and contextual differences limit causal interpretation. The observed association does not establish that imposing agile ceremonies will improve a concrete project.

Tailoring should examine requirements volatility, uncertainty about user needs, technical interdependence, cost of late change, consequences of failure, supplier incentives, distribution of decision rights, regulatory demands, geographic coordination and the ability of users to provide feedback. A suitable hybrid portal project may adopt fixed governance gates for data protection, integration and financial authorization while using two-week demonstrations to refine information architecture and workflow usability. Evidence must still connect each iteration to accepted criteria, documented change decisions and a feasible final transition. Continuous reprioritization does not justify infinite scope or unbounded staff workload.

Table 21.6. Conditional fit of project delivery approaches

Decision dimension	Predictive preference	Adaptive preference	Credible hybrid design
Requirement certainty	Stable and testable early	Important user needs still emerging	Fixed duties; evolving user features
Cost of late change	High, irreversible, safety-critical	Relatively reversible increments	Early architecture gates; iterative interfaces
Contracting	Defined outputs and acceptance	Progressive elaboration with bounded funding	Fixed milestones plus change-managed increments
User access	Validation at specified gates	Frequent representative feedback available	Regular demonstrations with formal acceptance

Decision dimension	Predictive preference	Adaptive preference	Credible hybrid design
Assurance	Strong pre-implementation evidence	Continuous automated and human testing	Continuous tests plus independent release gate

Note. Original analytical comparison informed by ISO (2020), Beck et al. (2001) and Serrador and Pinto (2015). The cells are conditional considerations rather than universally superior prescriptions.

21.10.1 Tailoring by uncertainty and verification burden

Method tailoring should be made auditable through a written rationale rather than chosen by a binary label. The project can rank uncertainty about the problem, solution, technology, regulatory duties, interfaces and user behaviour, then determine which decisions can be revised at low cost and which require early commitment. Requirements with uncertain user experience may be explored through demonstrations and representative testing, while encryption, data ownership, procurement approvals and specified accessibility conditions remain controlled constraints. A hybrid programme is defensible only when iteration boundaries, financial authority, acceptance criteria and ultimate operating responsibility are explicit. Agile ceremonies without user representation or release discipline merely redistribute ambiguity; predictive documentation without real testing merely records it.

21.11 MONITORING, EVALUATION AND BENEFITS REALIZATION: FROM OUTPUTS TO VALUE

Monitoring asks whether authorized work and conditions are proceeding as expected; evaluation examines merit, worth, performance, distribution and potential causation. Their evidence differs. A schedule dashboard can show task completion, a test register can establish whether a defined function works, and administrative records can reveal whether service times changed after deployment. None alone proves that the project caused the change. An apparent improvement could result from staffing increases, seasonal demand, new eligibility rules or an altered measurement process. Chapter 4 provides the broader inferential methods; project evaluation operationalizes them through baseline definition, exposure, comparison and benefit ownership.

A credible benefits map links the institutional problem to project outputs, required operational changes, intermediate outcomes and longer-term effects. It also identifies disbenefits and assumptions. A portal might produce working self-service forms (output), require staff to discontinue duplicate manual intake (operational change), reduce repeat visits (proximate outcome), improve access and capacity (potential benefit), and generate new exclusion or cybersecurity exposure (possible harm). Serra and Kunc (2015) document an association between benefits-realization management and perceived project success in their study; the finding supports disciplined benefit governance but not an unconditional estimate of effect. Shenhar et al. (2001) likewise conceptualized project success across multiple time horizons and strategic dimensions rather than treating it as an immutable triangle of schedule, budget and technical performance.

Table 21.7. Benefits-realization and evaluation matrix for the constructed portal

Claim and operational owner	Indicator and comparison	Verification timing and caution
Faster case handling; registrar	Median minutes per comparable completed request, before/after	Baseline before rollout; compare request mix and exclusions
Fewer repeat visits; student services	Repeated visit events per 100 eligible requests	Monthly; distinguish reporting changes from real reduction
Accessible service; inclusion lead	Completion rate by specified accessibility and access needs	User testing before release; review unequal exclusion
Reliable records; data controller	Verified record error rate and correction latency	Migration gate and quarterly audit; protect personal data
Resource capacity; finance and operations	Auditable staff hours released and converted to alternative service	Six- and twelve-month review; do not equate time freed with cash saved

Claim and operational owner	Indicator and comparison	Verification timing and caution
Sustainable service; ICT and finance	Uptime, support costs, unresolved incidents, renewal obligations	Quarterly over operating horizon; net of ongoing costs

Note. Targets, baselines and observed results must be populated from real authorized records; none are supplied or fabricated here. The indicators are illustrative specification, not findings.

Benefits can be direct or indirect, financial or nonfinancial, private or social, short-run or delayed. Their distribution matters: staff workload may fall while students' connectivity costs rise; automated processing may reduce queueing while disadvantaging applicants unable to verify identity digitally. Appraisal should therefore maintain at least two registers, one for financial contributions to enterprise viability and one for service quality, rights and external consequences. Ex post economic evaluation should avoid attributing every improvement to the intervention and should record uncertainties that remain irresolvable. For a small project, a carefully documented interrupted comparison with transparent limitations may be feasible; for major public expenditure, independent quasi-experimental or otherwise rigorous evaluation may be justified if design and data support it.

Benefits ownership continues after the delivery team disperses. This is a serious organizational problem because a project manager usually cannot require staff to stop using a legacy process, fund recurring licensing or maintain records after closure. The sponsor should identify a permanent owner and resource these obligations before authorizing transition. ISO 21513:2026 specifically addresses post-project and post-programme evaluation, reflecting the professional importance of looking beyond closure (ISO, 2026b). Evaluation should include stop, modify or scale decisions and a transparent account of promised but unrealized benefits, rather than recoding them retrospectively as 'lessons learned'.

21.11.1 Evaluation design, disbenefits and falsifiability

A theory of change is useful only if it can fail an empirical test. For the constructed portal, the hypothesis that faster electronic intake reduces student waiting may be undermined if users must make additional visits to correct digital errors. Evaluation should specify eligible requests, the denominator for completion and repeated visits, the time window, the treatment of incomplete cases and the sources from which timestamps are obtained. A before-and-after comparison needs to examine seasonality, case complexity, changes in staffing and parallel service reforms. If a comparable group adopts later, a carefully justified comparative design may strengthen inference, but parallel-trend assumptions or nonrandom selection must be challenged. Where a counterfactual is unidentifiable, the report should distinguish credible descriptive change from attributable project impact (Ika, 2009; Shenhar et al., 2001).

Benefit realization is not a single positive aggregate. The benefits owner must identify winners and losers, measure cybersecurity incidents and customer experience alongside cost, and guard against incentives to suppress complaints to improve a dashboard. A reduction in administrative hours is potential capacity, not automatically budgetary saving: the released time may be absorbed by more complex cases, improved support or unemployment. These outcomes are economically and morally different. The benefit case should specify the valuation approach for each component and require approval before converting assumed capacity into a cash saving. The published guidance in ISO 21513:2026 provides a useful basis for independent post-project and post-programme review while keeping ex post evaluation distinct from monitoring performed during delivery (ISO, 2026b).

21.12 TECHNOLOGY-ENABLED PROJECTS: DATA, AI, CYBERSECURITY AND HUMAN OVERSIGHT

Digital project platforms can improve traceability by linking requirements, work packages, schedule dependencies, procurement records, risks, issue resolution, approvals and benefits. Their usefulness depends on data quality and authority rather than visual sophistication. A shared dashboard may produce conflicting versions of truth if approved baselines differ across departments, if suppliers control underlying records or if project staff mark work as complete before acceptance. Information architecture should define a system of record, access privileges, version control, retention, time stamps, audit trails and mechanisms to correct incorrect entries. Interoperability and exportability also protect the enterprise's capacity to transition between vendors or continue service during an outage.

AI assistance may support preliminary schedule drafting, document search, summarization, risk-identification prompts, meeting transcription and classification of large issue logs. These are plausible applications, not claims that generative systems can reliably make final project decisions. Large language models can produce confident but fabricated dependencies, incorrect technical assumptions or invented citations; predictive algorithms can inherit the exclusions present in historical project data. The PMI's eighth-edition guidance and APM's eighth edition address AI and data as emerging project-management topics, while the National Institute of Standards and Technology's AI Risk Management Framework provides a general structure for governing AI risk (APM, 2025; National Institute of Standards and Technology [NIST], 2023; PMI, 2025). Such frameworks are guidance, not substitutes for the applicable law or a specific organization's risk assessment.

A proportionate AI-use protocol identifies the permitted task, data classification, tool and vendor, evidence sources, accuracy checks, reviewing human, decision record, privacy safeguards and incident route. No student data, staff disciplinary records or confidential supplier bids should be transmitted into an unapproved generative service merely for administrative convenience. AI-generated cost forecasts should be treated as candidate estimates requiring independent comparison; AI-written stakeholder messages require factual and accessibility review; and AI-derived risk scores must permit challenge by affected people. The decisive governance principle is that a consequential project decision remains owned by an identifiable, authorized person who can explain and revise it.

Cybersecurity and sustainability are design requirements, not late-stage appendices. Security planning should cover identity and access, secure development, backup and rollback, vendor dependencies, logging, vulnerability testing and user response. A digital project may also impose energy demand, electronic waste, recurring licence costs and new dependence on scarce technical capacity. Climate-sensitive construction projects face a different mix of exposure, including rainfall variability, material performance and community impacts. Project method must therefore be tailored to physical, digital and social contexts, while the recurring operation inherits a funded responsibility for maintenance, protection and continuous improvement after project closure.

21.12.1 AI assurance and the sustainability of digital project choices

A project team considering automated document drafting or risk scoring should first establish the decision being supported and the evidence needed to verify the output. A language model can propose a schedule narrative, but it cannot establish the feasibility of a predecessor relationship without authoritative project records and knowledgeable human review. In sensitive service contexts, procurement and information security must assess whether prompts or retrieved documents expose personal information, confidential bids or institutional credentials to external vendors. Review must include the possibility that an apparently fluent summary omits a safety exception or creates a false impression of consensus. The relevant performance measure is verified decision quality relative to an appropriate manual process, not volume of AI-generated text. Where the use case cannot be bounded and audited, a simpler digital workflow may be more defensible than deploying predictive or generative AI (NIST, 2023; PMI, 2025).

Sustainability appraisal should similarly move beyond the construction or procurement budget. A portal can reduce some paper use while increasing device replacement, support electricity demand, third-party hosting exposure and electronic waste. The project business case should identify the future infrastructure owner, maintenance funding, practical accessibility of hardware and software, supplier environmental claims, and procedures for secure decommissioning. In physical infrastructure projects, climate exposure, construction impacts, occupational health and community access require different methods and authoritative safeguards. The enduring principle is common: project closure transfers environmental and social obligations to institutions that must remain able to fulfil them.

21.13 INTEGRATED RWANDAN APPLICATION: A UNIVERSITY-SERVICE TRANSFORMATION PROJECT

21.13.1 Constructed project setting and approved charter

Consider a hypothetical medium-sized university in Kigali seeking to replace fragmented paper and spreadsheet processes for selected student-service requests with a secure and accessible web portal. The institution has a functioning ICT team, an academic registry, student-service personnel and a finance office, but the case assumes no specific headcount, annual institutional revenue or observed service deficiency. The teaching intervention is

deliberately bounded to requests for routine letters, status confirmations and straightforward record corrections. It excludes a full student-information-system replacement and a new national identity integration. These exclusions matter: an unqualified promise of ‘digital transformation’ would be too broad for a credible fifteen-week project and RWF 58.3 million maximum allocation.

Table 21.8. Illustrative project charter and decision rights

Charter field	Approved assumption for teaching
Problem and intended change	Reduce friction in selected student services without excluding users
Sponsor and benefits owner	Deputy vice-chancellor/registrar; registrar retains post-handover accountability
Project delivery lead	Appointed project manager with delegated baseline tolerances
Deliverables	Accessible request interface, secure workflows, migrated records, tested controls, staff preparation and pilot
Boundaries	No enterprise-wide records replacement; no unapproved identity integration
Planned duration	15 elapsed working weeks under activity assumptions in Table 21.3
Performance baseline	RWF 53.0 million; separately governed contingency RWF 5.3 million
Approval gates	Charter; design and controls; integration and security; pilot acceptance; benefits review
Acceptance and escalation	Evidence-backed test sign-off; material deviation goes to sponsor; privacy/safety risks cannot be waived casually
Benefits review	Operational reviews at 3, 6 and 12 months, with longer financial horizon separately stated

Note. Original hypothetical teaching charter. Roles are archetypes, not appointments within an identified institution. Actual data-protection, accessibility, procurement and employment obligations require institutional verification.

The project manager first convenes users, registry personnel, ICT, finance and safeguarding representatives to define legitimate requirements. A small set of service journeys is mapped, including cases where a student has incomplete data, a shared telephone, limited connectivity, a disability or a name requiring correction. The sponsor must approve whether an assisted non-digital channel will remain available. The technical team specifies data ownership, access permissions, retention rules, migration reconciliation and rollback criteria. Procurement evaluates the commercial terms and exit rights while legal and governance functions confirm what may be contracted and shared. Such planning shows why the work packages in Table 21.2 are interdependent rather than independently purchasable.

21.13.2 Network, budget, controls and a material deviation

Tables 21.3 and 21.4 give the complete teaching model. The forward and backward passes yield a 15-week planned finish and identify activities A, B, D, F and H as critical. If the sponsor postpones the initial requirements sign-off by one week, this shifts the entire critical path unless another assumption changes. If migration activity E experiences a one-week delay without a change elsewhere, its two-week total float absorbs the delay under the initial network. This is not proof that the project can safely consume all schedule float: an unavailable database specialist may simultaneously constrain configuration and migration, and a late defect discovered in E may change F’s duration. The delivery lead should therefore maintain both precedence and resource forecasts.

At the hypothetical week-10 report, PV = RWF 31.0 million, EV = RWF 27.0 million and AC = RWF 30.0 million. The resulting CPI of 0.900, SPI of 0.871 and EAC of RWF 58.89 million trigger a funding concern. The sponsor should investigate whether the cost variance comes from genuine overrun, supplier front-loaded payments, inaccurate EV recognition or an omitted contractual commitment. If the current estimate is credible, the EAC exceeds the RWF 58.3 million funding ceiling by RWF 0.59 million. The appropriate response is a documented choice: reduce legitimately optional scope, improve remaining efficiency, increase the funding ceiling through

proper authorization, or stop a no-longer-justified initiative. Quietly lowering security tests or removing assisted service access would create an apparent financial recovery by shifting unrecorded risks onto students.

Table 21.9. Illustrative sponsor decision and change-control log

Checkpoint	Evidence and decision	Authority and follow-up
Initial charter	Conditional approval subject to assessed privacy and accessibility requirements	Sponsor; preserve exclusion list and approved scope
Design gate	Confirm mappings, reconciliation and signed control design before production configuration	Sponsor with registry and security assurance
Week-10 exception	CPI 0.900; forecast RWF 58.89 million exceeds current ceiling	Sponsor to order bottom-up re-estimate; no silent reserve release
Pre-release gate	Security, service fallback, migration and usability tests must meet acceptance thresholds	Independent reviewers and operations owner; defer release if material defects persist
Handover and benefits	Operational budget, named owners and time-specific outcome tests documented	Registrar and finance; review at 3, 6 and 12 months

Note. Constructed decision register. It records what should be documented, not decisions taken by an actual university.

21.13.3 Financial benefits and sensitivity, with explicit safeguards

Assume for teaching that the selected services together handle 15,000 comparable requests annually and that a valid post-implementation time study could eventually establish a reduction of 20 staff minutes per request. The projected gross capacity released would be 15,000 × 20/60 = 5,000 staff hours annually. At an assumed fully loaded staff resource value of RWF 6,000 per hour, the theoretical resource value is RWF 30.0 million. The business case conservatively recognizes only 50% of that capacity, or RWF 15.0 million, as potentially convertible into identifiable funded activity. The word *potentially* is essential: a freed hour creates neither cash nor welfare automatically. Management must specify whether staff time is used for demonstrably valuable additional services, reduces overtime or avoids necessary future hiring. No dismissal or realized cash saving is presumed.

The illustrative annual benefits model then assumes RWF 3.5 million in avoided printing and materials and RWF 2.0 million in separately measured correction and rework costs, with overlap explicitly excluded through distinct accounting categories. Recurring system support and security costs are assumed at RWF 3.0 million annually. The resulting projected annual net economic benefit is 15.0 + 3.5 + 2.0 − 3.0 = RWF 17.5 million. On the further assumptions that the full initial funding ceiling of RWF 58.3 million is expended at time zero, that these net benefits arise at each year-end for five years, that there is no terminal value and that the illustrative discount rate is 12%, the five-year present-value factor is 3.604776. Consequently NPV = −58.3 + 17.5 × 3.604776 = **RWF +4.78 million**. These assumptions are not market data, a university forecast or a measured intervention effect; they exist to demonstrate appraisal logic.

A sensitivity test reveals the fragility of the headline. If only 75% of the RWF 20.5 million gross annual benefit is realized while RWF 3.0 million in operating costs persists, annual net benefit falls to RWF 12.375 million. Its five-year NPV becomes **RWF −13.69 million** using the same discount assumptions. The positive base-case appraisal is therefore highly conditional on adoption, real capacity conversion, absence of double counting and sustainable support. A detailed business case would also test delay to benefits, cost escalation, technology replacement, inflation and plausible variation in the discount rate. It should not treat a positive modeled NPV as authorization to breach privacy, abandon accessibility or misrepresent nonfinancial outcomes.

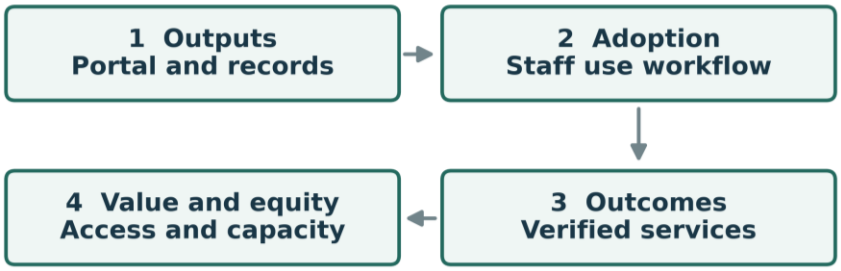


Figure 21.3. *Value pathway and evidence checkpoints for the hypothetical student-service portal.* Note. Original theory-of-change synthesis. Each arrow expresses an assumption requiring operational verification; it does not establish a causal effect.

The benefits owner should collect baseline request-level processing measures before implementation and define a reproducible denominator. Subsequent comparison must account for changes in the mix of requests, enrolment periods, service availability and manual fallback. Acceptance tests establish that system functions work; they do not prove that administrative waiting times fell because of the portal. Separate student-centred measures should examine accessibility, repeat visits and unresolved complaints. Where credible comparison data are unavailable, management should report descriptive improvement with limitations instead of implying causal certainty. This distinction implements the research and evidence safeguards developed in Chapter 4.

21.13.4 Decision, professional transfer and ethics

The constructed evidence does not warrant an unconditional instruction to proceed. A reasoned conditional authorization would require documented user needs; agreed minimum accessible services; credible data controls; resource commitments from the permanent registrar function; competing options, including process redesign without new software; a supplier market assessment; and staged design and pilot gates. Approval for subsequent expenditure should depend on evidence from the previous gate. If the risk log reveals unmanaged privacy exposure or a forecast that exceeds the approved ceiling without a feasible remedy, the authorized decision-maker must revise or stop the work. This approach makes both integrity and flexibility observable in the authorization record.

The case also demonstrates how delivery choices affect other functions. Marketing and communications must represent the portal's capabilities accurately; HR and organizational learning must equip staff to work within new decision rights; procurement must secure reliable supplier performance and exit arrangements; finance must distinguish estimates from liabilities and monitor operating sustainability; quality assurance must verify functionality and usability; and the continuing operation must own incidents and benefits. Project management is the temporary integration mechanism, not a substitute for these distinct specialist functions. The business lesson is not that every university needs a sophisticated project office. It is that a small, auditable change programme becomes credible only when the organization accepting its outputs has the resources and authority to make those outputs useful.

21.14 DOCUMENTED RWANDAN AND INTERNATIONAL COMPARATIVE EVIDENCE

21.14.1 Rwanda Digital Acceleration Project: evidence of programme architecture, not asserted success

Rwanda's Digital Acceleration Project (P173373) offers a documented national example of the programme and portfolio problem. The World Bank announced approval in December 2021 of US$100 million in financing to help expand broadband access and selected digital public services and strengthen the digital innovation ecosystem (World Bank, 2021). Rwanda's Ministry of Finance and Economic Planning reported a December 2021 agreement for another US$100 million in Asian Infrastructure Investment Bank financing, identifying a total programme investment of US$200 million and four broad components: digital access and inclusion, digital public service delivery, digital innovation and entrepreneurship, and project management (Ministry of Finance and Economic Planning [MINECOFIN], 2021). These official statements establish approved financing and design intentions; they do not by themselves establish implementation performance, actual disbursement or benefits realized.

The architecture is analytically important. Broadband infrastructure may provide little additional public value if people lack affordable devices or digital literacy; improved digital services may fail without institutional process redesign and trustworthy data governance. The project's interdependent components illustrate why programme coordination differs from a collection of independent ICT contracts. The World Bank's March 2026 project information document and the financing partner's publicly listed June 2026 monitoring report show continuing documentary oversight material exists, but this chapter does not extract unverified outcome indicators from those documents or claim that planned household, training or service targets were achieved (Asian Infrastructure Investment Bank [AIIB], 2026; World Bank, 2026). To make a rigorous ex post evaluation, a researcher would need dated indicator definitions, verified actuals, beneficiary baselines, implementation changes, expenditure records and appropriately designed comparisons.

For a Rwandan university or SME, the transferability lesson is one of dependency and proportionality rather than imitation. A national co-financed initiative has sovereign governance, multiple executing institutions, cross-sector benefits and formal development-finance safeguards. A small enterprise cannot replicate its committee structure without excessive burden, but it faces analogous dependencies among digital infrastructure, staff capability, service design, consent and recurring financing. Rwanda's public-procurement oversight debate also cautions that adequate preparation, contract amendment control and institutional accountability cannot be replaced by a digital procurement interface (Parliament of Rwanda, 2026).

A related empirical contribution qualifies the transfer of generic project-success formulas to development settings. Survey research on World Bank projects by Ika et al. (2012) identified monitoring, coordination, design, training and institutional environment as positively associated with project success as perceived by task-team leaders. This is meaningful because institutional capacity and beneficiary engagement may mediate the usefulness of technical controls. Nevertheless, the study's respondents, perceptions and observational design do not identify a causal effect of any prescribed package, and its global World Bank project context is not a representative survey of Rwandan enterprises. Its practical value is to widen the diagnostic frame beyond schedule competence while preserving caution about transferability.

21.14.1.1 Implementation evidence, financing revision and limits of inference

A subsequent International Development Association project paper on proposed additional financing supplies a stronger dated implementation record than the initial financing announcements. It reports that as of December 2025, 3,054 of a targeted 5,000 public sites had been connected and approximately 2.5 million people had received training through the Digital Ambassadors Programme, with 51% of trainees reported as women. The paper also records that overall implementation progress improved from Moderately Unsatisfactory in June 2025 to Moderately Satisfactory in December 2025, while progress toward the development objective remained Moderately Satisfactory. These are official project monitoring statements, not independently identified impacts on productivity, inclusion or citizen welfare (International Development Association [IDA], 2026).

The financing history illustrates why figures must be dated and classified. The same 2026 project paper records an earlier approved operation cost of US$180 million following cancellation of US$20 million, and proposes a further US$20 million IDA credit to restore total financing to US$200 million. Its table distinguishes previously approved amounts from the proposed additional financing; a proposal should not be reported as disbursement or final approval. The request to extend closing from December 2026 to June 2028 is also described as a request in the project paper, not a universally applicable deadline decision. The case therefore demonstrates a substantive governance issue: portfolio and programme evaluations must reconcile original financing commitments, subsequent restructurings, disbursements, implementation ratings and actual beneficiary outcomes rather than combining different dates and categories into one success statistic (IDA, 2026).

21.14.2 Crossrail: a documented warning about unrealistic integration assumptions

The United Kingdom's Crossrail programme provides a contrasting international case where a technologically complex transport investment confronted governance and integration difficulties. In its 2019 independent report, the National Audit Office (NAO) identified a compressed schedule, contractual arrangements, changing scope and an

unrealistic delivery plan among the sources of excessive cost and delay; it emphasized that final value for money could not yet be concluded before services opened and full costs were established (National Audit Office [NAO], 2019). Its subsequent progress reporting described the previously revised programme schedule and funding arrangements as insufficiently realistic given the extent of remaining work (NAO, 2021). The lesson is not that every megaproject inevitably overruns; it is that weak integration evidence and pressures to sustain politically salient dates can overwhelm sophisticated individual contract management.

A principled comparison distinguishes the cases' scale and objectives. Crossrail combines complex physical systems, safety-critical integration, numerous commercial interfaces and long asset lifetimes. Rwanda's digital programme addresses infrastructure, inclusion and public services under very different financing, institutional and access conditions. The hypothetical university portal has more limited scope and may permit meaningful incremental testing and reversal. Nevertheless, all three require sound baselines, cross-organization coordination, empowered sponsors, visibility of disbenefits and realistic benefit-handover arrangements. The mechanism transfers more readily than a particular schedule reserve, staffing ratio or governance committee design. The comparative conclusion therefore remains conditional and theory-informed, not a statistical generalization from two national programmes.

21.15 CROSS-FUNCTIONAL INTEGRATION, ETHICAL ACCOUNTABILITY AND RESEARCH OPPORTUNITIES

Project management occupies a distinctive position in the enterprise system because it coordinates temporary change that ordinarily crosses existing functional boundaries. Strategy decides which commitments merit investment; projects translate selected commitments into temporary deliverables; operations sustain the changed process; finance evaluates capital and cash consequences; procurement governs acquisition; human-resource systems supply and develop capabilities; governance supervises legitimate authority; and evaluation tests whether the intended results occurred. Failure at a single interface can defeat the whole investment. A technically acceptable digital platform can be unusable without trained staff; an affordable capital project can undermine liquidity through payment mismatches; a completed road can produce harmful local effects if consultation and remedy were inadequate. These connections are causal hypotheses to be investigated, not proof that coordination quality independently determines every outcome.

A useful analytical synthesis is the **authorized-change-to-benefit chain** illustrated in Figure 21.1: justified selection → delegated governance → feasible temporary delivery → verified acceptance → funded operational adoption → measured and fairly distributed outcomes → independent learning and possible correction. The model draws on temporary-organization and governance research as well as benefits realization, but its particular combination and arrows are proposed here as an integrative teaching framework rather than a validated scholarly instrument. Its strongest implication concerns responsibility gaps. Every arrow should have a named owner, evidence source, failure trigger and permission to revise. Where the owner changes across the handover boundary, the risk of apparently successful but ineffective investment increases unless the transition is governed explicitly.

The ethical dimensions are substantive. Strategic leaders may favor projects that confer short-term political visibility but fail a defensible comparison against less visible maintenance. Contractors may exploit information asymmetries; managers may transfer schedule pressure to unsafe labour; digital systems may exclude those with low literacy or limited connectivity; public reports may describe targets as achievements. Fair enterprise practice requires truthful baselines, lawful acquisition, due process for workers and suppliers, meaningful accessibility and proportional safeguards against irreversible harm. The proper test is not whether every participant agrees but whether decisions are made by authorized persons, reasons and evidence are visible, and affected parties retain a plausible path to challenge and remedy. This is a reasoned normative commitment, not an empirical claim that ethical practice always minimizes costs.

Research opportunities follow from the limitations of the evidence reviewed. One hypothesis is that explicitly assigning post-handover benefits ownership predicts stronger sustained service outcomes than assigning responsibility solely to the delivery manager, after accounting for enterprise capability and project selection. A second concerns the interaction of stakeholder participation with requirements uncertainty: participation may improve usability when iterative revision is feasible but create coordination costs when affected groups are numerous and decision rights are unclear. A third asks whether independent challenge and reference-class forecasting improve

cost accuracy in African public investments, distinguishing forecast accuracy from the politically determined selection of proposals. A fourth investigates whether AI-assisted project reporting improves early detection of deviations or instead increases dashboard confidence without increasing the underlying validity of evidence. Testing these propositions would require appropriately specified populations, longitudinal data, controls for selection and organizational differences, and, where ethical and feasible, designs capable of separating intervention effects from correlated capability.

21.15.1 A testable theory of accountable project value

The resulting conceptual proposition is conditional rather than deterministic. Project-selection discipline should improve the chance that resources address legitimate needs, but it can have little effect when decision-makers cannot implement or enforce selected alternatives. Delivery capability should increase the likelihood of accepted outputs, but its contribution to realized benefits may be mediated by adoption, complementary resources and the authority of the receiving operation. Stakeholder engagement may improve requirement validity while also increasing the coordination cost of reaching decisions; governance challenge may improve forecast honesty yet slow time-sensitive projects if review thresholds are poorly designed. These mechanisms invite empirical studies that distinguish baseline organizational capability, institutional context and project complexity from the effects of interventions introduced after authorization.

A credible African research agenda could assemble longitudinal project registers linking approved scope, contract revisions, independent audits, milestones, post-handover service measures and stakeholder harms. Comparative cases should stratify public, private, cooperative and nonprofit projects rather than assume one governance regime. Designs might exploit staggered adoption of a project assurance protocol or compare forecasts before and after institutional reforms, while examining whether selection and unobserved managerial capability confound estimates. Qualitative process tracing could test how information was suppressed or corrected at decisive stages. Such research would strengthen external validity and clarify the mechanisms by which accountability becomes practical capability instead of remaining a ceremonial compliance document.

21.16 CRITICAL SYNTHESIS AND CONCLUSION

Technical planning and accountable governance are complementary, but neither is sufficient on its own. Critical-path networks reveal the consequences of sequence assumptions, while sociotechnical analysis reveals dependencies that may not be captured as activities. Earned-value measures make spending and accepted work comparable, but can mislead when acceptance is weak or the wrong work was authorized. Agile feedback can improve responsiveness under genuine uncertainty, yet it cannot legitimize uncontrolled scope or bypass independent safety assurance. Benefits management extends concern beyond handover, but the mere existence of a benefits register does not establish causality or just distribution. These tensions are not anomalies to be removed by selecting one dominant methodology; they are features of managing consequential change in open enterprise systems.

An enterprise should authorize temporary investment only when its purpose, counterfactual alternatives, scope and distribution of consequences have survived proportionate scrutiny. Once authorized, the schedule must remain a revisable dependency model whose dates are qualified by resources, uncertainty and assurance. Expenditure discipline requires equally careful distinctions among budgeted progress, actual cost, cash affordability, risk provisions and downstream operating obligations. These distinctions become especially important where a numerical dashboard appears favorable while contractual liabilities or unmet safety requirements remain invisible. The authority to revise or terminate a project must therefore be preserved throughout its lifecycle rather than treated as an admission of failure.

The appropriate delivery method follows the structure of the problem, not the preference of the project manager. Stable and irreversible requirements justify extensive early assurance, whereas uncertain user needs may justify controlled iteration and genuine feedback. In either case, benefit ownership and continuing resource provision must be settled before the temporary team disbands. Independent evaluation, accessible stakeholder voice and documented corrective decisions connect the initial investment claim to durable enterprise value; without these mechanisms, apparently successful completion may remain institutionally or socially unsuccessful.

The central conclusion is that projects should be governed as **time-bounded, evidence-sensitive commitments to change**, nested in permanent institutions whose responsibilities and stakeholder relationships persist after the project team disbands. Portfolio selection must withstand scrutiny before money is spent. Programme management must coordinate dependencies and complementary benefits. Project delivery must maintain disciplined, revisable control over scope, schedule, costs, people, suppliers and risks. Operational owners must verify that the resulting capability is adopted, sustainable and ethically defensible. Success is therefore multidimensional and time-dependent: output conformance, delivery economy, credible service outcomes, stakeholder consequences and organizational learning may agree or diverge (Atkinson, 1999; Shenhar et al., 2001; Ika, 2009).

This chapter prepares the ground for the next part of the book by making the financial consequences of enterprise change explicit without reducing value to money. Chapters 22–26 develop faithful accounting, costing, investment finance, financial systems, taxation and controls, all of which furnish essential evidence for responsible project commitment and evaluation. The intended integrated enterprise is not a set of departments optimized separately, but an arrangement capable of choosing, implementing, evaluating and correcting consequential commitments under uncertainty.

21.17 KEY CONCEPTS, LEARNING ASSESSMENT AND EDUCATOR GUIDANCE

21.17.1 Core terminology

Term	Contextual definition
Project	Time-bounded authorized initiative undertaken to create a specific output, capability or change.
Programme	Coordinated related initiatives and activities managed to realize joint outcomes and benefits.
Portfolio	Strategically selected and monitored collection of competing or complementary investments.
Sponsor	Authorized owner of the initiative's continuing business justification and material escalation.
Business case	Evidence-based appraisal of purpose, alternatives, costs, benefits, risks and legitimacy.
Charter	Formal statement authorizing scope, boundaries, delegated responsibility and decision rights.
Work breakdown structure	Deliverable-oriented decomposition of the complete authorized project scope.
Critical path	Longest-duration precedence chain determining the earliest finish under stated assumptions.
Total float	Amount an activity can shift without delaying the specified modelled project finish.
Cost baseline	Time-phased authorized budget against which progress and cost are controlled.
Earned value	Budgeted value of objectively verified work accomplished by the reporting date.
Risk register	Documented causes, uncertain events, consequences, control owners, responses and triggers.
Change control	Governed evaluation and authorization of alterations to scope, time, cost or requirements.
Benefits realization	Planned adoption, measurement and review of intended outcomes after deliverables are accepted.
Stage gate	Authorized decision point for continued investment, modification, pause or termination.
Hybrid delivery	Justified combination of predictive and adaptive methods within coherent governance boundaries.

21.17.2 Foundational and analytical questions

21.17.2.1 Foundational analysis (LO1–LO2)

Explain why a student-information-system upgrade is a project while annual registration is an operation. Under what conditions would several related digital projects form a programme rather than simply a portfolio? Identify who owns benefits after closure and defend your answer using the governance theories addressed in the chapter.

21.17.2.2 Schedule and financial analysis (LO3–LO5)

Reconstruct Table 21.3 from the predecessor list, independently calculate ES, EF, LS, LF and total float, and explain what changes if integration activity E requires seven rather than four weeks. Recalculate CV, SV, CPI and SPI from the week-10 snapshot and produce a revised EAC using both the constant-CPI assumption and a reasoned bottom-up remaining-cost assumption of your own. Clearly explain why neither EVM index proves that the portal will be useful.

21.17.2.3 Governance and stakeholder analysis (LO5–LO7)

Evaluate a proposal to remove accessible assisted-service channels and shorten security testing to recover a threatened project deadline. Distinguish law and non-negotiable rights from negotiable scope, propose alternative recovery actions, and identify the responsible escalation forum. Explain how users with little formal influence would be heard.

21.17.2.4 Integrative capstone (LO1–LO8)

Develop an evidence-supported, 3,000–4,000-word business case for a Rwandan university, cooperative, enterprise or public agency considering one substantial temporary change initiative. Include at least two alternatives, a complete charter, scope boundary and WBS, auditable schedule and critical path, multi-period cost and funding plan, qualitative and quantified risks where defensible, procurement and stakeholder controls, justified delivery-method choice, benefits map and evaluation design. Compare the proposal with one appropriately documented regional or international case, and write a sponsor decision memorandum stating whether to approve, stage, revise or reject the initiative. Label every hypothetical assumption and distinguish official data from inference.

21.17.3 Educator answer guidance and analytical rubric

The foundational response should distinguish the duration and intended uniqueness of change from recurring service, explain why programme benefits require coordinated related work, and distinguish portfolio prioritization from programme interdependence. For the network exercise, the base-case project duration is 15 weeks and the zero-float chain is A–B–D–F–H. When E increases from four to seven weeks, its duration becomes 7, its earliest finish becomes week 11, F shifts to week 11, and project completion becomes week 16 unless dependencies or resources change. The new critical path includes A–C–E–F–H, which totals $2 + 2 + 7 + 3 + 2 = 16$ weeks; this is a useful demonstration that criticality is sensitive to change. For the earned-value component, the correct reported measures are CV = −RWF 3.0 million, SV = −RWF 4.0 million, CPI = 0.900, SPI ≈ 0.871 and constant-CPI EAC ≈ RWF 58.89 million. The cost ceiling, not merely BAC, must be assessed separately.

Table 21.10 provides a transparent assessment rubric. Equal weighting prevents technical calculation from displacing ethical, inferential and contextual reasoning; educators may recalibrate weights to declared programme outcomes before using the instrument.

Table 21.10. Suggested analytical assessment rubric for the Chapter 21 integrative capstone

Assessment domain	Weight	Evidence of satisfactory achievement
Problem framing, alternatives and theory	20%	Defensible rationale, competing options and bounded theoretical interpretation
Scope, schedule, costs and calculations	20%	Traceable WBS, consistent network, reproducible budget and sensitivity
Governance, risk, rights and contracting	20%	Authorized decisions, stakeholder protection and actionable risk responses
Benefits, evidence and uncertainty	20%	Measurable outcomes, transparent counterfactual limits and benefit ownership
Rwanda relevance, comparison and scholarly integrity	20%	Credible contextual data, warranted transfer claims, accurate citations and clear professional reasoning

21.17.4 Selected further reading

A practical sequence begins with PMI (2025) and ISO (2020) for contemporary professional language, then Kelley and Walker (1959) and Malcolm et al. (1959) for the formal planning tradition. Lundin and Söderholm (1995), Geraldi et al. (2011) and Too and Weaver (2014) develop the temporary-organization, complexity and governance critiques. Atkinson (1999), Shenhar et al. (2001), Ika (2009) and Serra and Kunc (2015) help readers distinguish delivery performance from longer-term success and realized benefit. For contextual interpretation, the World Bank (2021) and MINECOFIN (2021) documents should be compared with the NAO's independently reported Crossrail findings, without treating any country's project experience as a universal template.

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