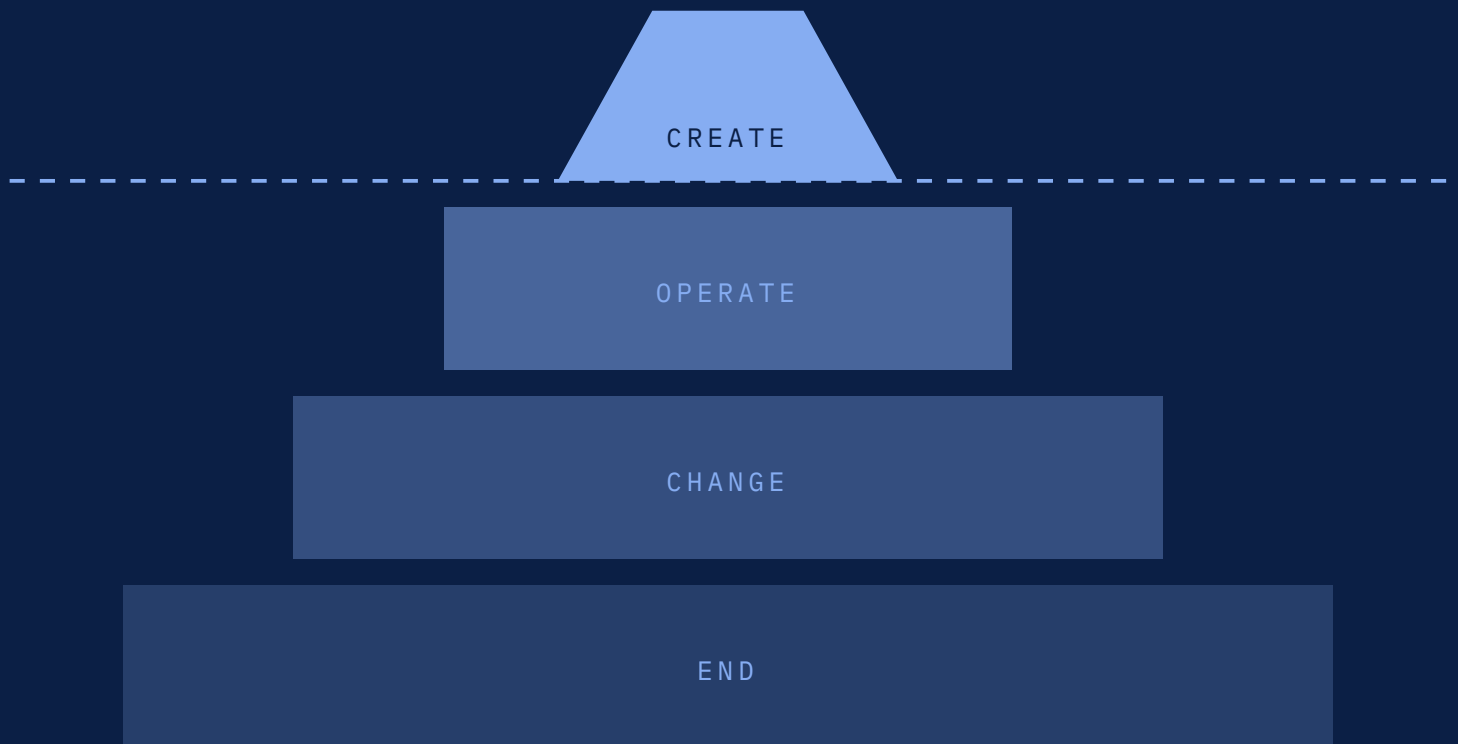




04 / 04

Cost-Effectiveness & Total Cost of Implementation

TCI strategy in emergency EdTech

SOURCE

Radford et al. (2026)
Education in Emergencies EdTech guidance

EDITION

October 2026

SUMMARY

In crisis-affected education systems, severe resource constraints and sharp reductions in international aid demand rigorous financial stewardship. As established by Radford et al. (2026), educational technology (EdTech) interventions in Education in Emergencies (EiE) frequently suffer from chronic under-costing.

Implementers routinely budget for initial hardware procurement or software development while ignoring ongoing operational expenditure, maintenance networks, connectivity fees, and system integration. Initial acquisition costs typically represent less than 30% of the total expenditure incurred over an intervention's operational lifespan.

THE SHIFT REQUIRED

Sustainable, cost-effective EdTech impact requires moving from upfront purchasing budgets toward a full Total Cost of Implementation (TCI) and Total Cost of Ownership (TCO) life-cycle framework, grounded in strategic sourcing and vendor-neutral procurement.

<30% of lifetime expenditure is initial acquisition	4 TCO cost buckets: create, operate, change, end	3 sourcing pathways: reuse, adapt, or build	15–20% annual device attrition to budget for in crisis zones
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ABOUT THIS BRIEF

Synthesised from Radford et al. (2026), Education in Emergencies EdTech guidance. Statistics, field evidence, and framework descriptions are reported as presented in that source. This is brief 04 of a four-part series.

01 Strategic Sourcing: The “Reuse, Adapt, or Build” Decision Pathway

The most consequential financial decision in emergency EdTech occurs before a single line of code is written or a hardware order is placed: deciding whether to reuse existing technology, adapt available tools, or build a new software solution.

The decision pathway matrix

Radford et al. (2026) outline three sourcing pathways, evaluated across speed, cost, technical requirements, and contextual fit.

CASE 1 Reuse	CASE 2 Adapt	CASE 3 Build
SCENARIO AND CONTEXT FIT A mature, relevant tool already exists and aligns with curriculum requirements. OPERATIONAL TRADE-OFFS Fastest and lowest upfront cost; may require minor pedagogical adjustments to fit local context. CORE PREREQUISITES Validated licensing, device compatibility, local user support capacity.	SCENARIO AND CONTEXT FIT Existing open solutions are a close fit but need translation, content alignment, or simplification. OPERATIONAL TRADE-OFFS Moderate cost and investment; requires dedicated development capacity for localisation and testing. CORE PREREQUISITES Content alignment expertise, open licensing (CC-BY/MIT), technical testing capacity.	SCENARIO AND CONTEXT FIT Learner needs are highly unique, and no viable, accessible solution exists on the market. OPERATIONAL TRADE-OFFS Time-intensive, costly, and high risk; imposes long-term software maintenance burdens on fragile systems. CORE PREREQUISITES Strong software engineering teams, multi-year guaranteed funding, durable maintenance plans.

FASTEST, LOWEST UPFRONT COST

SLOWEST, COSTLIEST, HIGHEST RISK

Jordan’s “Don’t Build It” framework

When considering custom software development (Case 3), implementation teams must apply the “Don’t Build It” framework formulated by Jordan (2021). Its central premise is that capability does not justify execution: an organisation having the technical capacity to build an application does not mean it should.

GHOST SOFTWARE

Custom builds in emergency settings frequently create fragile “ghost software”: applications that function briefly during donor funding cycles but become unusable because of unmaintained code, security vulnerabilities, or operating system updates.

Before committing to a custom build, decision-makers must evaluate three mandatory criteria.

01 Real user demand validation	Proving through field diagnostics that existing low-tech or open-source applications cannot satisfy instructional goals.
02 Long-term operational funding	Securing explicit multi-year budget commitments covering post-launch maintenance, server hosting, and bug resolution for at least three to five years beyond initial deployment.
03 Software governance and maintenance capacity	Establishing an in-house or contracted technical team capable of continuous DevOps, dependency updates, and security patching.

02 Total Cost of Implementation (TCI) & Life-Cycle TCO Architecture

To prevent systemic underestimation, Radford et al. (2026) mandate calculating the Total Cost of Implementation (TCI) using the United Kingdom Government's four-bucket Total Cost of Ownership (TCO) architecture.

LIFE-CYCLE COST PRINCIPLE

Initial procurement is only the tip of the financial iceberg. True financial sustainability requires capturing costs across four life-cycle buckets.

INITIAL ACQUISITION

Typically under 30% of total expenditure

OPERATE, CHANGE AND END

The remainder: operations, maintenance, connectivity, and system integration

BUCKET 1

Cost to Create

Upfront capital expenditure to launch

BUCKET 2

Cost to Operate

Recurrent costs to sustain daily learning

BUCKET 3

Cost to Change

Adapting and optimising over time

BUCKET 4

Cost to End

Transition, decommissioning, handover

1. Cost to Create

Upfront capital expenditures required to launch the intervention.

- Hardware acquisition (tablets, feature phones, servers, solar chargers).
- Software development, custom code architecture, or commercial platform licensing.
- Initial curriculum localisation, translation, and instructional design alignment.
- Baseline teacher, administrative, and technical support onboarding workshops.

2. Cost to Operate

Recurrent operational expenditures necessary to sustain daily learning operations.

Connectivity and data tariffs	Monthly cellular data costs, SIM card provisioning, internet bandwidth, and zero-rating negotiations with telecommunications providers.
Hardware servicing and device attrition	Replacing stolen, damaged, or obsolete devices, typically budgeting for a 15–20% annual device attrition rate in crisis zones.
Distributed maintenance ecosystems	Establishing local repair networks, helpdesk operations, and spare parts supply chains.
Continuous professional development	Ongoing coaching, peer learning networks, and refresher digital literacy training for teachers.

FIELD EXAMPLE / URUGUAY

Plan Ceibal

Plan Ceibal shows the operational necessity of an integrated maintenance ecosystem. To support nationwide device distribution, Ceibal established a distributed repair network, remote troubleshooting via phone and email, and a national service call centre. Without this dedicated operational infrastructure, device failure rates quickly stall digital learning continuity.

3. Cost to Change

Expenditures required to adapt and optimise the system over time.

Adaptive software maintenance	Updating operating systems, security libraries, and software dependencies to ensure compatibility.
Corrective maintenance	Establishing formal bug-tracking systems and field-level issue reporting pipelines to fix software faults rapidly.
Perfective maintenance	Refining code quality, reducing application load times, and optimising offline data synchronisation protocols.
Iterative curriculum alignment	Updating digital learning content in response to national curriculum reforms or learning outcome evaluations.

4. Cost to End

Transition, decommissioning, and institutionalisation costs.

- Decommissioning legacy hardware and executing environmentally responsible electronic waste (e-waste) recycling.
- Transitioning user data, assessment records, and open-source codebases to Ministry of Education cloud servers or national EMIS databases.
- Handover capacity building to transition operations from INGO or UN management to government ownership.

03 Strategic Procurement, Open Assets & Vendor Neutrality

Procurement protocols in Education in Emergencies must actively prevent proprietary vendor lock-in, which forces governments into costly, unsustainable licensing fees.

Digital Public Goods and open-source licensing

Implementers should prioritise solutions recognised as Digital Public Goods (DPGs): open-source software, open data, open AI models, and open content designed for public benefit and interoperability. When selecting or creating software, licensing models determine long-term sustainability.

Permissive licences (MIT, Apache 2.0)	Allow broad commercial and non-commercial reuse, modification, and redistribution with minimal restrictions. Ideal for maximising adoption across diverse international partners.
Copyleft licences (GNU GPL v3)	Mandate that any adapted or derivative works remain open-licensed. This guarantees that software remains a public asset, though it may restrict integration with proprietary government platforms.
Creative Commons content licensing (CC-BY, CC-BY-SA)	Enables educational materials to be freely translated, localised, and redistributed without costly copyright renegotiation.

Open technical standards

To ensure software components can be integrated into broader national platforms without re-engineering, procurement specifications must mandate open technical standards.

SCORM	Sharable Content Object Reference Model: ensures digital learning modules can run across different Learning Management Systems (LMS).
H5P	Enables the creation, sharing, and reuse of interactive HTML5 learning content across web platforms.
xAPI	Experience API: standardises the capture and transfer of learning activity data across offline applications and central databases.

Procurement contracting best practices

Contracts with technology vendors must move beyond basic product delivery to enforce long-term value.

Bundled warranties and SLAs	Mandating minimum two-year hardware warranties and Service-Level Agreements (SLAs) specifying 99.5% uptime targets and strict bug-resolution timelines.
Vendor neutrality and data portability	Guaranteeing that all learner records and assessment data remain full government property and can be exported in open, non-proprietary formats (such as CSV or JSON) at any time.

Codebase ownership

Ensuring procurement contracts assign full copyright, or perpetual royalty-free open-source rights, of all developed code and localisation assets to the Ministry of Education or the public domain.

04 Economic Evaluation & Systemic Feasibility Assessment

To judge whether an EdTech intervention is a sound investment, implementers must apply sector-recognised economic frameworks and systemic feasibility matrices.

Sector-recognised cost-effectiveness frameworks

FCDO 4Es Framework. Evaluates Value for Money across four dimensions.

E01

Economy

Minimising the cost of input resources, for example bulk device procurement savings.

E02

Efficiency

Maximising output quantity and quality for a given input, for example cost per active learning hour delivered.

E03

Effectiveness

Measuring primary educational outcomes relative to spend, for example cost per 0.1 SD gain in reading proficiency.

E04

Equity

Assessing how effectively expenditure reaches the most disadvantaged cohorts, for example cost per out-of-school girl or learner with a disability supported.

World Bank Learning-Adjusted Years of Schooling (LAYS)

Measures how effectively EdTech expenditure translates nominal years of schooling into equivalent years of high-quality learning.

Strategic Impact Evaluation Fund (SIEF) cost approach

Standardises ingredient-based cost accounting to compare cost-effectiveness across competing non-tech and EdTech delivery models.

Systemic feasibility matrix

Affordability is a subset of broader systemic feasibility. Radford et al. (2026) establish that an EdTech intervention must be evaluated across four feasibility dimensions before scaling.

Feasibility dimension	Evaluation criteria	Critical risk factors
Operational	Can the programme be delivered within existing administrative and school-level human resource capacities?	Overburdened teachers, lack of local IT support technicians, fragile supply chains.
Institutional	Is the technology compatible with existing government governance structures, mandates, and EMIS systems?	Fragmented data pipelines, overlapping ministry jurisdictions, lack of institutional policy anchor.
Technical	Is the delivery model viable given local electricity grids, network connectivity, and device infrastructure?	Unstable power grids, high cellular data costs, lack of offline synchronisation capability.
Political	Does the intervention align with national education sector plans, political priorities, and community norms?	Shifting political regimes, opposition to digital learning, lack of local stakeholder buy-in.

DO NEXT

Financial implementation protocol for decision-makers

01

Apply the “Don’t Build It” assessment

Audit existing DPGs and open-source tools before allocating capital for software development.

02

Execute full life-cycle costing

Calculate TCI across all four TCO buckets (Create, Operate, Change, End), ensuring operational expenses (connectivity, maintenance, CPD) are fully funded.

03

Mandate open standards and licences

Enforce SCORM/H5P standards, CC-BY content licensing, and MIT/GPL software licensing in all procurement contracts.

04

Negotiate telecom zero-rating

Partner with national regulatory bodies to zero-rate educational data traffic or establish subsidised bulk-data tariffs.

05

Establish distributed repair budgets

Set aside 15–20% of hardware budgets annually for maintenance networks, spare parts, and device attrition replacements.