REPORT ON
TELECOM TECHNOLOGY DEVELOPMENT FUND

Third Party Assessment

DR PAWAN K. TANEJA

Executive Summary

1. Purpose and Scope of the Assessment

This Third Party Assessment evaluates the design, implementation, portfolio structure, governance mechanisms, and emerging outcomes of the Telecom Technology Development Fund (TTDF). The assessment draws upon:

- Detailed document and scheme review
- Portfolio-level data analysis (136 approved projects)
- Field visits and stakeholder consultations (industry, academia, PEC members, DoT, C-DOT, TCoE)
- Project Performance Survey analysis
- Comparative benchmarking with global telecom innovation funding systems
- Comparative review of selected Indian innovation schemes

The Assessment aims to assess TTDF's relevance, effectiveness, efficiency, coherence, and strategic alignment, and to provide forward-looking recommendations for strengthening the scheme in subsequent phases.

2. Portfolio Overview and Ecosystem Composition

As of the review period, TTDF has approved 136 projects, with a strong concentration in advanced and frontier telecom domains, particularly the 6G ecosystem (74% of approved projects).

Key structural characteristics:

- 67.65% of projects are academia-led, reflecting strong research depth.
- Industry- and startup-led projects remain a minority.
- 64% of projects involve multi-institutional collaboration.
- Portfolio funding is heavily concentrated in long-horizon research windows.
- Application-oriented pilots (e.g., Samriddh Gram) represent a smaller but strategically important sub-segment.

The portfolio reflects a research-intensive, upstream technology development orientation, with relatively limited embedded commercialisation pathways.

3. Knowledge Outputs and Innovation Signals

TTDF has generated significant early innovation outputs:

- 26 patent entries (filed, under review, published, or granted)
- 48 peer-reviewed publications
- Emerging contributions relevant to Open RAN, 6G architectures, optical systems, AI/ML in networks, quantum security
- Initial engagement with national and international standards ecosystems

These outputs confirm that TTDF is functioning effectively as a technology capability-building instrument, particularly in frontier domains.

4. Survey Findings: Objective-Level Performance

The Project Performance Survey indicates:

Strong performance in:

- Indigenous technology ownership and IP creation
- Academia–industry–startup collaboration
- Early- and mid-stage TRL progression

Moderate performance in:

- Import substitution potential
- Deployment readiness
- Affordability orientation

Limited performance in:

- Full commercialisation
- Export realisation
- International standards participation
- Manufacturing scale-up

The survey confirms that TTDF effectively de-risks upstream innovation but faces constraints in downstream transition.

5. Stakeholder Consultation and Field Visit Insights

Field interactions reveal that TTDF has had strategic additionality, particularly for industry-led projects. Several industry participants noted that without TTDF funding, they would not have been able to pursue high-risk, strategically important telecom technologies critical to India's global positioning.

However, key operational challenges were identified:

- Delays in grant disbursement
- Rigid budget reallocation processes
- Certification and testing bottlenecks
- Limited operator participation
- Weak pilot-to-procurement pathways
- Perceived complexity in evaluation and PEC functioning
- GFR constraints affecting startup funding and IP structuring

Stakeholders consistently emphasised the need for stronger downstream integration without diluting TTDF's R&D focus.

6. Comparative Benchmarking Findings

Benchmarking against telecom innovation systems in:

- **United States (mission-driven, procurement-linked model)**
- **European Union (standards-led, market-shaping model)**
- **South Korea (operator-anchored commercialisation model)**

reveals that successful telecom innovation funding systems integrate:

- R&D grants
- Live testbeds
- Operator engagement
- Procurement pathways
- Standards leadership
- Stage-gated funding logic

TTDF compares favourably in early-stage risk absorption and inclusivity but exhibits structural gaps in:

- Procurement linkage
- Commercialisation scaffolding
- Operator anchoring
- Standards incentives
- Scale-up instruments

Comparative insights from Indian schemes (SISFS, NIDHI-SSS, iDEX) reinforce similar lessons regarding stage-based funding, mentoring, and demand anchoring.

7. Key Scheme-Level Observations

The Assessment identifies seven systemic observations:

1. TTDF is structurally strong in early- and mid-stage innovation.
2. Portfolio composition is heavily skewed towards academia and frontier research.
3. Governance architecture is comprehensive but increasingly complex.
4. Commercialisation and manufacturing risks remain external to the scheme.
5. Collaboration is strong; operator participation is limited.
6. Rural deployment intent is strong but field evidence remains limited.
7. Project-level monitoring is robust; scheme-level outcome visibility is weak.

These findings indicate that TTDF is succeeding in building technical capability but must evolve to enhance deployment sensitivity and market linkage.

8. Strategic Reform Directions

The consolidated recommendations focus on five reform pillars:

A. Design and Strategic Architecture

- Segment-specific evaluation based on applicant type and funding size
- Explicit TRL segmentation (TRL 2–4 early; TRL 5–7 late stage)
- Product-focused orientation for TRL 5+ projects
- Mandatory field pilots and certification prior to final disbursement

B. Funding Instruments and Financial Architecture

- 100% grants for early-stage projects (defined ceiling)
- Increased co-funding beyond 25% for later-stage projects
- Recoverable grant models for commercially viable outputs
- Exploration of equity participation via Section-8 company vehicle
- Structured benefit-sharing frameworks

C. Ecosystem and Engagement

- Commercialisation Facilitation Cell
- VC/PE and investor engagement events
- Matchmaking with PSUs and user ministries
- Pre-approved testing and certification networks
- Stronger operator anchoring in national priority projects

D. Governance and Safeguards

- Project-specific dedicated bank accounts
- Monitoring of self-funding commitments
- Swim-lane evaluation architecture
- Rotational BAEC for commercial tracks
- Dynamic performance-based project segmentation

E. Measurement and Adaptive Governance

- Time-to-TRL movement as KPI
- Tracking patents, standards contributions, IP revenue
- Multi-dimensional evaluation dashboard
- Structured “lessons learned” repository
- Mandatory third-party evaluation every 2–3 years

9. Reframing Evaluation Philosophy

A central theme of the assessment is the need to evaluate TTDF as an R&D-centric public innovation instrument, not as a short-term commercial subsidy.

Key principles:

- Technical risk is intrinsic to frontier innovation.
- Failure of an idea within structured R&D does not indicate scheme failure.
- Financial metrics alone are insufficient to evaluate innovation programmes.
- Evaluation must balance fiduciary accountability with innovation sensitivity.
- Institutional learning is itself a scheme-level outcome.

This reframing ensures that TTDF continues to encourage ambitious research while maintaining public finance discipline.

10. Strategic Way Forward

The next phase of TTDF should focus on:

Short Term (0–12 months):

- Improve disbursement agility
- Formalise testbed access
- Introduce outcome dashboards

Medium Term (1–3 years):

- Launch differentiated funding tracks
- Institutionalise certification support
- Deepen operator and PSU engagement
- Introduce co-funding and recoverable grant instruments

Long Term (3+ years):

- Position TTDF as the innovation anchor within India's telecom industrial policy ecosystem
- Strengthen standards participation and export readiness
- Institutionalise portfolio analytics and adaptive governance

11. Overall Conclusion

The Telecom Technology Development Fund has successfully:

- Rebuilt indigenous telecom R&D capability
- Strengthened academia–industry collaboration
- Generated meaningful knowledge outputs in frontier domains
- Established itself as a credible national innovation instrument

The principal challenge ahead lies not in technology creation, but in translating innovation into deployment, manufacturing, and global competitiveness.

With calibrated reforms—focused on stage-gated funding, downstream integration, operator engagement, certification enablement, and innovation-sensitive evaluation—TTDF can evolve from a strong R&D support scheme into a deployment-aware, strategically aligned, and globally competitive telecom innovation platform, while preserving its foundational strengths in research excellence and structured governance.

In sum, TTDF represents a strategically important national investment in telecom sovereignty. Its evolution now requires integration—not reinvention.