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The Application of Total Quality Management (TQM) Approaches to Disaster Risk Reduction and Recovery in Nigeria

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Abstract
Nigeria has lived with floods, erosion, drought, pollution and conflict-driven displacement for decades, yet the performance of its disaster programmes is still judged more by activity than by the reliability of results. This article asks whether the principles and tools of Total Quality Management (TQM) can make disaster risk reduction (DRR) and recovery more dependable. Using a structured narrative review of the quality-management and disaster-management literatures, together with a descriptive analysis of figures published by the National Emergency Management Agency (NEMA) for the 2022, 2024 and 2025 flood seasons, we map eight TQM principles onto the disaster cycle, derive a Plan–Do–Check–Act (PDCA) framework for Nigerian agencies, and identify six institutional barriers to adoption. Three findings stand out. First, official casualty and displacement totals moved by a factor of several within weeks of the 2022 floods, and figures attributed to NEMA for 2024 differ markedly by source, which points to a weak measurement system. Second, forecasts and warnings were issued, but action at the last mile and the operation of dams did not follow the same discipline. Third, the barriers are largely managerial rather than technical. We propose a five-level maturity ladder for self-assessment and six testable propositions. The study is conceptual and relies on secondary data; it offers a structure for empirical work rather than a final verdict. The implications reach federal and state emergency agencies, dam operators and industry–community partnerships in the Niger Delta.

Keywords: Total Quality Management, Disaster Risk Reduction, Disaster Recovery, PDCA, Data Quality, Flood Management, Nigeria, Sendai Framework

1. Introduction

A flood is a natural event, but a disaster is a social one. What turns rising water into a catastrophe is the gap between what institutions promise and what they reliably deliver when the river breaches its banks. In Nigeria that gap has been visible for years. The 2012 floods, which the Government of Nigeria assessed in a post-disaster needs assessment, affected large parts of the federation and exposed weaknesses in preparedness, coordination and recovery financing (Federal Republic of Nigeria, 2013) [8]. A decade later the 2022 floods were again described as the worst in years, and in 2024 the failure of the Alau Dam left much of Maiduguri under water (NEMA, 2024) [15]. In May 2025 a flash flood devastated Mokwa in Niger State after earlier dam-linked flooding in the same area (Al Jazeera, 2025; EnviroNews Nigeria, 2026) [2, 7].

Global policy has been clear about what should happen. The Sendai Framework for Disaster Risk Reduction 2015–2030 calls on states to understand disaster risk, strengthen governance, invest in resilience and improve preparedness so that recovery can "build back better" (United Nations Office for Disaster Risk Reduction [UNDRR], 2015) [23]. Yet delivering these priorities is a management task as much as a technical one. It requires clear processes, dependable data, trained people, listening to affected communities and the habit of learning from each event. Those are precisely the concerns of quality management.

Total Quality Management, associated with Deming (1986) [6] and Juran (1988) [12], treats quality as the responsibility of the whole organisation and builds it on a small set of ideas: focus on the customer, leadership, engaged people, process thinking,

decisions based on evidence and continual improvement. The approach has been studied extensively in manufacturing and services (Hackman & Wageman, 1995; Sousa & Voss, 2002) [10, 19], and its principles are embedded in the ISO 9001 family of standards (International Organization for Standardization [ISO], 2015) [11]. Its use in public disaster governance in Sub-Saharan Africa has received far less attention, and in Nigeria it has hardly been examined as a coherent framework.

This article addresses that gap. It is guided by three questions. **RQ1:** How do TQM principles correspond to the functions of disaster risk reduction and recovery? **RQ2:** What does recent NEMA-attributed evidence suggest about the quality of disaster information and processes in Nigeria? **RQ3:** What barriers limit the adoption of quality approaches, and what practical framework can agencies use to overcome them?

The paper makes three contributions. It offers a systematic mapping of TQM principles to the disaster cycle in a Nigerian setting. It brings together publicly reported NEMA figures to show, for the first time in one place, how unstable official loss statistics have been. And it proposes a practical PDCA framework and maturity ladder that agencies can use without waiting for new legislation. The remainder of the article is organised as follows: Section 2 reviews the conceptual background; Section 3 describes the method; Section 4 outlines the Nigerian context; Sections 5 to 9 present the mapping, framework, barriers, evidence and maturity ladder; Section 10 states propositions; and Sections 11 to 14 discuss implications, limitations and conclusions.

2. Conceptual and literature background

2.1 Disaster risk, vulnerability and resilience

Modern disaster scholarship sees risk as the product of hazard, exposure and vulnerability, and it locates vulnerability in the social, economic and political conditions that shape who is exposed and who can recover (Wisner *et al*., 2004; Adger, 2006) [24, 1]. Resilience is the complementary idea: the ability of a community or system to absorb shocks and bounce forward. Cutter *et al*. (2008) [3] describe community resilience as emerging from interacting ecological, social, institutional, infrastructural and community capacities, and they stress that these capacities can be assessed and improved. Good-practice guidance likewise argues that DRR belongs inside development planning and not beside it (Twigg, 2015) [22]. For a country like Nigeria, where poverty, rapid urbanisation, land-use change and weak enforcement of building and drainage rules compound natural hazards, this integrated view is essential.

2.2 Total Quality Management: principles and evidence

TQM grew out of the work of Deming, Juran and others who argued that most failures come from the system rather than from individual workers. Deming (1986) [6] emphasised understanding variation, profound knowledge of systems and constancy of purpose; Juran (1988) [12] framed quality as planning, control and improvement. Oakland (2014) [16] synthesises these into a practical set of principles that include customer focus, leadership, involvement of people, process management, continuous improvement and decisions based on fact. The seven principles of ISO 9001:2015 (customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision-making and relationship management) are a widely recognised statement of the same logic (ISO, 2015) [11].

Empirical reviews are cautious but supportive. Hackman and Wageman (1995) [10] argued that TQM works when its core practices are adopted with genuine leadership commitment and not as slogans, and Sousa and Voss (2002) [19] noted that the value of quality practices depends on context and on how well they fit the organisation. This matters for the present study. It suggests that TQM should be treated as a management discipline to be adapted for disaster agencies, not as a checklist to be imported.

2.3 Quality thinking in humanitarian and disaster work

Humanitarian practice already contains a strong quality tradition. The Sphere Handbook sets minimum standards for water, sanitation, shelter, food security and health in emergencies, and it links them to a humanitarian charter and to principles of accountability (Sphere Association, 2018) [20]. Moe and Pathranarakul (2006) [14] went further by arguing that disaster management can be understood as a chain of public projects whose success depends on critical factors such as stakeholder coordination, planning and monitoring. What is less developed is the step of connecting these strands with an organisation-wide quality system that can be audited and improved. The present article takes that step for Nigeria.

2.4 Research gap

Existing work has examined disaster vulnerability in Nigeria, the performance of individual programmes and the general merits of quality management, but few studies join the three. In particular, we found little evidence of studies that treat the reliability of disaster information as a quality problem, or that use the Plan–Do–Check–Act logic to diagnose why timely warnings do not always translate into protective action. The following sections attempt to fill that gap conceptually and to indicate how it might be tested empirically.

3. Methodology

3.1 Design

The study is a conceptual paper based on a structured narrative review supported by a descriptive secondary-data analysis. The review follows the logic of evidence-informed management reviews (Tranfield *et al*., 2003) [21]: defining questions, searching purposively, screening for relevance and synthesising themes. A narrative approach was chosen because the literature that links TQM to disaster governance in Nigeria is thin and heterogeneous, which makes a pooled quantitative synthesis inappropriate.

3.2 Sources and search

Two evidence streams were used. The first consisted of scholarly and standards documents on quality management, disaster risk and resilience, identified through Scopus, Web of Science and Google Scholar and through the repositories of UNDRR and the World Bank. The second consisted of publicly available reports and statements attributed to NEMA, government ministries and reputable news and humanitarian outlets concerning floods in 2022, 2024 and 2025, including the NEMA flood dashboard for 2024. Where figures were reported at several dates or by several sources, all versions were recorded so that their consistency could be examined.

3.3 Analysis

Literature was analysed thematically to map TQM principles to disaster-cycle phases, and the resulting mapping was checked against the Sendai priorities. The flood data were analysed descriptively by tracking how reported totals changed over time and how they differed between sources. Because most figures come from media reports that quote officials, they are treated as indicative and not as verified statistics. No inferential testing was attempted. The interpretation of patterns through the lens of PDCA and data quality is the authors' own and is offered as a proposition for testing.

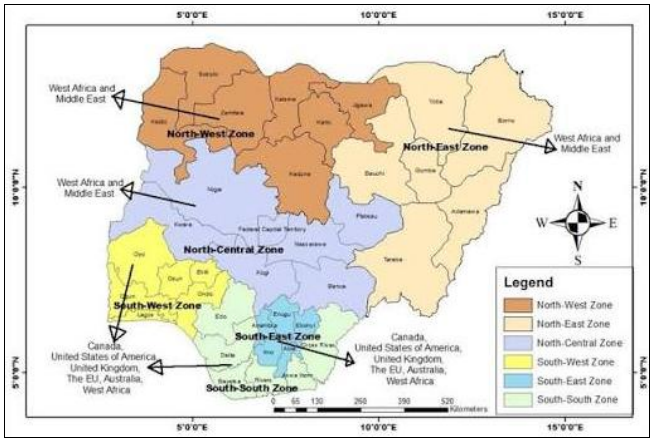
3.4 Trustworthiness

To limit bias, every figure in the evidence section is traceable to a named source, discrepancies are shown and not smoothed, and claims about causes are framed as consistent with the evidence rather than proven by it. Readers should nevertheless treat the study as exploratory. A primary-data phase, described in Section 13, would strengthen it considerably.

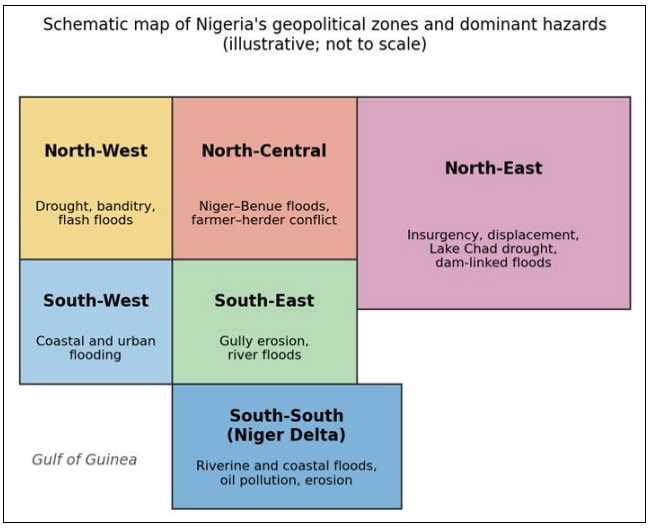
4. The Nigerian disaster context

4.1 Hazards and their geography

Nigeria's hazards follow its geography. River flooding tracks the Niger and Benue basins and the delta; coastal flooding, erosion and oil-related pollution concentrate in the South-South; gully erosion is a serious problem in parts of the South-East; drought and desertification press on the far North; and armed conflict has produced long-running displacement in the North-East. Urban flash flooding is a growing risk in cities across all zones. Fig 1 is a schematic orientation to these patterns. It draws on the general literature cited above and is not a cartographic product.



Nigeria's Map showing the six Geopolitical Zones (Olu-Adeyemi Lanre; 2017)



Note. Author's schematic synthesis based on hazard descriptions in the literature cited in Sections 1 and 4.

Fig 1: Schematic map of Nigeria's six geopolitical zones and their dominant hazards (illustrative; not to scale)

4.2 The institutional landscape

Disaster governance in Nigeria involves several bodies with distinct roles. NEMA coordinates national emergency management, works with state emergency management agencies (SEMAs) and local authorities, and publishes situation reports and flood outlooks. Forecasting depends on the Nigerian Meteorological Agency (NiMet) and the Nigeria Hydrological Services Agency (NIHSA), and NEMA has said it works with both to translate forecasts into impact-based warnings ("Flood kills 300," 2022) [9]. At the federal level a ministry responsible for humanitarian affairs and disaster management oversees policy, and in 2022 it convened stakeholders around a National Flood Emergency Preparedness and Response Plan (Leadership, 2022) [13]. States, local governments, traditional institutions, civil society and, in the Niger Delta, oil and gas operators all play additional roles.

This is a plural system, and plural systems need reliable interfaces. Quality management is fundamentally about interfaces: who hands what to whom, in what form, by when and with what check. That is why it is a natural lens for the coordination problems that recur in Nigerian disaster reports.

5. Mapping TQM principles to the disaster cycle

Table 1 answers RQ1. Each principle is paired with the phase where it does most work, a concrete Nigerian application and an example indicator. The indicators are illustrative and should be adapted by each agency.

Table 1: TQM principles mapped to DRR and recovery functions

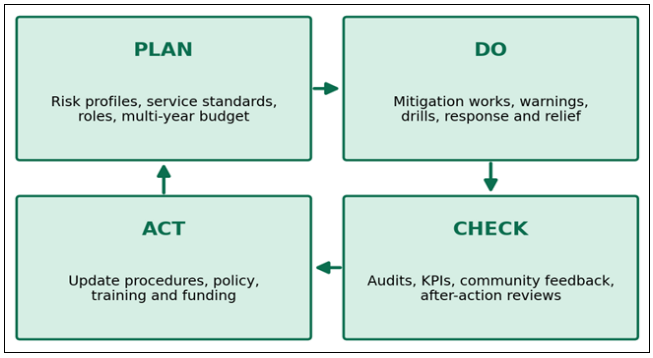
TQM principle	Disaster phase	Application in Nigeria	Example indicator
Customer (community) focus	Preparedness, response	Community-validated early-warning messages in local languages and through trusted channels	% of at-risk households receiving a warning before onset
Leadership	Mitigation	State governors and heads of NEMA/SEMAs own annual risk-reduction targets and publish progress	Budget released versus approved for DRR
Engagement of people	All phases	Training and drills for volunteers, traditional leaders and first responders	Drill completion and competency scores
Process approach	Response	Standard operating procedures for relief targeting, camp management and logistics	Time from alert to first delivery
Evidence-based decisions	Mitigation, recovery	Hazard mapping and a single verified damage database feeding budgets	Share of decisions referencing recorded data
Continual improvement	Recovery	After-action reviews after every flood season, with tracked corrective actions	Corrective actions closed by deadline
Relationship management	Recovery	Defined roles for government, oil operators, NGOs and host communities	Duplication rate of relief interventions
Systems thinking (Deming)	Mitigation, recovery	Linking land use, drainage, dam operation and housing standards to disaster plans	Compliance with drainage and building codes

Note. Author's synthesis drawing on Deming (1986) [6], ISO (2015) [11], Oakland (2014) [16] and UNDRR (2015) [23].

Two observations follow. First, several principles appear in more than one phase, which reflects the fact that quality is a property of the whole system. Second, the mapping shows that many Sendai priorities can be expressed as quality requirements. "Strengthening governance" is largely a matter of leadership and process clarity; "investing in resilience" depends on evidence-based decisions; and "build back better" is impossible without continual improvement and learning.

6. A PDCA framework for Nigerian agencies

The Plan–Do–Check–Act cycle, popularised by Deming, is deliberately simple. Its strength in this context is that it can be applied by a federal agency, a state emergency office or a local committee without new legislation. Fig 2 shows how we adapt it.



Note. Author's conceptual synthesis.

Fig 2: A PDCA framework for disaster risk reduction and recovery quality management

Plan. Agencies define hazard and vulnerability profiles, set service standards (for example, warning lead-times and time to first relief), assign accountable owners and secure multi-year budgets. **Do.** They carry out mitigation works, issue warnings, run drills and deliver relief according to documented procedures. **Check.** They measure results against the standards, audit critical assets such as dams and drainage, gather feedback from affected people and hold after-action reviews. **Act.** They correct procedures, retrain staff, adjust budgets and update plans, and then begin the next cycle with what they have learned.

The framework asks for nothing exotic. What it demands is discipline: writing down the standard, measuring against it and closing the loop. As Section 8 will show, it is often the Check and Act stages that appear weakest in Nigerian disaster experience.

7. Barriers to adoption

Table 2 addresses the first part of RQ3. The barriers are drawn from the literature and from patterns in the official statements and reports reviewed. They are proposals for testing, not established findings.

Table 2: Barriers to quality management in disaster governance and proposed responses

Barrier	How it appears	TQM-based response
Fragmented mandates	Overlap among federal, state and local bodies; unclear hand-offs	Process mapping and a single accountable owner for each service
Weak data systems	Late, inconsistent or un-versioned loss reporting	Standard definitions, a single data owner, dated revisions and periodic data audit
Funding volatility	Reactive release of funds after events	Multi-year, indicator-linked DRR budgets
Limited skills	Few trained quality, risk and audit professionals	Competency frameworks; partnerships with certified auditors and universities
Short political cycles	Programmes discontinued with changes of leadership	Institutionalise processes through standards and law, not personalities
Trust deficit	Communities doubt the fairness of relief	Transparent targeting, published criteria and accessible complaint channels

Note. Author's synthesis.

None of these barriers is uniquely Nigerian, but their combination is potent. A fragmented mandate makes accountability diffuse; weak data hides the problem; volatile funding prevents long-term fixes; and a trust deficit reduces the willingness of communities to heed warnings or evacuate. Quality management is not a cure for all of this, but it supplies tools such as process maps, control charts, audits and corrective-action registers that make each problem visible and manageable.

8. Evidence from NEMA-attributed records, 2022–2025

To ground the framework, we compiled figures published by NEMA and cited in official statements, humanitarian updates and press reports (Table 3). The compilation is descriptive and secondary and should not be read as a census of losses.

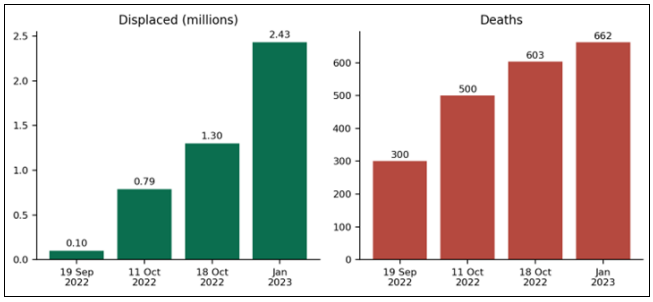
Table 3: Selected NEMA-attributed flood figures, 2022–2025

Event and date of report	Reported figures	Source
2022 national floods (19 Sep 2022)	More than 300 deaths, 500 injured and 100,000 displaced; 29 states including the FCT	Vanguard (2022)
2022 national floods (11–12 Oct 2022)	About 500 deaths; 790,254 displaced; 1.4 million affected	Davies (2022) [5]
2022 national floods (18 Oct 2022)	603 deaths; about 1.3 million displaced; over 2.5 million affected; 82,053 houses destroyed	ReliefWeb (2022) [18]; Leadership (2022) [13]
2022 national floods (later NEMA statement)	662 deaths; 3,174 injured; 2,430,445 displaced	Daily Trust (2023) [4]
Maiduguri / Alau Dam, Borno (Sep 2024)	414,176 affected; 389,267 displaced; 7,155 houses damaged across nine LGAs	NEMA (2024) [15]
2024 national season	More than 1,200 deaths and 1.2 million displaced in 31 states (as cited); a separate summary of NEMA's annual report cites more than 300 deaths and 1.3 million affected in 33 states	Al Jazeera (2025) [2]; PRNigeria (2025) [17]
Mokwa, Niger State (May 2025)	At least 150 killed in early reports; 3,534 displaced according to NEMA; later tallies were higher and remain to be reconciled; earlier dam-linked flooding in April 2025	Al Jazeera (2025) [2]; EnviroNews Nigeria (2026) [7]

Note. Figures are as reported at the dates shown and are not adjusted. Several sources are press reports quoting officials.

8.1 Finding 1: The measurement system drifts

The 2022 season shows how quickly the official picture moved. Displacement totals grew from about 100,000 in mid-September to more than 2.4 million in a later NEMA statement, and deaths rose from about 300 to 662 (Fig 3). Some growth is expected as assessments reach remote areas, and the floods themselves continued to unfold. Even so, the scale of change suggests that the reporting process lacked fixed definitions (for example, "displaced" versus "affected"), stable reporting cut-offs and a single verified database. In Deming's terms, decisions were being made on a moving and loosely specified measure.

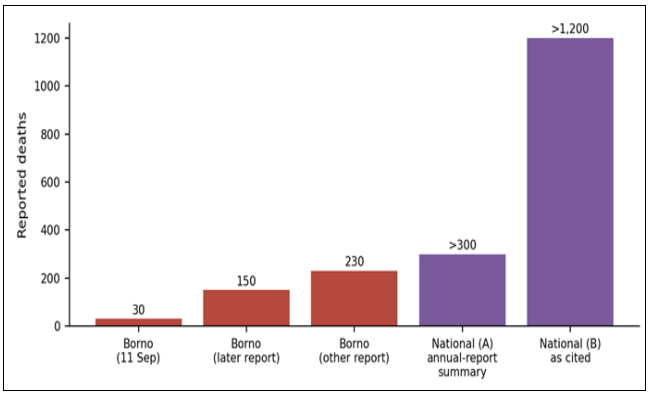


Note. Data from Table 3. Death figures for 19 Sep, 11 Oct, 18 Oct and January 2023 are 300 ("more than"), about 500, 603 and 662.

Fig 3: Successive official totals for the 2022 floods

8.2 Finding 2: Figures for the same season diverge by source

For 2024, sources that attribute figures to NEMA differ widely on national mortality (more than 300 versus more than 1,200), and Borno deaths appear as 30, 150 and 230 depending on the date and the reporter (Fig 4). We do not attempt to adjudicate which is correct. The point is that no single, authoritative and versioned dataset was evident to the public, so readers, planners and donors are left to choose among numbers. A quality approach would require one data owner, published definitions, dated revisions and a reconciliation process.



Note. National (A): summary of NEMA annual report (PRNigeria, 2025) [17]. National (B): as cited by Al Jazeera (2025) [2]. Borno figures are from reports of the Alau Dam collapse and are shown to illustrate divergence, not to establish a true count.

Fig 4: Divergent reported deaths for the 2024 floods

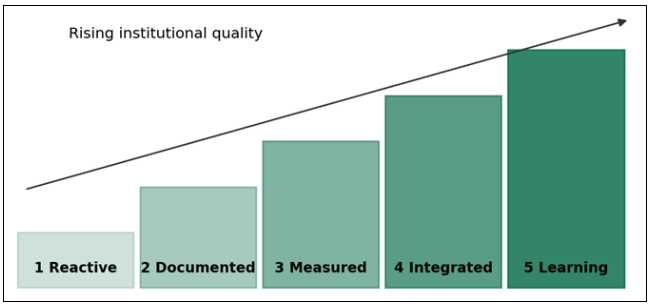
8.3 Finding 3: Warning existed, but process control failed downstream

In 2022 the responsible minister stated that there had been enough warning and information but that states, local governments and communities had not acted on it (Leadership, 2022) [13]. In 2025 NEMA issued advance warnings that named Niger State among 30 states at high flood risk, yet Mokwa still suffered a deadly flash flood weeks after a previous dam-linked event, one of at least six flooding episodes linked to water released from the Jebba dam (EnviroNews Nigeria, 2026) [7]. The Alau Dam collapse in Borno likewise followed inflows that exceeded capacity (NEMA, 2024) [15]. These cases point to weaknesses in the Do and Check stages of PDCA: last-mile action, dam-operation protocols and structural inspection, rather than in forecasting alone.

This interpretation should be held with care. Press reports simplify complicated causal chains, and the contributions of rainfall extremes, land-use change, dam management and governance cannot be separated on this evidence. What can be said is that a quality lens directs attention to the parts of the system that fail silently: hand-offs, inspection and follow-through.

9. A maturity ladder for self-assessment

Agencies often ask where to start. Fig 5 offers a five-level ladder that can serve as a common vocabulary for planning conversations. The levels are ordinal descriptions, not quantitative scores.



Note. Author's synthesis.

Fig 5: Conceptual maturity ladder for quality management in disaster agencies

Table 4: Description of maturity levels

Level	Description	Typical evidence
1 Reactive	Action follows events; procedures are informal	No standard reporting definitions; ad hoc coordination
2 Documented	Procedures and roles are written down	Approved SOPs; contingency plans exist on paper
3 Measured	Performance is tracked against standards	KPI dashboard; dated, versioned loss data
4 Integrated	Processes are linked across agencies and sectors	Joint drills; shared databases; audited hand-offs
5 Learning	Continuous improvement and external benchmarking	Closed corrective actions; peer review; published lessons

Note. Author's synthesis.

An agency can use the ladder by scoring itself honestly on each of the eight principles in Table 1, identifying its weakest principle and choosing one or two improvements for the next flood season. The purpose is progress, not ranking.

10. Propositions for empirical testing

The analysis yields six propositions that future research can test through surveys, case studies and administrative data.

- **P1.** Agencies that adopt standard data definitions and a single data owner will show smaller revisions in reported loss figures within a season.
- **P2.** Documented and audited procedures linking early warning to local action will increase the share of at-risk households that act on warnings.
- **P3.** Visible leadership commitment and multi-year funding will be positively associated with higher maturity levels.
- **P4.** Clear relationship management among government, operators and NGOs will reduce duplication and gaps in relief.
- **P5.** Independent audit of dam-operation and inspection protocols will reduce the recurrence of downstream flooding episodes.
- **P6.** Formal community feedback mechanisms will improve perceived fairness of relief targeting and trust in warnings.

11. Discussion

The analysis suggests that many of the failures seen in Nigerian floods are failures of management systems more than of science. Forecasts, risk maps and plans exist. What is less consistent is the reliability with which they are turned into action and checked afterwards. This is a familiar pattern in quality management, where the gap between a documented process and a practised one is often the greatest source of loss.

The finding on data deserves emphasis. Numbers steer decisions: they determine how much relief is pre-positioned, which communities are prioritised and how donors judge need. When the same season can be described with figures that differ by a factor of two or more, the decision system is working with a blurred picture. This is not a criticism of the individuals who compile the data under pressure; it is a reminder that measurement systems need design, ownership and audit like any other process.

The results are consistent with the broader literature that treats TQM as a discipline of leadership and systems, not a set of tools (Hackman & Wageman, 1995; Oakland, 2014) [10, 16]. They also complement humanitarian standards such as Sphere (2018) [20], which define what good looks like at the point of delivery, by supplying the organisational machinery that keeps delivery consistent. Finally, they sit comfortably with the resilience literature: Cutter *et al.* (2008) [3] treat institutional capacity as a core component of resilience, and quality management is one practical way to build it.

For the Niger Delta, where oil and gas operators and communities share hazards, a quality vocabulary offers something unusually useful: a common language. Operators already run management systems built on ISO standards. Extending the same discipline, through joint drills, shared incident learning and audited hand-offs, to community-facing preparedness could improve outcomes without creating a separate bureaucracy.

12. Practical implications

The following recommendations are offered to agencies and partners. They are deliberately modest so that they can start within one budget cycle.

- **Create one authoritative disaster-loss dataset:** Publish definitions for "affected", "displaced", "injured" and "dead or missing"; assign a data owner; date and version every release; and reconcile figures across federal and state sources.
- **Standardise the warning-to-action chain:** Write down who acts at each level when a warning is issued, what they must do, by when and how completion is confirmed. Test it in drills before the rains.
- **Audit critical assets:** Subject dams, embankments and drainage to scheduled independent inspection, with published findings and time-bound corrective actions.
- **Institutionalise after-action learning:** Hold a structured review after every season and track corrective actions to closure in a public register.
- **Build quality capacity:** Train emergency-management staff in basic quality tools and partner with certified auditors, universities and industry HSE professionals.
- **Listen to communities:** Provide accessible feedback and complaint channels for relief and recovery, and report what changed as a result.

13. Limitations and future research

This study has several limitations. It is conceptual and relies on secondary sources, many of which are press reports quoting officials. Its literature base, although suitable for a framework paper, is narrower than a full systematic review

would provide. The maturity ladder and propositions have not yet been tested, and the data analysis is descriptive. The interpretation of causes in individual events is necessarily tentative.

Future work should therefore proceed on three fronts. A protocol-registered systematic review would broaden the evidence on quality management in disaster settings. A mixed-methods field study, combining a survey of staff in NEMA, SEMAs and local committees with interviews and a Delphi consensus exercise, would test the propositions and validate the maturity ladder. Finally, case studies of a single flood season, tracing information and decisions from forecast to delivery, would show exactly where the PDCA loop breaks and how it can be repaired. Primary NEMA situation reports and annual reports should replace secondary citations in all such work.

14. Conclusion

Every flood season in Nigeria tests the distance between intention and delivery. The evidence assembled here suggests that this distance is often shaped less by the weather than by ordinary management questions: whether the numbers agree, whether the warning reaches the last household, whether the dam is inspected, whether anyone checks what worked and changes what did not. These are quality questions, and quality management has a long record of answering them in other fields.

The paper has shown how eight TQM principles line up with the disaster cycle, how a simple PDCA loop can organise agency effort, why six barriers stand in the way, and how a five-level ladder can help institutions decide where to begin. It has also drawn attention to a problem that is easy to overlook because it is so common: official disaster figures that shift and diverge, and thereby weaken the decisions built on them.

None of this requires a new agency or a new law. It requires leaders who treat reliability as a public duty, staff who are trained and trusted to measure honestly, and communities who are heard when they say that a warning did not reach them or that relief missed them. If Nigeria's disaster institutions can build that habit, one flood season at a time, then each event becomes not only a loss to be mourned but a lesson that is actually learned. That, in the end, is what quality means in a disaster: fewer surprises, fewer preventable deaths and a recovery that leaves people safer than it found them.

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