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Sustainable Reconstruction Management in Libya: A Multi-Level Governance and Integrated Project-Cycle Framework

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إدارة إعادة الإعمار المستدام في ليبيا: إطار متعدد المستويات للحوكمة ودورة المشروع المتكاملة

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Abstract
Libya faces a reconstruction challenge that extends beyond repairing physical assets. It involves restoring services, rebuilding public trust, coordinating public investment, and strengthening the capacity of national and municipal institutions to plan, deliver, operate, and maintain infrastructure. These tasks are complicated by institutional fragmentation, uneven local capacity, conflict-related vulnerability, disaster exposure, water scarcity, and climate pressures. This paper develops an analytical framework for sustainable reconstruction management in Libya. It combines multi-level governance, project-cycle management, integrated economic-social-environmental appraisal, asset-management principles, and institutional learning. The paper uses a descriptive-analytical approach based on a targeted review of institutional reports and reconstruction literature, with particular attention to the Libya Rapid Damage and Needs Assessment following the September 2023 floods. The proposed framework is organized around seven linked elements: context, governance, project cycle, integrated appraisal, outputs, development impact, and institutional sustainability. It argues that reconstruction efficiency requires a shift from a narrow "building projects" approach to portfolio management of assets and services. Projects should be selected according to need, risk, service value, lifecycle cost, and operation-and-maintenance feasibility. The paper proposes a project registry, transparent financing and grievance mechanisms, community participation, climate- and water-sensitive design, and a phased implementation roadmap. The framework is conceptual and policy-oriented; it does not claim to provide causal estimates or field-validated performance results. Its principal contribution is a practical architecture that can be tested through municipal pilots and adapted to Libya's institutional and regional diversity.

Keywords: Libya; sustainable reconstruction; post-disaster recovery; infrastructure governance; municipal capacity; climate resilience; water security.

الملخص
تواجه ليبيا تحدياً في إعادة الإعمار يتجاوز إصلاح الأصول المادية، إذ يشمل استعادة الخدمات، وإعادة بناء الثقة العامة، وتنسيق الاستثمار العام، وتعزيز قدرة المؤسسات الوطنية والبلديات على التخطيط والتنفيذ والتشغيل والصيانة. وتزداد صعوبة هذه المهام بسبب التجزؤ المؤسسي، وتفاوت القدرات المحلية، والهشاشة المرتبطة بالنزاع، والتعرض للكوارث، وندرة المياه، والضغوط المناخية. تطور هذه الدراسة إطاراً تحليلياً لإدارة إعادة الإعمار المستدام في ليبيا، يجمع بين الحوكمة متعددة المستويات، وإدارة دورة المشروع، والتقييم الاقتصادي والاجتماعي والبيئي المتكامل، وإدارة الأصول، والتعلم المؤسسي. وتعتمد الدراسة منهجاً وصفياً تحليلياً يستند إلى مراجعة موجهة للتقارير المؤسسية وأدبيات إعادة الإعمار، مع التركيز على تقييم الأضرار والاحتياجات في ليبيا بعد فيضانات سبتمبر 2023. ويتكون الإطار المقترح من سبعة عناصر مترابطة: السياق، والحوكمة، ودورة المشروع، والتقييم المتكامل، والمخرجات، والأثر التنموي، والاستدامة المؤسسية. وتخلص الدراسة إلى ضرورة الانتقال من نهج تنفيذ مشاريع البناء المنفردة إلى إدارة محفظة من الأصول والخدمات، مع اعتماد سجل وطني للمشاريع، وتمويل شفاف، وآليات للتظلم، ومشاركة مجتمعية، وتصميم يراعي المناخ والمياه، وخارطة طريق تنفيذية مرحلية. ويظل الإطار تصوراً سياساتياً يحتاج إلى اختبار ميداني من خلال مشروعات تجريبية بلدية.

الكلمات المفتاحية: ليبيا؛ إعادة الإعمار المستدام؛ التعافي بعد الكوارث؛ حوكمة البنية التحتية؛ القدرة البلدية؛ المرونة المناخية؛ أمن المياه.

1. Introduction

Reconstruction in Libya is not a single engineering programme. It is a governance and development challenge that connects damaged infrastructure, disrupted services, institutional fragmentation, unequal local capacity, social trust, and long-term fiscal and environmental risks. The September 2023 floods in eastern Libya made this challenge visible at national scale. The joint World Bank, United Nations, and European Union assessment estimated recovery and reconstruction needs at US$1.8 billion, with approximately 1.5 million people affected. It also estimated more than 18,500 houses damaged or destroyed and indicated that about 70% of reconstruction costs would concern infrastructure [1].

The size of the need does not by itself determine the quality of recovery. Reconstruction can reproduce pre-existing vulnerabilities when projects are selected without a portfolio perspective, when responsibilities are unclear, when operation and maintenance are ignored, or when affected communities have limited influence over priorities. Conversely, reconstruction can create a development opportunity if it links physical investment to service outcomes, local institutional capacity, disaster-risk reduction, climate adaptation, and transparent public financial management.

This paper asks: How can Libya organize reconstruction so that investments restore essential services while also strengthening resilience, inclusion, and institutional sustainability? It develops a compact analytical framework rather than claiming to evaluate a completed reconstruction programme. The framework is intended for national authorities, municipalities, development partners, project owners, consultants, and civil-society organizations. It emphasizes three principles: reconstruction should be governed across levels; projects should be managed across their full lifecycle; and success should be measured through durable service and development outcomes rather than construction volume alone.

2. Context and Problem Definition

Libya's reconstruction environment combines several forms of uncertainty. Political and institutional fragmentation can complicate priority setting, procurement, budget execution, land administration, and accountability. Municipalities may face limited technical, financial, and data capacity even when they are closest to affected communities. Conflict damage and displacement can alter local needs, while disasters such as floods expose weaknesses in drainage, settlement planning, warning systems, and asset maintenance. Water scarcity adds a structural constraint: UNDP describes Libya as a highly water-stressed country and emphasizes integrated water-resources management, climate-informed governance, infrastructure management, and community empowerment as central to water security [2].

The 2023 flood assessment also illustrates the concentration problem. Although the assessment covered 20 municipalities, 85% of reported damages and losses occurred in five of the most affected cities [1]. A national strategy therefore needs both common standards and area-based prioritization. It should provide a national platform for data, finance, safeguards, and technical standards while allowing municipalities to adapt sequencing to local exposure, population needs, service gaps, and institutional readiness.

The core policy problem can be expressed as a mismatch between project delivery and public value. A project may be completed physically yet fail to produce reliable services because it is poorly located, unaffordable to operate, disconnected from networks, or not accepted by users. Sustainable reconstruction therefore requires a shift from counting outputs—roads, schools, clinics, networks—to evaluating whether assets remain functional, accessible, safe, affordable, and maintained over time.

3. Conceptual Framework

The proposed framework combines four complementary perspectives. First, multi-level governance recognizes that reconstruction decisions are distributed across national institutions, municipalities, communities, development partners, contractors, and service providers. Second, project-cycle management links needs assessment, prioritization, design, procurement, construction, commissioning, operation, maintenance, and evaluation. Third, integrated appraisal evaluates economic, social, environmental, institutional, and climate dimensions together rather than treating them as separate compliance exercises. Fourth, institutional learning treats each project as a source of information for improving standards, procurement, risk registers, maintenance systems, and future investment decisions.

These perspectives are connected through seven elements. Context identifies hazards, institutional conditions, affected populations, and service deficits. Governance allocates roles, decision rights, coordination mechanisms, safeguards, and disclosure requirements. The project cycle converts priorities into prepared and deliverable investments. Integrated appraisal tests value, feasibility, equity, resilience, and lifecycle cost. Outputs are the physical and organizational deliverables. Development impact concerns service quality, livelihoods, safety, inclusion, and local economic recovery. Institutional sustainability concerns whether the responsible organizations can finance, operate, maintain, monitor, and learn from the assets.

4. Methodology

The paper adopts a descriptive-analytical and framework-development design. It synthesizes the Libya Rapid Damage and Needs Assessment, UNDP materials on local resilience and water security, and established principles of urban recovery and sustainable reconstruction. The analysis proceeds in four steps. First, it identifies the contextual risks that can undermine reconstruction results. Second, it maps the institutional and project-cycle functions required to manage those risks. Third, it develops an indicator matrix for prioritization, implementation, and monitoring. Fourth, it proposes a phased roadmap that can be tested through municipal pilots.

The method is deliberately non-empirical in its claims. No original survey, project database, causal model, or statistical impact evaluation is presented. The framework should therefore be treated as a structured policy proposition. Its validity depends on subsequent field testing, stakeholder review, data availability, and comparison across municipalities and sectors. This limitation is important because a credible reconstruction framework must distinguish between evidence about observed damage and recommendations about future governance and delivery.

5. A Sustainable Reconstruction Management Model

5.1 Multi-level governance and coordination

A national reconstruction platform should coordinate standards, financing, data, safeguards, and reporting without eliminating municipal ownership. Its minimum functions would include maintaining a national project registry; defining eligibility and prioritization criteria; publishing project status and financing information; coordinating international support; resolving inter-agency bottlenecks; and issuing common guidance for procurement, environmental and social risk, climate resilience, and operation and maintenance. Municipal reconstruction units should translate national principles into area-based investment plans through consultations with residents, utilities, service providers, professional associations, and civil-society organizations.

Local participation should be treated as a decision mechanism, not only as communication. UNDP's local-capacity work in Libya illustrates the value of municipal coordination mechanisms, community needs assessments, local consultations, and support for basic services, social cohesion, and vulnerable groups [3]. These practices can inform reconstruction planning by making priorities more transparent and by reducing the risk that technically attractive projects are disconnected from local needs.

5.2 Project-cycle management

The project cycle should begin with a service-and-risk diagnosis rather than a preselected construction project. Identification should document population exposure, service deficits, network dependencies, land and institutional constraints, and the responsible operating entity. Preparation should include options analysis, lifecycle costing, climate and disaster-risk screening, social inclusion, procurement strategy, and an operation-and-maintenance plan. Appraisal should compare projects within a portfolio so that scarce funds are directed toward the combination of urgency, service value, resilience, feasibility, and institutional readiness.

Procurement and implementation should use realistic schedules, transparent contract management, independent quality assurance, variation controls, and dispute-resolution mechanisms. Commissioning should verify not only physical completion but also staffing, equipment, utility connections, operating procedures, maintenance budgets, and user accessibility. Post-completion evaluation should examine whether the asset produces the intended service and whether lessons are recorded in the project registry.

5.3 Integrated assessment and prioritization

A reconstruction portfolio should avoid arbitrary prioritization based only on political visibility or the estimated cost of damage. A practical screening score can combine need, risk reduction, service impact, inclusion, climate resilience, lifecycle affordability, implementation readiness, and institutional sustainability. The score should support deliberation rather than replace judgment. Projects with high need but low readiness may enter a preparation pipeline, while projects with high readiness but weak service value should not automatically receive priority.

Dimension	Illustrative questions	Evidence or indicator
Need and equity	Who is affected and which essential services are unavailable?	Affected population; service gap; vulnerability profile; access by gender, disability and displacement status
Risk reduction	Will the project reduce exposure to floods, infrastructure failure or future disruption?	Hazard screening; design standard; redundancy; early-warning and emergency access
Service value	What durable service will the asset provide?	Users served; reliability; quality; affordability; network connectivity
Economic and fiscal viability	Can the project be financed and operated over its life?	Lifecycle cost; recurrent budget; procurement estimate; revenue or subsidy needs
Institutional readiness	Who will own, operate, maintain and monitor the asset?	Assigned institution; staffing; maintenance plan; data and reporting capacity
Environmental and social sustainability	What impacts and safeguards are required?	Environmental screening; resettlement risk; stakeholder plan; grievance mechanism
Implementation readiness	Can the project be delivered transparently and on time?	Land status; design maturity; procurement route; risk register; market capacity

6. Real-World Case Study: Derna After the September 2023 Floods

This section applies the proposed reconstruction framework to Derna using publicly available secondary evidence. It is a documentary case study, not an original field survey or causal impact evaluation. The purpose is to test whether the framework can organize a real reconstruction problem into actionable governance, project-cycle, resilience, and accountability decisions.

6.1 Event, exposure and human impact

On 10 September 2023, Storm Daniel affected northeastern Libya with torrential rain and flash floods. According to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), Derna was hit hardest after the burst of two dams released a destructive flood through the city centre. OCHA reports more than 5,923 deaths, approximately 44,862 people initially displaced, and thousands still missing. It estimated that 250,000 people were directly affected and required urgent assistance in shelter, health, water, sanitation and hygiene, food, non-food items, and education [4].

The human impact demonstrates why reconstruction cannot be reduced to replacing structures. Displacement, loss of livelihoods, interrupted education, trauma, and psychosocial needs affect the capacity of households to recover and the ability of institutions to plan. OCHA also identifies female-headed households, persons with disabilities, unaccompanied or separated children, migrants, asylum-seekers, and non-Libyans among groups requiring particular protection and support [4]. These conditions make inclusion and protection part of infrastructure governance rather than separate humanitarian concerns.

6.2 Damage, service disruption and reconstruction needs

The joint World Bank, European Union, and United Nations Rapid Damage and Needs Assessment (RDNA) estimated Libya's overall recovery and reconstruction needs after the floods at US$1.8 billion. It assessed damages at US$1.03 billion and losses at US$0.62 billion, with the combined total equivalent to 3.6% of Libya's 2022 GDP. More than 18,500 houses were damaged or destroyed, and approximately 70% of reconstruction costs were associated with infrastructure. The assessment covered 20 municipalities, while 85% of damages and losses were concentrated in five of the most affected cities, including Derna [1].

For the framework proposed in this paper, these findings imply four linked reconstruction tasks. The first is restoring safe and reliable services, especially housing, water, sanitation, transport, health, and education. The second is reducing future hazard exposure through dam safety, drainage, land-use planning, warning systems, and resilient design. The third is rebuilding institutional arrangements for coordination, procurement, operation, and maintenance. The fourth is protecting social legitimacy through transparent priorities, participation, grievance mechanisms, and equitable support to displaced and vulnerable groups.

Case evidence	Reconstruction implication	Framework response
Dam failure and flood passage through the city centre	Rebuilding in the same risk conditions could reproduce exposure.	Hazard screening, dam-risk governance, drainage standards, early warning, and safe land-use decisions.
Large-scale displacement and missing persons	Households require more than physical reconstruction.	Housing, protection, psychosocial support, livelihood recovery, and inclusive consultation.
Damage concentrated in a limited number of municipalities	A national programme needs geographic prioritization.	Area-based portfolios linked to common national standards and transparent criteria.
Damage to housing, transport, water and environmental assets	Assets are interdependent and require coordinated sequencing.	Network and service mapping, lifecycle appraisal, and integrated project-cycle management.
Fragmented institutional environment	Unclear roles can delay decisions and weaken accountability.	A national reconstruction platform, municipal focal points, public registry, and grievance channels.

6.3 Applying the project-cycle framework to Derna

At the identification stage, Derna requires a service-and-risk baseline that combines satellite and engineering assessments with municipal records, community reporting, and utility information. The baseline should distinguish destroyed assets from damaged but repairable assets and should identify dependencies among roads, bridges, water systems, electricity, health facilities, schools, housing, and emergency access. At the preparation stage, each major investment should include options analysis, a hazard and climate screen, lifecycle cost estimates, land and social safeguards, an operating institution, and a funded maintenance plan.

At the delivery stage, the case requires transparent procurement, independent quality assurance, contract disclosure, change-order control, and coordination among national institutions, the municipality, utilities, humanitarian actors, communities, and development partners. At commissioning, the test should be whether services can operate: a water facility needs power, staff, treatment capacity, network connections, operating finance, and a maintenance response system. At the learning stage, every project should document delays, design changes, complaints, safety incidents, and service outcomes so that reconstruction standards improve over time.

6.4 Case-based lessons for sustainable reconstruction

The Derna case supports the paper's central argument that reconstruction should be managed as an asset-and-service portfolio. A road, bridge, drainage channel, water facility, school, or housing programme has limited public value if its network connections, operating arrangements, or risk controls are absent. The case also shows that institutional capacity and public trust are delivery variables. The RDNA called for coordinated, inclusive, and resilient recovery and highlighted the need for a national reconstruction platform [1]. The case therefore provides a practical test of the proposed governance model rather than merely an illustration of disaster damage.

The analytical lesson is not that one city can represent all of Libya. Derna is a high-severity, high-visibility case with distinctive dam and flood risks. Its value lies in showing how the framework works when multiple risks interact: natural hazard, infrastructure failure, displacement, service disruption, institutional coordination, and social vulnerability. Other municipalities would require their own area-based assessments, while national standards should ensure comparability and accountability.

6.5 Case-study limitations

The case analysis is limited by the availability and consistency of public secondary data. Reported figures may be revised as identification, damage verification, and recovery assessments continue. The paper does not independently verify casualty numbers, engineering conditions, procurement performance, or household outcomes. It also does not attribute the disaster to a single cause. The case is used to demonstrate framework application and to identify governance and project-management requirements; field surveys, engineering investigations, and independent evaluations are needed for stronger conclusions.

7. Implementation Roadmap

A phased roadmap reduces the risk of announcing a large portfolio before institutions, data, designs, and maintenance arrangements are ready. The phases should overlap, but each phase has a distinct management purpose.

Phase	Main actions	Expected outputs
1. Establish and diagnose	Create national platform and municipal focal points; build project registry; map damage, service gaps, hazards, ownership and maintenance responsibilities.	Common data model; municipal profiles; initial priority pipeline; public information protocol.
2. Prepare and prioritize	Conduct options analysis; apply integrated screening; consult affected groups; prepare designs, safeguards, procurement and O&M plans.	Appraised project concepts; ranked portfolio; bankable preparation packages; disclosed decisions.
3. Deliver and safeguard	Procure transparently; supervise contracts; manage changes and claims; monitor quality, schedule, cost, safety and social risks.	Completed assets; auditable contracts; issue logs; safeguards and grievance records.
4. Operate and learn	Commission assets; fund maintenance; monitor service outcomes; evaluate equity and resilience; update standards and registry.	Functioning services; maintenance records; outcome reports; lessons for next investment cycle.

8. Monitoring, Accountability and Learning

Monitoring should combine implementation indicators with outcome indicators. Implementation indicators may include procurement duration, cost variance, schedule variance, payment timeliness, unresolved claims, change-order value, safety incidents, and grievance resolution. Outcome indicators should measure service availability, reliability, user access, operating cost, maintenance response time, disaster downtime, and satisfaction among affected groups. A project can be on schedule and still be failing if the intended service is inaccessible or unaffordable.

Transparency is a delivery instrument. A public project registry should disclose project purpose, location, responsible entity, financing source, procurement status, contractor, contract value, implementation progress, changes, completion status, and operating entity. Disclosure should be complemented by accessible grievance channels and periodic community reporting. Independent technical and social audits can focus on high-risk projects, while municipalities should retain a role in verifying service outcomes.

Learning requires structured review. At the end of each phase, responsible institutions should record what changed, why it changed, what risks materialized, how communities experienced the project, and what should be standardized or redesigned. This creates an institutional memory that is particularly important where staff turnover, fragmented mandates, and repeated emergencies can otherwise force institutions to restart the learning process.

9. Discussion

The framework has three implications. First, reconstruction governance should be portfolio-based. Individual projects are interdependent: a repaired water facility may not restore service without power, network connections, trained staff, and operating finance. Portfolio governance makes these dependencies visible and reduces duplication. Second, sustainability should be operational rather than rhetorical. Climate resilience, water security, social inclusion, and environmental protection must be translated into design requirements, appraisal criteria, budgets, and monitoring indicators. Third, municipal capacity is an investment outcome in its own right. A technically sound asset may not be sustainable if the operating institution cannot manage procurement, staffing, data, maintenance, and user engagement.

The framework also offers a way to connect emergency recovery with long-term development. The RDNA's call for coordinated, inclusive, and resilient recovery is consistent with a national platform that combines common standards with area-based municipal planning [1]. UNDP's work on local resilience and water security further suggests that recovery should strengthen local coordination, climate-informed governance, infrastructure management, and community participation [2, 3]. The proposed model turns these principles into a sequence of decisions that can be monitored and revised.

10. Limitations and Conclusion

This paper has limitations. It is a conceptual and policy-oriented study rather than an empirical evaluation. It does not estimate the causal effect of a reconstruction intervention, compare municipal performance statistically, or validate the proposed indicators against a project database. The recommendations also require adaptation to Libya's legal, political, financial, and regional conditions. Future research should develop a municipal project dataset, test the prioritization matrix with stakeholders, estimate lifecycle costs, assess institutional readiness, and evaluate whether transparency and participation improve project outcomes.

Sustainable reconstruction in Libya should be understood as the management of an asset-and-service portfolio under conditions of institutional, political, environmental, and fiscal uncertainty. The central recommendation is to connect national coordination with municipal ownership, project selection with integrated appraisal, construction with operation and maintenance, and physical outputs with measurable service and development outcomes. A national project registry, transparent financing and grievance systems, climate- and water-sensitive design, and phased municipal pilots can provide the practical foundation. The framework is not a substitute for field evidence; it is a structured starting point for generating that evidence and for improving the probability that reconstruction investments become durable public value.

Compliance with ethical standards

This is a conceptual, policy-oriented study based on publicly available secondary sources. It did not involve human participants, personal data, or animal subjects; therefore, no ethics approval was required.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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