WHITEPAPER

PM WANI
The Foundation for India's Digital Public Infrastructure

BIF
BROADBAND INDIA FORUM
"Think Tank for Digital Transformation"

June 18, 2026

Credits:

BIF Wi-Fi COMMITTEE

Mr. Manoj Tandon
Chairman, Wi-Fi Committee, Broadband India Forum
Director – Projects, Operations & Maintenance, RailTel Corporation of India Ltd.

Mr. Sumit Garg
Co-Chair, Wi-Fi Committee, Broadband India Forum
Managing Director, Immunity Networks & Technologies Pvt. Ltd.

Mr. Arun Mukarji
Convenor, Wi-Fi Committee, Broadband India Forum
Senior Director – Operations, Broadband India Forum

EDITORIAL SUPPORT & RESEARCH CONTRIBUTIONS

Mr. Debashish Bhattacharya
Addl. Director General, Broadband India Forum

Ms. Shubhika Saluja
Associate Director – Policy Advocacy & Communications, Broadband India Forum

Ms. Neha Hathiari
Research Analyst, Advisory@TVR

The analysis, conclusions, and recommendations represent the collective position of the BIF Wi-Fi Committee.

Individual contributions reflect the professional expertise of the respective authors and do not necessarily represent the official positions of their affiliated organisations.

TABLE OF CONTENTS

Executive Summary

India has built world's leading Digital Public Infrastructure across identity, payments and data exchange. Yet a critical component of universal broadband access remains underdeveloped: affordable, high-quality and widely accessible and inclusive public Wi-Fi.

Launched in December 2020, the Prime Minister's Wi-Fi Access Network Interface (PM-WANI) is an unique, completely indigenously architected Public Wi-Fi framework that is fully decentralised, completely unbundled and a fully democratised Public Wi-Fi system, the like of which has few parallels across the world . Its licence-free, and interoperable architecture enables small businesses, local entrepreneurs and community institutions to participate in broadband access delivery, and supporting last-mile connectivity.

As of February 2026, over 4.09 lakh PM-WANI hotspots have been deployed across India. While this remains below earlier national ambitions, it represents the creation of a functioning public Wi-Fi ecosystem and an important foundation for future growth.

Recent policy reforms by the Department of Telecommunications (September 2024) and TRAI (June 2025) have significantly improved the viability of the framework. By permitting the use of retail broadband connections, enabling roaming and rationalising broadband tariffs for PDOs, these reforms have materially reduced backhaul costs and strengthened the commercial case for deployment. The central finding of this whitepaper is that PM-WANI's challenge is no longer one of design. The framework itself is robust. The barriers to scale arise from execution challenges, fragmented user experience, uneven deployment density, limited interoperability, and underdeveloped monetisation mechanisms.

Public Wi-Fi should not be viewed as a competitor to mobile broadband, but as a complementary access layer that improves network efficiency through Wi-Fi offload, strengthens indoor connectivity, and enables shared access models for households, communities and small businesses. Given the significantly lower cost per GB and higher capacity of Wi-Fi networks, public Wi-Fi remains an important mechanism for enabling affordable, high-volume broadband usage in fixed or indoor locations.

Global experience demonstrates that successful public Wi-Fi ecosystems depend on four key factors: sustainable economics, seamless user experience, interoperability, and institutional support. India has already established the necessary policy and architectural foundations. The next phase of PM-WANI should focus on reducing user friction, improving interoperability, strengthening deployment economics, leveraging existing broadband infrastructure, and expanding adoption across public institutions and community spaces.

A critical requirement will be the creation of a seamless national public Wi-Fi experience on the lines of mobile broadband. This may be enabled through a neutral interoperability framework that supports discovery, roaming and settlement across PDOA networks while preserving competition and innovation. Similar to the role played by NPCI in the UPI ecosystem, such a framework could help transform PM-WANI from a collection of individual hotspots into a coherent national connectivity platform.

With millions of potential access points across retail establishments, educational institutions, transport hubs and rural communities, PM-WANI has the potential to become a significant pillar of India's broadband strategy, supporting digital inclusion, entrepreneurship and the continued growth of the digital economy.

CHAPTER 1:

Introduction: PM-WANI – Design Strengths & Strategic Foundations

PM-WANI's significance lies not merely in its deployment numbers, but in the **architecture it introduces for public connectivity in India**. At its core, PM-WANI represents a shift from traditional, centralised telecom models to a **distributed, platform-based connectivity ecosystem**.

Unlike most global public Wi-Fi programmes—which are either **government-funded**, **telco-operated**, or **venue-controlled**—PM-WANI adopts a **structurally unbundled approach**, separating infrastructure, service delivery, and user access into independent but interoperable layers. This design enables scale not through central investment, but through **ecosystem participation**.

1.1 A Fully Liberalised, Licence-Free Framework

PM-WANI is one of the few public Wi-Fi frameworks globally where the last-mile provider—the **Public Data Office (PDO)**—can operate **without a telecom licence, registration fee, or spectrum cost**.

This dramatically lowers entry barriers and enables:

- Small retailers, kirana stores, and local establishments to become connectivity providers;
- Rapid, low-cost deployment of access points;
- Participation from non-traditional actors in the digital ecosystem.

This level of liberalisation is structurally distinct from most international models, where participation is typically restricted to licensed operators or government-approved entities.

1.2 Enabling Micro-Entrepreneurship at Scale

A defining feature of PM-WANI is its ability to convert existing physical retail infrastructure into digital access points.

The model envisions:

- A tea stall, kirana shop, or small business acting as a **local broadband node**
- Incremental income generation through Wi-Fi services
- Increased customer dwell time and associated consumption

This aligns public Wi-Fi deployment with **local economic incentives**, making it inherently more scalable than purely state-funded infrastructure models.

1.3 Decentralised & Unbundled Architecture

PM-WANI's four-layer architecture—comprising PDOs, PDO Aggregators (PDOAs), App Providers, and a Central Registry—reflects a deliberate policy choice to separate roles across the value chain.

This unbundling enables:

- Infrastructure-light entry for PDOs
- **Platform innovation** at the PDOA layer (authentication, billing, analytics)
- **User interface competition** through multiple App Providers
- Central interoperability via the registry

Such a modular structure mirrors the design philosophy of India's broader Digital Public Infrastructure, where interoperability and open participation drive scale.

1.4 Policy Responsiveness and Evolution

The PM-WANI framework has demonstrated an important characteristic often missing in large-scale digital programmes: **policy adaptability**.

Key regulatory interventions have strengthened the ecosystem:

- **September 2024 DoT reforms** enabling use of retail broadband connections and facilitating interoperability
- **TRAI's 71st Amendment (June 2025)** addressing pricing structures and improving affordability of backhaul

These changes have significantly improved the **operational and financial viability** of PDOs, marking a transition from early-stage constraints to a more enabling environment for growth.

1.5 Complementary Role in India's Broadband Ecosystem

PM-WANI architecture's role as a **complementary access layer** becomes particularly relevant in:

- **Indoor environments** where mobile signal quality may be inconsistent
- High-density usage scenarios requiring data offload
- **Shared access contexts**, such as households and community spaces

By enabling low-cost, high-volume data consumption, PM-WANI based public Wi-Fi can enhance overall network efficiency while expanding access to underserved segments.

CHAPTER 2:

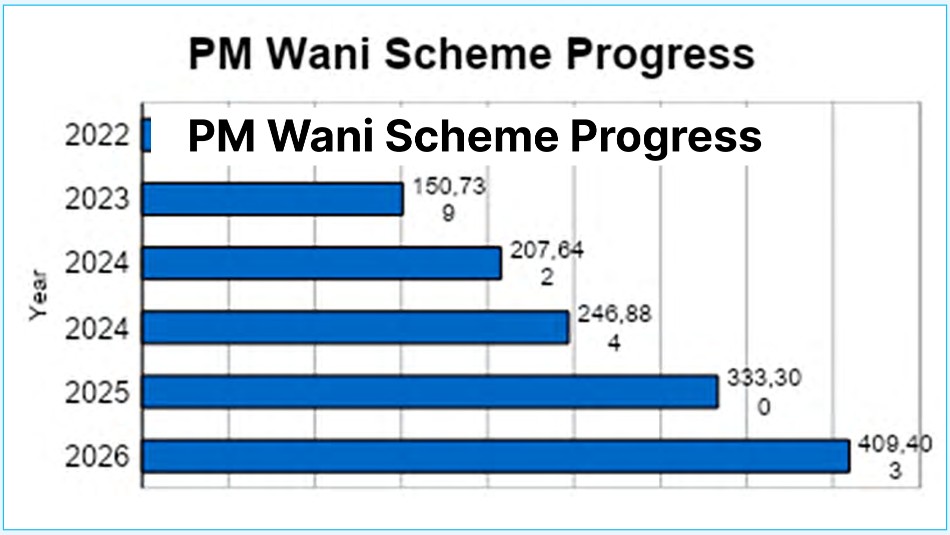
PM-WANI: Current Status, Scale and Emerging Trajectory

PM-WANI has transitioned from a policy construct into a **functioning and expanding public connectivity layer**, with measurable progress across infrastructure deployment, user adoption, and ecosystem participation. As of **28 February 2026**, the Central Registry record shows India has **4,09,403 operational public Wi-Fi hotspots (PDOs)**, supported by **207 PDO Aggregators (PDOAs)** and **113 App Providers**. The network has served over **2.44 crore users**, with cumulative data consumption exceeding **58 petabytes**, indicating sustained and meaningful utilisation.

These metrics position PM-WANI among the **largest decentralised public Wi-Fi ecosystems globally**, particularly given its licence-free and distributed deployment model. At the same time, its current scale must be interpreted in the context of India's significantly larger digital connectivity ambitions.

2.1 Scale and Growth Trajectory: From Early Adoption to Acceleration

PM-WANI's deployment trajectory reflects a transition from early-stage rollout to accelerated expansion, consistent with ecosystem-led infrastructure models.



This represents an over eightfold increase in deployment between 2022 and 2026, with a visible acceleration beginning in 2024. Considering the growth pattern, the incremental policy interventions seem to have provided the requisite operational clarity and resulted in expansion of the PM-WANI hotspots as is seen in the graph below. .

Despite such growth, when benchmarked against national targets, however, the gap remains substantial:

Benchmark	Scale
Current PM-WANI deployment	4.09 lakh
NDCP 2018 target	50 Lakh by 2020 and 1 crore by 2022
Bharat 6G Vision 2030	5 crore

Current deployment represents approximately **4.1% of the NDCP target** and **0.8% of the Bharat 6G Vision ambition**. This divergence reflects the inherently gradual nature of decentralised, market-driven rollout models, where scale builds progressively through ecosystem adoption rather than centralised execution.

In this context, PM-WANI can be understood as having moved beyond the initial proof-of-concept stage and entering a phase of structured expansion, albeit with significant headroom for growth.

2.2 Density, Distribution and Usage: Indicators of Network Maturity

A more meaningful assessment of public Wi-Fi infrastructure lies in network density, geographic spread, and usage intensity.

With approximately **4.09 lakh hotspots serving a population of ~1.42 billion**, India's current density is estimated at: ~29 hotspots per 1 lakh population.

This remains well below global benchmarks, where mature public Wi-Fi ecosystems typically range between **200 and 500 hotspots per lakh population**. The current level suggests that PM-WANI remains in an early stage of diffusion, with considerable scope for further expansion. Deployment patterns further indicate geographic concentration, with leading contributions from states such as Delhi, Maharashtra, Karnataka, and Uttar Pradesh.[1] This suggests that the model has demonstrated viability in high-density and high-footfall environments, but has yet to achieve uniform national distribution.

At the same time, usage metrics reflect active engagement where networks are available. With over **2.44 crore users** and **cumulative 58.6 petabytes of data consumption**, PM-WANI is supporting meaningful broadband usage rather than limited or sporadic access.

1 https://pmwani.gov.in/wani - *PMWANI Central Registry*

Taken together, these indicators suggest that while demand and utilisation are established, network density and geographic coverage appear to be among the most significant constraints on wider adoption.

2.3 Ecosystem Evolution and Policy Enablement

PM-WANI's architecture is designed as a multi-layered ecosystem, and current participation levels indicate that this structure is now operational.

Ecosystem Layer	Scale
PDO Aggregators (PDOAs)	207
App Providers	113

This layered participation enables separation of functions across access provisioning, service management, and user interface, supporting interoperability and scalability.

The evolution of the ecosystem has been reinforced by a series of policy interventions introduced between 2024 and 2025. These have addressed key operational and economic constraints, including:

- Permission for **FTTH-based backhaul**, reducing cost barriers for PDOs
- Allowance for aggregation of multiple hotspots per connection
- Introduction of **revenue opportunities**, including mobile data offloading and consent-based content delivery
- Enablement of **roaming and interoperability** across networks
- Tariff rationalisation through TRAI's 2025 amendment, capping broadband costs for PDOs relative to retail pricing

These measures collectively improve both the cost structure and revenue potential of the model, while enhancing user experience and operational flexibility.

The broader experience of public Wi-Fi deployment in India also highlights the importance of linking infrastructure rollout to viable operating models. In this regard, PM-WANI's decentralised, entrepreneur-driven approach represents a structural departure from earlier initiatives that relied primarily on centrally provisioned infrastructure.

As a result, the ecosystem has reached a stage where foundational elements—policy support, platform layers, and early adoption—are in place, enabling a more sustained phase of expansion.

2.4 Strategic Positioning: A Network with Established Foundations

India has achieved remarkable success in mobile broadband proliferation but remains under-penetrated in fixed broadband and public Wi-Fi infrastructure relative to future digital requirements.

PM-WANI today reflects a **validated public Wi-Fi framework**, supported by:

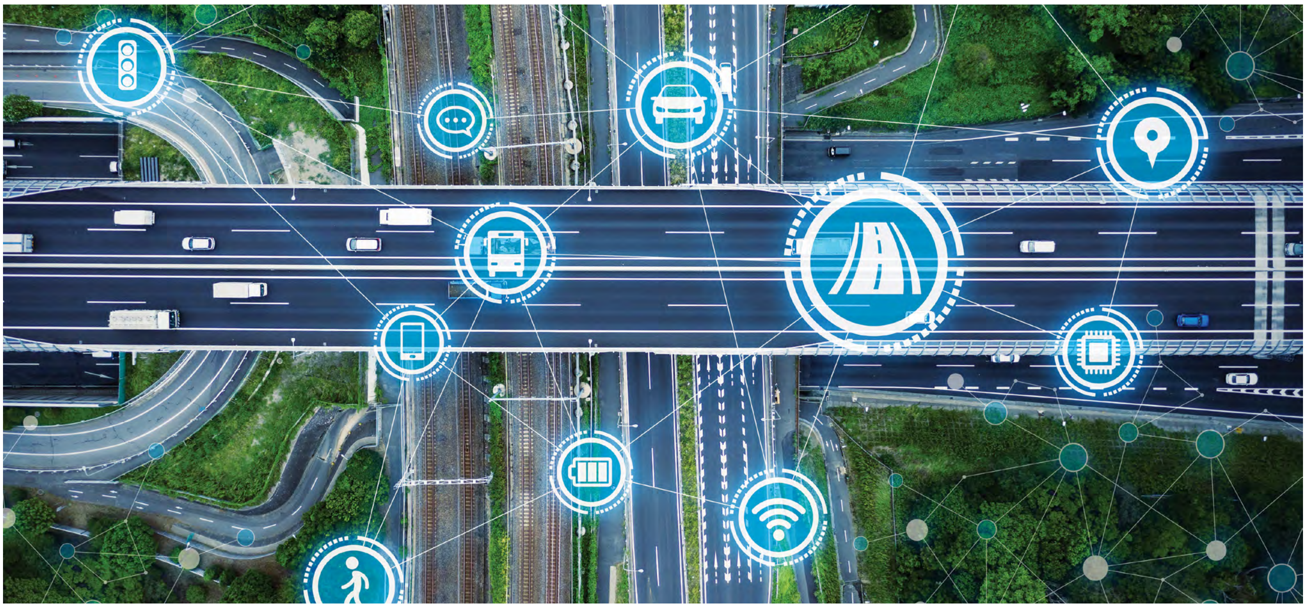
- A liberalised and interoperable policy architecture
- A functioning multi-layer ecosystem
- Demonstrated user adoption and data consumption

At the same time, the gap between current deployment and national ambition remains pronounced, particularly in terms of network density and geographic reach.

The next phase of development will depend on expanding deployment beyond high-performing clusters, strengthening the economic viability of last-mile providers, and enabling broader institutional and commercial adoption.

CHAPTER 3:

Economics of PM-WANI: Unit Model, Cost Structures and Viability



The pace of PM-WANI deployment is closely linked to the underlying economics of hotspot operation. While the framework enables low-barrier participation, long-term sustainability depends on whether Public Data Offices (PDOs) can operate within viable cost and revenue structures. The economic profile of PM-WANI has evolved meaningfully since its launch, particularly following regulatory interventions that addressed cost inefficiencies and limited monetisation pathways.

3.1 Unit Economics of a PM-WANI Hotspot

A typical PM-WANI hotspot operates on a low capital expenditure base but is sensitive to recurring operating costs, particularly backhaul connectivity. Industry inputs and prevailing broadband tariffs indicate the following cost structure.

Cost Component	Estimated Range (₹ / month)	Reference Anchor
Backhaul (FTTH broadband 50–200 Mbps)	700 – 1,500	Based on retail FTTH plans from Indian ISPs and TRAI tariff benchmarking (2025)
Electricity & maintenance	200 – 400	Derived from small commercial electricity usage norms
PDOA/platform service fees	100 – 300	Industry discussions with PDOA models and platform pricing
Miscellaneous overheads	100 – 300	Local servicing, upkeep, minor repairs
Total Monthly OPEX	**~1,100 – 2,500**	**Consolidated estimate**

The capital expenditure required to activate a hotspot remains relatively modest.

Component	Estimated Range (₹)	Reference Anchor
Wi-Fi access point/router	1,500 – 3,000	Market pricing for entry to mid-range commercial routers
Installation & setup	500 – 1,500	Field-level deployment inputs
Total CAPEX per hotspot	**~2,000 – 4,500**	**Consolidated estimate**

On the revenue side, PM-WANI operates across multiple potential streams, although realisation varies significantly by location and usage intensity.

Revenue Stream	Estimated Range (₹ / month)	Reference Anchor
User payments (low-ticket data packs)	500 – 2,000	Based on PM-WANI usage models and low ARPU prepaid behaviour
Advertising / branded content	300 – 1,500	Digital captive portal benchmarks (global Wi-Fi monetisation models)
Data offloading / enterprise partnerships	Emerging	Referenced in DoT policy enablement (2024 reforms)
Total Revenue Potential	**~800 – 3,500+**	**Consolidated estimate**

These ranges indicate that break-even is achievable in moderate to high footfall environments, particularly where multiple revenue streams are leveraged. However, in low-usage scenarios, revenues may remain below cost thresholds. The model is therefore inherently location-sensitive and operates on a micro-margin structure where viability improves through aggregation and scale rather than high per-user revenue.

3.2 Evolution of Viability: Impact of Policy Reforms

The initial phase of PM-WANI (2020–2023) was characterised by structural economic constraints. Backhaul costs were relatively high due to reliance on non-optimised connectivity plans, monetisation options were limited, and user experience challenges reduced repeat usage. As a result, deployment remained concentrated in pilot clusters and did not achieve broad-based expansion.

This situation has shifted materially following regulatory interventions introduced between 2024 and 2025. Key policy measures have directly influenced both cost structures and revenue potential.

On the cost side, the permission to use retail FTTH connections as backhaul, combined with the ability to aggregate multiple hotspots on a single connection, has significantly reduced per-unit operating costs. This has been reinforced by TRAI's Telecommunication Tariff Order amendment (2025), which limits PDO broadband tariffs to a maximum of twice the corresponding retail tariff, thereby substantially reducing one of the largest cost drivers historically faced by the ecosystem

On the revenue side, the framework now allows mobile data offloading by telecom operators and consent-based advertising or content delivery, creating additional monetisation avenues beyond direct user payments. These changes are particularly relevant in high-footfall environments where indirect revenue streams can meaningfully contribute to viability.

In parallel, improvements in interoperability, including roaming across PDOA networks and integration of existing Wi-Fi infrastructure, have enhanced user experience and session continuity, supporting higher utilisation levels.

Taken together, these interventions represent a shift from a constrained economic model to one where viability is achievable under defined conditions. The focus has moved from structural limitations to operational execution and ecosystem maturity.

3.3 Conditions for Commercial Viability and Scale

The economics of PM-WANI are not uniform across geographies and use cases. Viability is closely linked to location characteristics, user density, and the ability to layer revenue streams.

High-viability environments include transport hubs, dense urban markets, commercial clusters, and educational campuses, where consistent footfall and repeat usage support both direct and indirect monetisation. In such settings, hotspots are more likely to achieve or exceed break-even thresholds.

Moderate-viability environments, such as Tier 2 and Tier 3 urban centres, require a combination of user aggregation and hybrid monetisation models. Here, viability improves when multiple hotspots are operated within a cluster, enabling cost efficiencies and higher cumulative usage.

In low-density or rural environments, the model faces structural challenges due to lower usage intensity and limited paying capacity. In such cases, deployment may need to be anchored through institutional use cases, including schools, public service centres, or community networks, potentially supported by policy incentives or bundled service models.

The economic characteristics of PM-WANI therefore align with a distributed access framework in which individual nodes may operate on modest margins, but overall viability improves with network density, aggregation, and ecosystem integration.

Available evidence suggests that the current economic profile of PM-WANI is no longer constrained by the cost barriers that characterised its early years and can achieve commercial viability in appropriate deployment environments. Policy interventions have addressed the most critical structural challenges, particularly those related to backhaul pricing and monetisation flexibility.

At the same time, the transition from viability to large-scale adoption depends on improving execution at the edge. This includes expanding deployment beyond high-performing clusters, strengthening PDO-level economics through aggregation, and enabling broader participation across commercial and institutional settings.

In this context, PM-WANI represents a model that has achieved economic feasibility in principle, with the next phase of growth dependent on scaling operational adoption and deepening ecosystem participation.

Public Wi-Fi must evolve from isolated entrepreneurial hotspots into a scalable managed-service category integrated with mainstream ISP and telecom business models.

ISPs may offer standardised "Public Wi-Fi Enablement" plans linked to FTTH offerings including authentication, bandwidth partitioning, lawful traceability and remote hotspot management.

Commercial establishments in broadband-served areas should have the ability to procure managed public Wi-Fi connectivity on transparent and non-discriminatory terms.

"I run a tea stall near a bus stand, I earn ₹3,000–4,000 extra per month from Wi-Fi. My customers stay longer. They order more tea. The Wi-Fi pays for itself."

— PDO operator

CHAPTER 4:

Global Public Wi-Fi Benchmarks and Deployment Models

In many countries, public Wi-Fi has evolved from a supplementary access layer into an important component of digital infrastructure., supporting inclusion, economic participation, and public service delivery. Countries have adopted diverse deployment models depending on institutional capacity, market maturity, and policy objectives. A comparative view highlights that successful public Wi-Fi ecosystems are not defined by a single approach, but by the alignment of **deployment architecture, funding mechanisms, and monetisation strategies**.

4.1 Global Scale and Density Comparison

A comparison of public Wi-Fi deployment across countries illustrates the extent of variation in both absolute scale and network density.

Country/Region	Public Wi-Fi Hotspots	Hotspots per 100,000 People	Source
India	4,09,111	~28.6	DoT / PM-WANI
China	41,700,000	~2,890	Statista (2021)
United States	986,256	~298	Wi-Fi Map (2025)
United Kingdom	5,000,000	~7,400	Broadband Genie (2024)
France	57,381	~85.6	BroadbandSearch (2025)
Germany	56,067	~70.1	BroadbandSearch (2025)

This comparison highlights that India's current deployment, while significant in absolute terms, remains low in density relative to mature markets, where hotspot availability is several multiples higher. The implication is that India's challenge is not only expanding infrastructure, but achieving sufficient network density to enable meaningful and reliable access.

4.2 Global Deployment Archetypes

Global deployments demonstrate that public Wi-Fi systems typically evolve through a limited set of structural models, each defined by distinct funding mechanisms, operational architectures, and monetisation pathways. While implementations vary across geographies, four dominant deployment archetypes emerge, offering important insights into scalability, sustainability, and user adoption.

4.2.1. Government-funded and universal service models

Government-funded and universal service models are widely deployed to address digital inclusion objectives, particularly in underserved and low-income regions where commercial viability is limited. These models are typically financed through public budgets, universal service funds, or targeted grant-based mechanisms, with the primary objective of ensuring baseline connectivity access rather than generating direct financial returns.

A prominent example is the **Wi-Fi4EU initiative**, under which **8,802 municipalities** across Europe were awarded vouchers of up to **€15,000 each** to deploy free public Wi-Fi infrastructure in community spaces such as town centres, libraries, healthcare facilities, and public institutions. The programme attracted participation from over **29,000 municipalities**, reflecting strong institutional demand for publicly funded connectivity as a civic utility[2].

At the city level, large-scale deployments such as **Seoul's public Wi-Fi programme[3]** demonstrate how universal access models can achieve significant network density. By early 2025, Seoul had deployed approximately **34,000 public Wi-Fi networks**, with ongoing expansion focused on transport corridors, public spaces, and digitally vulnerable user groups. The programme continues to invest in both coverage expansion and infrastructure upgrades, reflecting a long-term commitment to maintaining service quality alongside accessibility.

Similarly, publicly funded connectivity programmes targeting social infrastructure highlight the role of Wi-Fi as an enabler of essential services. In Brazil's public access ecosystem[4], government-led initiatives have connected approximately **94,000 out of 138,000 public schools** (around **68% coverage**) as of 2025, extending connectivity to education and community service institutions where private investment alone would be insufficient.

Across these deployments, government-funded models are characterised by:

- Capex-driven rollout supported through grants or public financing
- Free or heavily subsidised access for end users
- Deployment prioritisation based on social inclusion rather than traffic demand
- Strong presence in public institutions such as schools, healthcare centres, and municipal spaces

While these models are highly effective in expanding access and bridging the digital divide, global experience indicates that their sustainability depends heavily on continued operational funding, maintenance frameworks, and institutional ownership. In the absence of clear O&M mechanisms, several publicly funded deployments have faced challenges related to network uptime, service quality, and long-term utilisation.

2 *https://wifi4eu.ec.europa.eu/*

3 *https://english.seoul.go.kr/seoul-to-expand-intelligent-cctvs-and-public-wi-fi-for-a-digitally-safe-city/*

4 *https://www.telecompaper.com/news/brazil-connects-68-of-public-schools-with-internet--1558468*

Government-funded universal access models are effective in rapidly expanding coverage across public institutions, but their long-term performance is ultimately determined by the strength of local execution—particularly in maintenance ownership, upgrade cycles, and integration with broader digital service ecosystems.

In rural and underserved areas, criteria governing allocation of funding may include absence of broadband access, digital inclusion requirements, remoteness, institutional relevance, educational and healthcare importance and community-level impact. The UN's Sustainable Development Goal (SDG) for digital connectivity ensures safe, affordable, and meaningful internet access for every person worldwide by 2030. It is a critical accelerator, aiming to bridge the global digital divide, empower marginalized communities, and foster inclusive digital public infrastructure. In view of these goals which India is a signatory to, PMWANI/Public Wi-Fi in these rural and under-served areas may be declared eligible for CSR support, which would attract corporate funding.

4.2.2 Commercial and venue-led models

Commercial and venue-led public Wi-Fi models are typically deployed in high-density, high-footfall environments such as urban centres, transport hubs, airports, stadiums, and commercial districts, where predictable user demand enables viable monetisation. Unlike publicly funded models, these deployments are driven by private operators or public-private partnerships and are designed to achieve operational sustainability through revenue generation rather than subsidy.

A widely cited example is **LinkNYC**[5], which transformed legacy payphone infrastructure into a network of over 10,000 digital kiosks, providing free high-speed public Wi-Fi across New York City. The network has recorded over 1 billion user sessions annually, with monetisation driven primarily through digital advertising displayed on kiosk screens. This demonstrates how public Wi-Fi can function as an urban digital infrastructure layer while remaining financially self-sustaining through non-user revenue streams.

At a global scale, operators such as **Boingo Wireless**[6], have built large commercial Wi-Fi ecosystems across airports, stadiums, transit hubs, and enterprise environments, managing over 1 million Wi-Fi hotspots worldwide. Boingo's model integrates multiple revenue streams, including advertising, carrier Wi-Fi offload agreements, roaming partnerships, and enterprise connectivity services. Importantly, this model reduces reliance on direct user payments by leveraging high-value partnerships and location-based demand aggregation.

In addition to advertising-led monetisation, commercial deployments often benefit from indirect economic value creation. For instance, venue operators report increased dwell time, higher customer engagement, and improved retail conversion in environments offering seamless Wi-Fi access, making connectivity an embedded part of the commercial experience rather than a standalone service.

These systems are characterised by:

- Deployment in high-density, high-traffic locations
- Revenue models centred around advertising, partnerships, and premium services
- Free or low-cost user access to maximise engagement
- Strong linkage between connectivity and commercial outcomes (retail, mobility, events)

However, the viability of this model is closely tied to user density and location economics. Outside high-footfall environments, monetisation potential declines sharply, limiting the model's applicability in low-density or rural contexts.

---

5 https://www.link.nyc/

6 https://www.boingo.com/

Commercial and venue-led models demonstrate that public Wi-Fi can achieve financial sustainability without subsidy, but their success is inherently location-dependent, making them effective in dense urban ecosystems but difficult to scale uniformly across broader geographies.

More advanced implementations of this approach have evolved into platform-based aggregation models, where connectivity across multiple venues is unified under a single operational and monetisation layer—an approach that holds greater relevance for large-scale, distributed systems such as PM-WANI and is examined in subsequent sections

4.2.3 Broadband-Integrated Ecosystem Model

Broadband-integrated public Wi-Fi models extend connectivity by leveraging existing fixed broadband infrastructure, enabling large-scale deployment with minimal incremental investment. In this approach, public Wi-Fi is not treated as a standalone network, but as an extension layer of the fixed broadband ecosystem, utilising residential, enterprise, and institutional connections to create distributed access networks.

A widely adopted implementation of this model is seen in operator-led Wi-Fi ecosystems, where broadband providers enable hotspot functionality across their subscriber base. For example, networks such as **BT Wi-Fi in UK**[7] provide access to millions of hotspots by allowing users to share a portion of their home or enterprise broadband connection, while maintaining secure and segregated traffic flows. Subscribers benefit from seamless access across the network, while non-subscribers can access the same infrastructure through paid plans.

A more deeply integrated version of this model is observed in large-scale digital ecosystems such as **China**[8], where public Wi-Fi is tightly coupled with broadband networks and digital platforms. Wi-Fi access is often embedded within widely used applications and services, enabling seamless authentication through mobile numbers, payment platforms, or identity-linked systems. This integration allows public Wi-Fi to function not just as a connectivity layer, but as an extension of a broader digital ecosystem, supporting high user adoption and frequent usage across urban environments

Across such deployments, public Wi-Fi also plays a critical role in network optimisation. By offloading high-volume data traffic—particularly indoor usage—from mobile networks to fixed broadband infrastructure, operators are able to improve spectrum efficiency, reduce network congestion, and deliver more consistent user experience at lower marginal cost.

These systems are characterised by:

- Leveraging existing fixed broadband connections for last-mile access
- Low incremental capital expenditure due to infrastructure reuse
- Integration with telecom, broadband, and digital service ecosystems
- Hybrid monetisation through bundled access and pay-per-use models

A key advantage of this model lies in its operational efficiency. By utilising already deployed broadband infrastructure, it significantly lowers the cost per hotspot while enabling rapid scaling. However, the effectiveness of this approach is closely tied to the underlying penetration and quality of fixed broadband networks. In environments where broadband access remains limited or unevenly distributed, the scalability of such integrated Wi-Fi systems is inherently constrained.

7 https://www.bt.com/broadband/wifi
8 https://www.tencent.com/en-us/business.html | https://www.alizila.com/

Broadband-integrated models represent one of the most efficient pathways for scaling public Wi-Fi, and when combined with digital service ecosystems, they significantly enhance user adoption and network utilisation.

The principles underlying broadband-integrated deployments—particularly the use of distributed last-mile connections and infrastructure reuse—have strong structural parallels with decentralized models such as PM-WANI, where individual access points are expected to operate over existing broadband networks.

4.2.4 Telco-Led and Smart City Integrated Model

Telco-led and smart city integrated public Wi-Fi models represent a more advanced evolution of deployment, where connectivity is embedded within urban digital infrastructure and mobility ecosystems. In this approach, public Wi-Fi is delivered through a combination of telecom operator networks and city-level initiatives, enabling seamless access across transport systems, public spaces, and commercial environments.

A prominent implementation of this model is observed in **Japan**, where public Wi-Fi is provided through a combination of government-supported initiatives and operator-led deployments by players such as **NTT Docomo**[9] **and SoftBank**[10]. These networks are increasingly integrated with **OpenRoaming frameworks**[11], enabling users to connect automatically across multiple locations without repeated authentication.

Such deployments are typically embedded within broader smart city ecosystems, where connectivity supports mobility, tourism, digital services, and urban governance. By enabling interoperable access across transport hubs, commercial zones, and public infrastructure, these systems significantly improve user experience while increasing network utilisation.

These systems are characterised by:

- Strong involvement of telecom operators in deployment and management
- Integration with smart city infrastructure and urban mobility systems
- Use of seamless authentication frameworks such as OpenRoaming
- Enhanced user experience through automatic connection and interoperability
- Monetisation through bundled telecom services, partnerships, and ecosystem integration

A key differentiator of this model lies in its focus on **user experience and interoperability at scale**. Unlike fragmented access systems, these deployments minimise friction by enabling automatic authentication and cross-network mobility, which significantly improves adoption and repeat usage.

However, the scalability of this model depends on coordination between multiple stakeholders, including telecom operators, municipal authorities, and technology platforms. Without alignment across these actors, interoperability and seamless access can be difficult to achieve.

Telco-led and smart city integrated models demonstrate that seamless user experience and interoperability are critical to large-scale adoption, but their success depends on strong ecosystem coordination and institutional alignment.

9 https://www.nttdocomo.co.jp/english/service/d_wifi/

10 https://www.softbank.jp/en/mobile/network/wifispot/

11 https://wballiance.com/openroaming/

The global landscape demonstrates that public Wi-Fi deployments converge around a limited set of structural archetypes, with monetisation approaches ranging from fully subsidised public access to multi-sided commercial platforms. Across all models, long-term performance is closely linked to the alignment between deployment architecture, funding mechanisms, and user experience design.

PM-WANI, by design, has the structural potential to evolve into a platform-led model, but currently operates closer to a low-monetisation distributed deployment framework.

Country/Region	Model	Characteristic Features	Challenges
United States	Commercialized and venue-based Govt funded Universal Service Administrative Company (USAC), E-Rate programme	Ad-supported LinkNYC kiosks and Boingo roaming agreements create revenue-generating models for dense urban zones E-Rate program to support the off-premises use of Wi-Fi hotspots and mobile wireless Internet services through libraries and schools across the country	Fragmented access; minimal government subsidy
United Kingdom	Integrated with broadband ecosystem	BT Wi-Fi leverages existing home routers for hotspot sharing, providing seamless access to its subscriber base	Paid access for non-subscribers
European Union	Public voucher scheme (15,000/town)– EU funded programme	Wi-Fi4EU effectively enables rural and small-town connectivity through a neutral, vendor-agnostic deployment model	Requires municipal capacity to execute
France / Germany / Spain / Italy	Hybrid of municipal, airport, and national rail Wi-Fi	Rail and airport-based access (e.g., DB trains, CDG airport) boosts public connectivity during travel and tourism	Limited city-scale expansion

Japan	Telco-driven + OpenRoaming smart city integration. partially government backed	Public Wi-Fi offered via SoftBank and NTT Docomo is layered with tourist and loyalty programs; Tokyo Free Wi-Fi showcases government-backed roaming	Service fragmentation
Brazil	Federal public program (Wi-Fi Brasil)	Wi-Fi rollout at schools and health units improves service access in underserved areas	Urban-rural deployment gap
Russia	Telco-led with commercial growth	Private telcos like Beeline drive rapid hotspot growth while leveraging captive portals for monetization	Subscription-based access common
Turkey	City-led; free unlimited model government funded	IBB Wi-Fi ensures ubiquitous connectivity in public areas through city-operated telecom infrastructure	Local capacity constraints
Canada	Private telecom partnerships	Partnerships in Toronto and Vancouver extend Wi-Fi into public areas without direct state funding	Uneven access in remote areas
China	State-integrated with Smart City + fintech	Wi-Fi bundled with Alipay and WeChat platforms enhances e-governance and citizen convenience using seamless login via ID	State-driven architecture may limit openness
Latin America & Caribbean	USF-backed public deployments	Universities and government agencies benefit from Wi-Fi funded through Universal Service Funds	Maintenance and scaling
Taiwan	Government-run (iTaiwan) for indoor access	Free Wi-Fi available in 5,000+ locations with no registration; quick adoption among residents	Limited speeds (1 Mbps)

4.3 The Boingo Model: Platform-Based Commercial Viability

A particularly relevant benchmark for evaluating the long-term sustainability of public Wi-Fi is the model developed by Boingo Wireless. Unlike traditional access-based approaches, Boingo operates as a **neutral-host digital infrastructure platform**, combining connectivity with layered monetisation.

Boingo's network spans **130+ major airports**, serves over **1 billion annual users**, and operates more than **1 million hotspots globally**, alongside institutional deployments across military bases and enterprise environments.

The distinguishing feature of the model lies in its **multi-sided revenue architecture**. Rather than relying primarily on user payments, Boingo generates revenue through a combination of:

- advertising and sponsored access
- carrier offload and distributed antenna systems (DAS)
- long-term venue contracts
- roaming partnerships and enterprise services

User-paid access, once a primary revenue source, now plays a relatively limited role, with monetisation increasingly shifting toward **indirect and platform-driven revenue streams**.

From a financial perspective, Boingo demonstrated sustained commercial viability prior to its privatisation. In FY2019, the company reported revenues of **US$263.8 million** with an **EBITDA margin of over 31%**, increasing to **35.2% in 2020**, indicating strong operating leverage within the model.

The underlying economics are driven by:

- **high-density venues**, ensuring consistent usage
- **shared infrastructure**, reducing marginal costs
- **diversified revenue streams**, lowering dependence on user pricing

Following its acquisition by Digital Colony (DigitalBridge) in 2021 at an enterprise valuation exceeding **US$850 million**, Boingo has transitioned into a long-term infrastructure asset, further reinforcing the viability of platform-based public Wi-Fi models.

4.3.1 Implications for PM-WANI: From Distributed Access to Platform-Based Public Wi-Fi

The evolution of platform-based public Wi-Fi models provides important directional insights for India's PM-WANI framework, which has been architected as a decentralized, low-cost access ecosystem. By design, PM-WANI enables a distributed network of Public Data Offices (PDOs) operating over existing broadband connections, thereby lowering entry barriers and encouraging rapid expansion of last-mile connectivity.

However, while the architecture supports scale in terms of deployment, its long-term sustainability will depend on the development of a coherent monetisation and aggregation layer. In its current form, PM-WANI operates largely as a distributed access model, where individual PDOs function independently with limited ability to capture value beyond basic user access.

CHAPTER 5:

PM-WANI at the Crossroads: Challenges, Constraints and the Path to Scale

5.1 PM-WANI's Position in India's Broadband Ecosystem

PM-WANI occupies a distinctive position within India's broadband landscape. Unlike most global public Wi-Fi programmes, which are typically government-funded, venue-controlled, or telecom operator-led, PM-WANI has been conceived as a decentralised, market-driven public access framework built on open participation and interoperability. Its architecture aligns closely with India's broader Digital Public Infrastructure philosophy, emphasising distributed participation, low barriers to entry, and ecosystem-led growth.

From a policy perspective, PM-WANI is not intended to compete with mobile broadband or fixed broadband services. Rather, it serves as a complementary access layer that extends the reach and utility of existing broadband infrastructure. Public Wi-Fi improves indoor coverage, supports data offloading from mobile networks, and enables shared access models that are particularly relevant in cost-sensitive and multi-user environments.

Despite these structural strengths, PM-WANI's realised outcomes remain at an early stage. While deployment has reached over four lakh hotspots, the network has yet to achieve the density and continuity required for reliable, everyday usage. As a result, public Wi-Fi remains a situational access option rather than a pervasive connectivity layer integrated into users' daily digital lives.

India's broadband environment presents both a challenge and an opportunity. Unlike many countries where public Wi-Fi evolved alongside widespread fixed broadband penetration, India remains predominantly mobile-first. This has reduced immediate dependence on public Wi-Fi while simultaneously creating a significant opportunity for low-cost, high-capacity shared access in locations where mobile connectivity is constrained by economics, coverage limitations, or usage caps.

A particularly important opportunity lies in the relationship between BharatNet and PM-WANI. BharatNet has already established a nationwide fibre backbone extending to Gram Panchayats. However, the value of this infrastructure depends on how effectively connectivity reaches end users. Direct fibre-to-home deployment remains costly and operationally challenging in many rural and semi-urban environments. Public Wi-Fi offers a practical mechanism for extending the reach of BharatNet by enabling multiple users to share a common broadband connection through local access points.

A fibre-plus-Wi-Fi model aligns particularly well with the realities of low-income and low-ARPU markets. Modern Wi-Fi technologies are capable of supporting broadband-intensive applications including education, telemedicine, digital public services, content consumption, and local commerce. By combining BharatNet's backhaul infrastructure with PM-WANI's distributed access architecture, India can accelerate broadband adoption while improving utilisation of existing public investment.

The strategic significance of PM-WANI therefore extends beyond hotspot deployment. If scaled effectively, it has the potential to function as a distributed public access layer supporting broadband inclusion, network efficiency, local entrepreneurship, and digital service delivery. The challenge is not whether the framework is capable of delivering these outcomes, but whether the ecosystem can overcome the structural and operational constraints that currently limit scale.

5.2 Structural Constraints Limiting Scale

PM-WANI's design architecture is fundamentally sound. The framework incorporates many of the characteristics associated with successful public connectivity ecosystems, including decentralisation, interoperability, low barriers to participation, and market-led deployment. Yet the gap between architectural potential and realised outcomes remains substantial.

The reasons are not rooted in design deficiencies but in a series of structural constraints that affect user adoption, deployment economics, ecosystem coordination, and long-term sustainability. These constraints are interrelated and collectively influence the ability of the ecosystem to generate scale.

5.2.1 Fragmented User Discovery and Access

One of the most significant barriers to adoption is the fragmented nature of the user access experience.

While PM-WANI enables multiple PDOAs and App Providers to participate in the ecosystem, the resulting user journey often remains fragmented. Users may need to identify a compatible application, register, authenticate, select a hotspot, purchase a plan, and initiate a session before obtaining connectivity. The process varies across providers and frequently requires multiple steps before access is established.

This complexity contrasts sharply with the direction of global public Wi-Fi ecosystems, which increasingly emphasise seamless authentication, automatic discovery, and persistent connectivity.

The consequence is that many users perceive public Wi-Fi as a transaction rather than a network. Access becomes occasional and situational rather than habitual. First-time users experience friction, repeat usage declines, and network effects are less likely to emerge at scale.

It is important, however, not to attribute PM-WANI's adoption challenges solely to user experience friction. While fragmented discovery, multiple applications and repeated authentication requirements can discourage usage, they represent only one element of a broader adoption landscape.

The pace of ecosystem growth is also influenced by factors such as India's highly affordable mobile broadband market, limited fixed broadband penetration, low hotspot density in many locations, inconsistent service quality, limited public awareness, and the absence of established user habits around public Wi-Fi usage. In addition, venue owners and local operators require clear commercial incentives to sustain participation.

User experience simplification should therefore be viewed as a necessary, but not sufficient, condition for large-scale adoption. Sustainable growth is likely to depend on the combined effects of improved usability, greater network density, stronger economics, broader awareness and enhanced service quality.

5.2.2 Weak Platform Aggregation and Network Effects

A second constraint lies in the absence of a strong aggregation layer capable of unifying fragmented infrastructure into a coherent national access experience.

Successful public Wi-Fi ecosystems typically rely on platform layers that aggregate users, venues, service providers, and infrastructure under a common operational framework. These platforms facilitate discovery, authentication, settlement, roaming, analytics, and monetisation while preserving competition among participating entities.

Within PM-WANI, PDOAs perform important onboarding and management functions. However, the ecosystem lacks a broader aggregation mechanism capable of creating strong network effects across providers. As a result, individual deployments often remain isolated from one another, limiting both user adoption and commercial value creation.

Without aggregation, scale remains linear. Each hotspot contributes incremental value, but the ecosystem does not generate the exponential benefits associated with networked platforms.

5.2.2.1 PDOA Fragmentation and the Absence of Platform Scale

Of 206 registered PDOAs on the PM-WANI Central Registry, the vast majority are dormant registrations with zero or minimal active hotspots. Industry estimates suggest fewer than 30 PDOAs have more than 100 active hotspots, and fewer than 10 have any meaningful commercial traction. The ecosystem is heavily concentrated:

PDOA	Model	Hotspots	Funding	App Downloads	Status
WIOM	B2C sachet pricing	70,000+	$65M (Series B)	1.7M downloads	Largest PDOA
CSC / BharatNet	Govt-funded GPs	~50K installed	Govt (USOF)	Via CSC app	49% non-operational
HFCL	Enterprise / ISP	<5,000 est.	Public company	N/A	Hardware + PDOA
Wi-Fi Dabba	Urban Bengaluru	<2,000 est.	Seed funded	Minimal	Niche city focus
Nanovise	PM-WANI platform	<1,000 est.	Bootstrapped	529 installs	Platform provider
Netwall	Software platform	<500 est.	Bootstrapped	N/A	Platform provider
Immunity Networks	Multi-tenant PDOA + HW	<3,500	Self-funded	Subscriber App	Platform + monetization (Co-author)
Others (185+)	Various	Minimal	Unfunded	Negligible	Mostly dormant

The C-WANI reference app developed by C-DoT and various PDOA-branded apps on Google Play Store tell a stark story: WIOM's app has 1.7 million downloads; Nanovise's PM-WANI app has 529 installs; most other PDOA apps have fewer than 1,000 downloads each. Compared to Singapore's Wireless@SGx which serves an entire nation through a single app, India's 112 fragmented App

Providers collectively reach fewer users than one mid-sized Indian mobile game. [**Source:** *Google Play Store listings; AppBrain analytics; C-DoT WANI product page*]

The competitive landscape is ripe for consolidation. A platform provider that can offer white-label PDOA-as-a-Service to the 6,000+ small ISPs — giving them instant PM-WANI capability without building their own technology stack — will capture the platform layer as the market scales.

5.2.3 Uneven Deployment and Limited Coverage Density

The effectiveness of any public Wi-Fi ecosystem depends not only on the number of hotspots deployed but also on their geographic distribution and density.

Current deployment patterns remain heavily concentrated in specific urban clusters and high-footfall environments. While these deployments demonstrate the viability of the model under favourable conditions, they do not yet provide the continuity required for users to rely upon public Wi-Fi as a consistent access layer.

This creates a circular challenge. Limited density reduces user confidence in availability, resulting in lower usage. Lower usage weakens economics, which in turn discourages further deployment. The ecosystem therefore struggles to move beyond isolated hotspots toward continuous coverage zones.

International experience suggests that public Wi-Fi becomes significantly more valuable when users can reasonably expect connectivity across multiple locations rather than at isolated points of access. Achieving this transition remains a key challenge for PM-WANI.

5.2.4 Economic and Monetisation Constraints

The sustainability of public Wi-Fi ultimately depends on the economics of participation.

Although recent regulatory reforms have substantially improved viability, particularly through the use of retail broadband connections and tariff rationalisation, the economics of many deployments remain sensitive to utilisation levels and location characteristics.

Standalone hotspots in low-footfall locations frequently struggle to generate sufficient revenue through user payments alone. At the same time, monetisation pathways such as advertising, content partnerships, enterprise services, and telecom offload arrangements remain underdeveloped.

Global experience demonstrates that successful public Wi-Fi ecosystems rarely rely exclusively on direct user payments. Instead, they typically combine multiple revenue streams, enabling operators to monetise connectivity indirectly through broader digital services and commercial partnerships.

The development of similar monetisation mechanisms may support long-term scalability.

From Structural Constraints to Execution Challenges

Taken together, these constraints point to a broader conclusion. PM-WANI's limitations are not primarily architectural. The framework itself remains robust and compares favourably with many international public Wi-Fi models. The principal barriers to scale arise from execution challenges, pricing distortions, ecosystem fragmentation, and the absence of mechanisms that support deployment in commercially marginal environments.

Understanding how these constraints manifest in practice is essential to understanding why deployment has fallen short of ambition. The challenge facing PM-WANI is therefore not one of design, but of execution.

5.3 Execution Reality: Where the Model Breaks Down

The gap between PM-WANI's design strengths and deployment outcomes is not the result of a single failure point. Rather, it reflects a series of interrelated breakdowns across economics, procurement models, operational ownership, platform integration, and deployment incentives.

Across government deployments, institutional networks, public programmes, and field-level implementations, a recurring pattern emerges: infrastructure is created, but the ecosystem required to sustain it is either weak or absent.

The result is a system that demonstrates technical feasibility but struggles to translate participation into large-scale adoption.

5.3.1 Systemic Challenges Landscape

The implementation experience of PM-WANI reveals several recurring structural challenges that collectively constrain scale.

Challenge Area	Observed Reality	System Impact
Scale Gap	Deployment remains far below national ambitions	Limits network effects
Backhaul Cost Distortions	Historically high connectivity costs	Reduced PDO viability
BharatNet Wi-Fi Underutilisation	Significant proportion of assets inactive	Stranded infrastructure
Hardware-Led Procurement	Infrastructure without ecosystem design	Low sustainability
Institutional Revenue Models	Weak commercial incentives	Poor participation
Platform Fragmentation	Multiple apps and discovery challenges	Reduced adoption
Legacy Asset Non-Integration	Existing networks remain isolated	Lost scaling opportunities

The challenge is therefore systemic rather than isolated. Individual issues reinforce one another, creating a cycle that limits adoption, weakens economics, and slows expansion.

Voice from the Ground

"The BharatNet Wi-Fi at our Gram Panchayat worked for three months after inauguration. Then it stopped. Nobody comes to fix it. My students walk 4 km to the block office for internet."

— Government school teacher, Jharkhand (anonymised composite)

This observation illustrates a recurring challenge across publicly funded connectivity projects: infrastructure deployment alone does not guarantee sustainable service delivery. Without local ownership, maintenance frameworks, operating incentives, and integration into viable ecosystems, connectivity assets risk becoming underutilised or dormant.

5.3.2 Supply-Side Economic and Procurement Distortions

At the core of PM-WANI's implementation challenges lies a fundamental economic contradiction. The framework was conceived as a low-cost, high-volume, distributed public access system, yet for a significant period it was forced to operate within a cost structure more suited to enterprise telecommunications than community broadband access.

The most visible manifestation of this distortion was the historical requirement for Public Data Offices (PDOs) to procure Internet Leased Lines (ILLs) for backhaul connectivity. Annual connectivity costs frequently ranged between ₹4 lakh and ₹8 lakh, compared to retail FTTH services that could provide comparable bandwidth for a fraction of the cost. This created a situation where the cost of connectivity substantially exceeded the revenue-generating potential of a typical public Wi-Fi hotspot.

The issue was not merely one of pricing, but of structural misalignment. Internet Leased Lines are designed for enterprise applications requiring dedicated capacity, service guarantees, and stringent uptime commitments. PM-WANI, by contrast, was conceived as a shared-access model intended to maximise affordability and participation. Applying enterprise-grade connectivity economics to a mass-market public access framework undermined viability at the very point where scale was expected to emerge.

Voice from the Ground

"I invested ₹3.5 lakh in an Internet Leased Line because my ISP said FTTH wasn't allowed for PDOs. I was earning ₹800–1,200 per month from Wi-Fi sales. I shut down in 4 months. Nobody told me the rules were being changed."

— Former PDO operator, Tier-2 city, Uttar Pradesh (anonymised composite)

While subsequent regulatory reforms addressed this issue by permitting retail broadband connections and rationalising tariffs, the earlier distortion had already discouraged participation and weakened confidence among prospective operators.

The same pattern is evident in public sector and institutional deployments. Many government tenders have adopted a hardware-centric approach, focusing primarily on access point installation and network rollout targets. Critical elements such as subscriber management, platform integration, monetisation mechanisms, operational ownership, and post-deployment sustainability have frequently received less attention.

The result has been a recurring install-and-abandon cycle. Networks are deployed under capital expenditure programmes, maintained during contractual support periods, and subsequently experience declining utilisation or service quality once dedicated funding ends. Infrastructure is created, but the ecosystem necessary to sustain it is not.

A related challenge has emerged in institutional deployments where vendors are expected not only to provide public Wi-Fi services at their own cost, but also to share revenues with host institutions. Such reverse revenue-sharing models may appear attractive from a procurement perspective but are often economically untenable in environments characterised by low willingness to pay and modest usage intensity. The result is either a lack of bidder interest or deployments that struggle to maintain service quality over time.

These experiences illustrate a broader lesson. Sustainable public Wi-Fi cannot be created through infrastructure procurement alone. Long-term success depends on aligning deployment incentives, operating economics, ownership structures, and platform capabilities. Without these elements, infrastructure risks becoming an underutilised asset rather than a functioning public service.

5.3.3 Demand-Side Economics and the Case for Public Wi-Fi

While discussions around PM-WANI often focus on supply-side economics, the demand side presents a very different picture. Evaluating public Wi-Fi solely through comparisons of tariffs or infrastructure costs risks overlooking a more important question: how users actually consume data when access constraints are removed.

Mobile broadband usage in India is shaped by pricing structures that impose daily usage limits, typically ranging between 1 GB and 2 GB per day. Although these plans are affordable, they create a behavioural ceiling on consumption. Users ration data, postpone software updates, avoid large downloads, restrict video quality, and limit usage of bandwidth-intensive applications.

Observed consumption levels may partially reflect the influence of pricing structures and usage limits rather than unconstrained digital behaviour.The economics of fixed broadband and public Wi-Fi operate differently. When users gain access to high-capacity, low-cost connectivity, consumption patterns often change significantly. Video streaming, online learning, cloud applications, software updates, digital entertainment, telemedicine, and shared household access become more practical and affordable.

Furthermore, public Wi-Fi often functions as a shared resource. A single hotspot may support multiple users, devices, and use cases simultaneously. This distinguishes PM-WANI from individual mobile subscriptions and positions it closer to a community access model.

Mobile broadband costs are estimated at approximately ₹8.18 per GB, whereas effective fixed broadband Wi-Fi costs can fall below ₹1–2 per GB under public Wi-Fi usage conditions. FTTH subscribers typically consume 250–300 GB per month, compared with approximately 28–42 GB under standard capped mobile plans. High-capacity applications tend to migrate towards fixed and Wi-Fi networks because cost-per-GB is dramatically lower, throughput is higher, and network capacity scales more efficiently.

The significance of this difference extends beyond pricing. Public Wi-Fi can enable a shift from rationed, individual consumption towards shared, higher-volume access. This creates opportunities for educational services, community connectivity, local commerce, digital public services, and content consumption that are difficult to sustain under mobile-centric usage models.

Service Type	Monthly Cost	Data Availability	Effective Cost per GB	Consumption Context
Mobile 4G/5G Plans	₹299–₹349	42–56 GB	₹6–₹9 per GB	Individual, capped
Wireless Average (India)	₹172 ARPU	~21 GB	~₹9 per GB	Individual usage
PM-WANI Daily Model	~₹150 equivalent	~150 GB	~₹1 per GB	Shared access
PM-WANI Monthly Model	₹50–₹60	~150 GB	₹0.33–₹0.40 per GB	High-volume shared usage

From a demand-side perspective, public Wi-Fi is therefore not merely a cheaper alternative to mobile broadband. It represents a different consumption model altogether— one that may help unlock latent demand for affordable, high-volume broadband access.

5.3.4 Why Telecom Operators May Benefit from Public Wi-Fi

Public Wi-Fi is sometimes perceived as competing with mobile broadband. However, global experience suggests that fixed and wireless access technologies are often complementary rather than substitutive, particularly as data consumption continues to grow.

From a network economics perspective, mobile spectrum remains a scarce and expensive resource. High-volume applications such as video streaming, software updates, cloud backups, and large content downloads can place significant demands on mobile networks, particularly in dense urban environments and indoor locations. Public Wi-Fi can help accommodate a portion of this traffic through offload mechanisms, allowing mobile networks to utilise spectrum resources more efficiently.

Wi-Fi may also provide a cost-effective solution for improving indoor connectivity. A significant proportion of mobile traffic originates indoors, where signal penetration can be challenging and network densification can be costly. In many scenarios, Wi-Fi-based access can complement mobile networks by improving user experience while reducing the need for additional radio infrastructure.

The evolution of 5G Advanced and future 6G architectures is expected to increase convergence between licensed and unlicensed wireless technologies. Internationally, operators are increasingly adopting integrated connectivity models in which cellular, Wi-Fi, fixed broadband and private networks operate as complementary layers within a broader access ecosystem.

PM-WANI may therefore be viewed not only as a digital inclusion initiative, but also as a mechanism that can contribute to network efficiency, enhanced indoor coverage, improved user experience and more efficient utilisation of broadband infrastructure. Under appropriate commercial arrangements, public Wi-Fi can create value for telecom operators, internet service providers and infrastructure providers while simultaneously expanding affordable broadband access.

The extent of such benefits will depend on deployment models, traffic patterns, commercial structures and the evolution of interoperability frameworks. Nevertheless, international experience suggests that public Wi-Fi and mobile broadband can coexist as complementary components of a modern broadband ecosystem rather than as competing alternatives.

Potential Benefits of PM-WANI for Telecom Operators

Area	Potential Benefit
Indoor Coverage	Lower-cost enhancement of indoor user experience
Network Congestion	Traffic offload in dense locations
Spectrum Efficiency	More efficient use of licensed spectrum
Enterprise Connectivity	Support for campuses, malls, airports and venues
6 GHz Ecosystem	Encourages broader Wi-Fi adoption alongside 6 GHz availability
Infrastructure Costs	Reduced need for incremental capacity expansion in some scenarios

5.4 From Fragmentation to Interoperability: The Need for a Unified Access Layer

The challenges discussed thus far reveal a common underlying issue: fragmentation.

Users encounter fragmented discovery, fragmented authentication, fragmented balances, fragmented applications, and fragmented experiences. Individual hotspots may function effectively, yet the ecosystem as a whole lacks the continuity that users associate with a mature national connectivity platform.

Addressing this fragmentation is critical to PM-WANI's next phase of evolution.

5.4.1 Lessons from Mobile Roaming

Many of the current challenges within the PM-WANI ecosystem resemble the early evolution of mobile telephony. In the initial years of mobile connectivity, users faced fragmented networks, inconsistent coverage, separate billing arrangements, and cumbersome roaming processes. Connectivity existed, but the experience was often complex and unreliable.

The transformation of mobile services into a seamless national network was driven not only by infrastructure expansion, but by interoperability, common standards, real-time settlement systems, and neutral roaming frameworks that enabled users to move effortlessly across networks.

PM-WANI today faces a similar challenge. Users encounter fragmented discovery, multiple applications, separate balances, repeated authentication, and inconsistent experiences across PDOA networks. Consequently, public Wi-Fi often operates as a collection of isolated hotspots rather than as a unified national connectivity layer.

The telecom experience suggests that scale alone may be insufficient; interoperability is often a critical enabler of network effects.

5.4.2 The Role of a Neutral National Interoperability Layer

A Neutral National Interoperability Layer (consider a National/Super PDOA) could address this challenge by serving as a common interoperability and settlement framework for the ecosystem.

Acting as a neutral backbone, it would enable seamless movement across participating PDOA networks, allowing users to remain connected without repeatedly switching applications, re-authenticating, or losing unused balances. From the user's perspective, public Wi-Fi would become a continuous experience rather than a series of disconnected transactions.

For the avoidance of doubt, the proposed NPDOA is not envisaged as a dominant commercial PDOA competing with existing market participants. Rather, its role would be analogous to a neutral interoperability, trust and settlement layer that enables discovery, authentication, roaming and commercial settlement across multiple independent PDOAs while preserving competition and innovation at the service layer.

Crucially, the NPDOA should not function as a commercial PDOA, retail service provider, or market participant. Consistent with the principles advocated by Broadband India Forum and Dr. R.S. Sharma, the NPDOA should operate as a neutral, non-partisan, and non-discriminatory institution whose sole purpose is to facilitate interoperability, discovery, roaming, and settlement across the ecosystem.

Its role would be analogous to that of a clearinghouse, ensuring that all participating PDOAs operate on a level playing field without favouring any particular entity.

The model is comparable to the role played by NPCI within India's UPI ecosystem. NPCI does not compete with banks or payment applications. Instead, it provides the standards, infrastructure, and settlement framework that enable interoperability while preserving competition and innovation among market participants.

Similarly, PDOAs would continue to manage customer onboarding, compliance, customer support, pricing, and value-added services. The NPDOA would simply provide the common interoperability layer required to create a seamless national user experience.

The objective is not to centralise the ecosystem, but to connect it. Just as roaming frameworks transformed a collection of individual mobile networks into a cohesive national service, a neutral NPDOA can transform PM-WANI from a patchwork of disconnected hotspots into a trusted, interoperable, and scalable public connectivity infrastructure.

5.4.3 Technical and Governance Preconditions for Seamless Public Wi-Fi

While interoperability and roaming offer significant potential benefits for the PM-WANI ecosystem, their successful implementation requires a robust technical, operational and governance framework. Global experience demonstrates that seamless public Wi-Fi is not achieved through connectivity standards alone; it depends equally on trusted identity management, security frameworks, operational governance and commercial settlement mechanisms.

Emerging models such as OpenRoaming provide useful reference points. OpenRoaming enables automatic and secure connectivity across independently operated Wi-Fi networks through federated trust frameworks, allowing users to authenticate once and connect seamlessly across participating locations. However, such systems rely on clearly defined trust relationships among network operators, identity providers and platform administrators.

A future interoperable PM-WANI ecosystem would therefore require a number of foundational capabilities:

Identity and Trust Frameworks

- Federated identity management enabling trusted authentication across participating PDOAs.
- Clearly defined trust chains governing issuance, validation and revocation of subscriber credentials.
- Common standards for identity assurance and subscriber onboarding.

Authentication and Roaming Infrastructure

- Standards-based AAA (Authentication, Authorisation and Accounting) architecture, including RADIUS and related protocols.
- Support for Passpoint (Hotspot 2.0) and certificate-based authentication mechanisms.
- Interoperable roaming procedures across participating networks.

Security and Cyber Resilience

- Common security baselines and certification requirements for participating networks.
- Protection against credential theft, spoofing, fraudulent access and cyber-attacks.
- Defined incident response and threat-sharing mechanisms across ecosystem participants.

Lawful Traceability and Compliance

- Maintenance of lawful interception, auditability and subscriber traceability obligations consistent with applicable regulatory requirements.
- Clear allocation of compliance responsibilities across PDOs, PDOAs and interoperability providers.
- Standardised approaches to logging, record retention and security governance.

Settlement and Commercial Governance

- Transparent frameworks for roaming settlement, revenue allocation and dispute resolution.
- Standardised operational procedures governing interoperability between participating PDOAs.
- Neutral governance arrangements that preserve competition while enabling ecosystem-wide coordination.

These requirements do not diminish the value of interoperability. Rather, they highlight that seamless public Wi-Fi should be viewed as both a technical and governance challenge. As PM-WANI evolves, the development of common trust, security and settlement frameworks will be as important as the underlying connectivity infrastructure itself.

5.5 Building the Next Generation PM-WANI Architecture

The first phase of PM-WANI focused on enabling participation. The next phase must focus on enabling scale.

Infrastructure expansion alone will not achieve this objective. The ecosystem must evolve towards a model characterised by simplicity, continuity, interoperability, sustainable economics, and institutional confidence.

5.5.1 Reducing Friction at the Point of Access

User friction remains an important constraint on adoption, although it operates alongside broader factors including network density, awareness, service quality and deployment economics.Many global public Wi-Fi systems require one or two interactions before connectivity is established. PM-WANI frequently requires significantly more steps, including application discovery, registration, authentication, hotspot selection, payment, and session activation.

Each additional step reduces conversion rates, discourages repeat usage, and weakens network effects.

Reducing friction should therefore be treated as a strategic priority rather than merely a user interface improvement.

5.5.2 Beyond Captive Portals

The current architecture remains heavily dependent on captive portal-based access models.

While suitable during early deployment phases, captive portals are inherently transactional. Mature public Wi-Fi ecosystems increasingly rely on technologies such as Passpoint (Hotspot 2.0), certificate-based authentication, and seamless onboarding mechanisms that minimise user intervention.

The long-term objective should be a transition from:

- Session-based connectivity to persistent connectivity;
- Manual authentication to automatic authentication;
- Transactional access to continuous access.

Such evolution would significantly improve user retention, satisfaction, and adoption.

Enhancing Usability Through a Unified Subscriber Experience

One of the principal barriers to wider PM-WANI adoption is the fragmented user experience. Users frequently encounter multiple applications, repeated authentication requirements, inconsistent onboarding processes, and limited visibility of available hotspots. These frictions discourage spontaneous usage and reduce the likelihood of repeat engagement.

As the ecosystem matures, there is an opportunity for PDOAs and platform providers to simplify discovery, access, payments, and service continuity across multiple hotspots and networks. Capabilities such as interoperable hotspot discovery, seamless authentication, integrated payment mechanisms, and session portability can significantly improve ease of use while supporting greater adoption.

In parallel, platform-based tools such as usage analytics, customer insights, and network performance monitoring can help PDOs and PDOAs improve service quality, optimise operations, and strengthen commercial sustainability.

The objective is not to prescribe a specific application model, but to encourage the development of user-centric service layers that reduce friction, improve continuity, and enhance the overall PM-WANI experience.

5.5.3 Interoperable and Backhaul-Agnostic Architecture

The future architecture of PM-WANI should remain technology-neutral and backhaul-agnostic.

While fibre remains the preferred foundation for dense deployments, future growth will increasingly depend on integration across multiple connectivity environments, including fibre, fixed wireless, mobile broadband, and satellite-supported access.

This flexibility is particularly important in remote, low-density, and geographically challenging regions where conventional fibre economics may be less favourable.

The same principle applies to existing infrastructure assets. Earlier public Wi-Fi deployments, institutional networks, and legacy connectivity assets should be capable of integration into the PM-WANI ecosystem without requiring extensive redesign or replacement.

5.5.4 Regulatory Certainty and Ecosystem Confidence

The long-term success of PM-WANI depends not only on technology and economics, but also on confidence.

Entrepreneurs, PDOs, PDOAs, ISPs, and platform providers are more likely to invest when policy direction is clear and stable. Uncertainty regarding future regulatory treatment, compliance obligations, licensing interpretations, or market structure can discourage investment even when underlying economics are attractive.

Entrepreneur confidence therefore depends upon continuity and preservation of PM-WANI's light-touch character. Public Wi-Fi should be clearly positioned as a continuing and important component of India's broadband strategy. Ecosystem participants must have confidence that the framework is intended to evolve and mature rather than be reversed or replaced.

Regulatory certainty is not merely a policy objective. It is an economic enabler.

5.5.5 Privacy, Compliance and Trust by Design

As PM-WANI scales, compliance and trust must become foundational architectural principles rather than operational afterthoughts.

Privacy protection, consent management, data minimisation, session logging, security controls, and breach-readiness should be incorporated into common standards and platform frameworks.

Standardisation in these areas will improve not only compliance outcomes but also user confidence and institutional adoption.

5.5.6 Public Wi-Fi Ready Buildings and Campuses

As India expands its broadband infrastructure, attention should increasingly shift from individual hotspot deployment towards creating environments that are inherently capable of supporting public Wi-Fi services. International experience suggests that large-scale adoption is often accelerated when buildings, campuses and public facilities are designed with broadband and Wi-Fi readiness in mind.

A "Public Wi-Fi Ready" framework could encourage the incorporation of basic enabling infrastructure within commercial buildings, educational institutions, healthcare facilities, transportation hubs, government premises, public venues and large residential developments. Such readiness would not necessarily require active hotspot deployment, but would ensure the availability of key prerequisites including broadband connectivity, power, mounting locations, structured cabling, and suitable access point placement.

The objective would be to reduce future deployment costs, simplify installation, improve coverage quality and enable faster activation of PM-WANI services whenever required. Similar to the manner in which modern buildings routinely provide provisions for electricity, water, telecommunications and digital infrastructure, public Wi-Fi readiness can become an integral element of future digital infrastructure planning.

A Public Wi-Fi Ready framework would be particularly relevant for locations with high footfall and significant public interaction, including railway stations, bus terminals, airports, educational campuses, hospitals, municipal facilities, markets, shopping centres, convention venues and tourism destinations. Such an approach would strengthen the long-term scalability of PM-WANI while creating a larger pool of deployment-ready locations across both urban and rural India.

Importantly, the framework should be facilitative rather than prescriptive, focusing on voluntary adoption, model guidelines, incentives and best-practice standards rather than imposing additional regulatory burdens. By embedding Wi-Fi readiness into infrastructure planning today, India can significantly reduce deployment friction and accelerate the growth of public broadband access in the years ahead.

5.6 Chapter Conclusion

PM-WANI has progressed beyond the stage where its success depends solely on enabling participation. The framework has demonstrated that a decentralised, licence-free, entrepreneur-driven model for public Wi-Fi can function at scale. The challenge now is to transform a collection of independent deployments into a coherent national public access platform.

The path forward is increasingly clear. Structural strengths already exist. Regulatory reforms have improved viability. Demand for affordable high-capacity connectivity continues to grow. The next phase therefore depends on reducing user friction, strengthening interoperability, enabling sustainable economics, activating existing infrastructure, and providing long-term policy certainty.

The question is no longer whether PM-WANI can contribute meaningfully to India's broadband ecosystem. The question is how quickly it can evolve into a seamless, trusted, interoperable, and economically sustainable public connectivity layer capable of supporting the next phase of India's digital transformation.

CHAPTER 6:

Pathways to Scale: Platform Aggregation, ISP Participation and Sustainable Growth

The transition outlined in the previous chapter establishes the architectural direction required for PM-WANI to scale. However, architecture alone is insufficient. Public Wi-Fi ecosystems achieve scale when **three conditions converge simultaneously**: a viable economic model at the edge, a platform layer that aggregates fragmented supply, and an expansion pathway that leverages existing infrastructure rather than relying solely on new deployment.

At present, all three conditions exist in partial form within the PM-WANI ecosystem, but they do not operate in alignment. The result is a system that demonstrates viability in pockets but has not yet translated into sustained, national-scale growth.

This chapter examines how these elements can be brought together into a **scalable ecosystem model**, with particular focus on the role of platform consolidation and ISP-led expansion.

6.1 From Fragmentation to Platform Scale

The PM-WANI framework was intentionally designed as a decentralised system. However, decentralisation without aggregation leads to fragmentation.

This fragmentation has two direct consequences. First, it prevents the formation of network effects, as users do not perceive the ecosystem as a unified access layer. Second, it limits commercial viability, as traffic and revenue remain dispersed rather than aggregated.

A platform layer is therefore not an optional enhancement. It is the **central scaling mechanism**. Global precedents reinforce this point. Public Wi-Fi ecosystems that have scaled successfully—whether in airports, cities, or national programmes—have relied on a platform that aggregates fragmented infrastructure into a unified service layer. The value of the network emerges not from the number of access points, but from the **coherence of the user and operator experience**.

Public Wi-Fi must evolve from fragmented hotspots into an integrated broadband platform ecosystem using interoperable platform layer; unified service discovery; scalable onboarding and platform economics. It may be more practical to consider **Cluster-based deployment in** Markets; Universities; Hospital districts; Tourism zones; Commercial streets; Transport areas; etc. User value arises from zones rather than isolated hotspots.

Fragmented Ecosystem vs Platform-Led Scale

Dimension	Current PM-WANI State	Platform-Led Model
PDOA structure	Multiple small providers	Aggregated platform layer
User access	App fragmentation	Unified discovery
Network perception	Disconnected hotspots	Single network experience
Revenue distribution	Thin, fragmented	Aggregated and scalable
Growth pattern	Linear	Network-driven

6.2 The ISP-as-PDOA Model: Unlocking Existing Infrastructure

While platform aggregation addresses fragmentation, the question of expansion remains. The most viable pathway does not lie in building new networks from scratch, but in **activating existing broadband infrastructure through the ISP ecosystem**.

India has over 6,000 small and mid-sized ISPs, many of which operate localised fibre networks with limited service diversification. These networks already reach into residential clusters, markets, and semi-urban areas—precisely the environments where PM-WANI is most relevant.

However, most of these ISPs do not operate as PDOAs. The primary constraint is not intent, but capability. Building a compliant PDOA stack requires:

- platform development
- regulatory integration
- billing and analytics systems
- subscriber management

For most regional ISPs, this represents a prohibitive barrier.

Public Wi-Fi proliferation is unlikely to scale unless telecom operators derive clear commercial value from the ecosystem.

Managed hotspot arrangements can improve spectrum efficiency, reduce congestion and lower future cellular densification costs.

Commercial establishments may function as broadband customers procuring managed hotspot capability rather than independent telecom operators.

The ISP-as-PDOA model addresses this constraint by **decoupling platform capability from network ownership**. Under this model, ISPs can adopt a **white-label PDOA platform**, enabling them to activate PM-WANI services across their existing footprint without building their own technology stack.

ISP-Led PDOA Model: Structural Advantages

Factor	Traditional Expansion Model	ISP-as-PDOA Model
Infrastructure requirement	New deployment	Uses existing FTTH networks
Time to scale	Slow	Rapid activation
Platform cost	High (per ISP)	Shared (SaaS model)
Market reach	Limited	Immediate local penetration
Operational control	Centralised	Distributed

Why This Model Is Structurally Strong

The ISP-as-PDOA approach aligns with the fundamental design principles of PM-WANI:

- It leverages **existing last-mile infrastructure**
- It enables **distributed entrepreneurship through PDOs**
- It reduces **time-to-market for deployment**
- It avoids duplication of platform investment

More importantly, it transforms PM-WANI from a policy-driven initiative into a **commercially viable extension of ISP operations**.

This model is particularly relevant for Tier 2 and Tier 3 markets, where local ISPs already maintain customer relationships and network presence. By enabling these operators to function as PDOAs, PM-WANI can scale organically through **existing distribution channels rather than new rollouts**.

Illustrative Scaling Model: ISP-Led PM-WANI Expansion

Parameter	Assumption	Rationale
Total ISPs in India	~6,000	Industry estimate (small + mid ISPs included)
ISPs adopting PDOA role	20% (1,200 ISPs)	Conservative adoption scenario
Avg PDOs per ISP	50	Localised cluster deployment (markets, streets, institutions)
Total PDOs activated	60,000	Early-stage scalable footprint
Avg daily users per PDO	20 users	Low-to-moderate utilisation assumption
Total daily users	12,00,000	Network-level aggregation
Avg revenue per user	₹5–10	Sachet pricing + blended model
Daily ecosystem revenue	₹60–120 lakh	Across all PDOs
Annual ecosystem revenue	₹220–440 crore	Conservative range
Additional revenue streams	Ads, referrals, FTTH upsell	Not fully captured above

6.3 Economics at Scale: From Edge Viability to Network Profitability

A recurring concern in public Wi-Fi models is the sustainability of unit economics. At the level of an individual PDO, margins are often modest and dependent on local demand conditions. However, the economics of PM-WANI must be evaluated at the **network level**, not at the node level.

When aggregated across multiple PDOs, revenue streams diversify and scale.

6.4 Public Investment as a Catalyst, Not a Substitute

Global public Wi-Fi programmes have typically relied on targeted public funding to achieve initial scale. PM-WANI, in contrast, has largely depended on market-driven expansion.

While this approach ensures efficiency, it also slows deployment in areas where commercial viability is marginal.

Targeted intervention—particularly in the form of **equipment subsidies and infrastructure activation support**—can accelerate adoption without distorting the market

Public Investment Impact Pathway

Intervention	Immediate Effect	System Outcome
PDO capex support	Lowers entry barrier	Increased participation
BharatNet integration	Activates idle assets	Faster scale
Policy enforcement	Aligns pricing	Restores viability
Platform standardisation	Reduces fragmentation	Improves utilisation

Medium-Term Scale Scenario

Parameter	Value
ISPs onboarded	2,000
PDOs per ISP	100
Total PDOs	2,00,000
Daily users	40–50 lakh
Annual revenue potential	₹800–1,200 crore

Even under conservative assumptions, PM-WANI demonstrates the characteristics of a **scale-driven network economy**, where viability improves with aggregation rather than at the individual node level.

There needs to be some form of Anchor institutions for economies of scale such as GP offices; PHCs; CSCs; schools; stations; post offices to give PDOs steady revenue.

Other opportunities are integration with BharatNet ; adoption by Smart Cities; Municipal participation and District Wi-Fi plans.

Promote a Public Wi-Fi Ready Infrastructure Framework

- Develop voluntary guidelines for Public Wi-Fi Ready buildings, campuses and public facilities
- Encourage incorporation of broadband and Wi-Fi readiness in new public infrastructure project
- Prioritise transport hubs, educational institutions, healthcare facilities and high-footfall public venues
- Facilitate low-cost future deployment of PM-WANI services through infrastructure preparedness

6.4.1 Spatial Planning Framework for Public Wi-Fi

India's Public Wi-Fi expansion challenge is not merely one of increasing hotspot numbers, but of creating a spatially distributed, commercially sustainable and socially meaningful broadband access layer. Public Wi-Fi proliferation must therefore be approached as a digital infrastructure planning issue, similar to the planning of fibre routes, mobile towers, transport systems and other public utilities.

The current deployment model remains fragmented and location-specific, resulting in isolated hotspots, weak continuity and limited user habit formation. A more effective approach would involve planned deployment based on footfall, mobility patterns, institutional demand, fibre availability, commercial activity, public service delivery points and digital inclusion priorities.

A spatial planning framework for Public Wi-Fi may therefore help transition India from scattered hotspot deployment toward dense, discoverable and interoperable Wi-Fi ecosystems across urban, semi-urban, rural and underserved geographies.

6.4.1.1 Hotspot Clusters

The first strategic step in spatial planning should be the transition from isolated hotspots to hotspot clusters. Public Wi-Fi becomes significantly more valuable when users experience predictable and continuous connectivity across a defined zone rather than at a single isolated point.

Accordingly, deployment may be prioritised in identified high-footfall Wi-Fi zones such as:

• markets and commercial districts,	• tourism centres,
• railway station areas,	• public parks,
• bus terminals,	• government service centres,

• university zones,	• dense residential-commercial neighbourhoods.
• hospital districts,	

Cluster-based deployment can generate stronger network effects by:

• improving user familiarity,	• improving discoverability,
• increasing repeat usage,	• enhancing commercial viability for PDOs and PDOAs.
• supporting roaming continuity,	

Such clusters may also support future interoperable roaming frameworks and platform-led aggregation models as the ecosystem matures.

6.4.1.2 Public Wi-Fi Corridors

The second strategic step should involve the creation of Public Wi-Fi corridors aligned with user movement patterns rather than purely administrative boundaries. Connectivity demand often exists not merely at static locations but across transit and mobility routes.

Potential Public Wi-Fi corridors may include:

• tourism and heritage circuits,	• educational corridors,
• religious corridors,	• industrial clusters,
• public transport routes,	• market streets,
• railway and metro corridors,	• and rural service corridors.

Such corridor-based planning can improve continuity of connectivity across travel paths and public movement zones. It may also strengthen digital access for tourism, commerce, public transport and public service delivery.

Corridor models can be particularly valuable in India due to:

- high commuter mobility,
- large public transport dependence,
- tourism concentration,
- and dense mixed-use urban environments.

Over time, such corridors may evolve into interoperable broadband access layers supporting seamless roaming and location continuity.

6.4.1.3 Anchor Institutions

For rural, remote and underserved geographies, an anchor institution model may provide a more practical and sustainable deployment pathway than purely market-led expansion.

Under this approach, Public Wi-Fi deployment may initially focus on institutions that already function as community access nodes, including Gram Panchayat offices, schools and colleges, primary health centres, Common Service Centres (CSCs),post offices, railway stations, bus stands, and local government facilities.

Such institutions already possess:

- community relevance,
- regular public footfall,
- basic infrastructure availability,
- and trusted local presence.

Once anchor locations are connected, nearby commercial establishments and local entrepreneurs may gradually extend the Wi-Fi layer into surrounding areas.

This approach may be particularly effective when integrated with:

- BharatNet infrastructure,
- state fibre networks,
- Smart City infrastructure,
- and local digital governance programmes.

Anchor institutions can therefore serve as the foundational nodes for broader neighbourhood-level Public Wi-Fi expansion.

6.4.1.4 District Wi-Fi Plans

The final strategic step should involve development of district-level and city-level Public Wi-Fi plans aligned with local infrastructure, economic activity and digital inclusion requirements.

Such plans may identify:

• priority hotspot clusters,	• available fibre infrastructure,
• underserved areas,	• municipal assets,
• transport corridors,	• likely business models,
• public service delivery points,	• and responsible implementation agencies.
• tourism zones,	

District Wi-Fi plans may also facilitate better coordination between:

• municipalities,	• Smart City agencies,
• Panchayats,	• BharatNet implementation agencies,
• ISPs,	• utility infrastructure providers,
• PDOAs,	• local trade associations.

Importantly, these plans should focus not merely on numerical hotspot targets, but on:

• usability,	• inclusion,
• continuity,	• commercial sustainability,
• density,	• and long-term ecosystem viability.

Such a planning-led approach may help create dense, discoverable and geographically inclusive Public Wi-Fi ecosystems capable of supporting broadband proliferation, public service delivery and broader digital transformation objectives.

CHAPTER 7:

Recommendations

The pathway to scale for PM-WANI requires coordinated execution across policy, platform, and ecosystem layers. The following recommendations are structured for clarity, prioritisation, and immediate action.

7.1 For Government and Regulators

Correct residual economic distortions

- Enforce broadband tariff parity for PDOs across all service providers
- Prevent reintroduction of enterprise-grade pricing structures for public Wi-Fi
- Ensure uniform compliance across telecom operators

Mandate PM-WANI compliance across all public Wi-Fi deployments

- Require all government-funded and Smart City Wi-Fi to be PM-WANI compliant
- Integrate institutional Wi-Fi (railways, airports, hospitals, campuses) into the framework
- Eliminate parallel, closed Wi-Fi systems

Enable a unified national access layer

- Establish a common discovery and authentication framework
- Enable interoperability across PDOAs
- Ensure PM-WANI is experienced as a single network

Accelerate conversion of existing infrastructure

- Integrate BharatNet hotspots into PM-WANI
- Activate legacy public Wi-Fi deployments
- Focus on utilisation rather than new deployment

Introduce targeted catalytic support

- Provide one-time capex support for PDO enablement in low-viability areas
- Prioritise rural clusters, public institutions, and underserved zones
- Link support to activation and usage outcomes

Standardise procurement frameworks

- Move from hardware-led tenders to outcome-based models
- Eliminate reverse revenue share and non-viable contract structures
- Ensure lifecycle sustainability in all deployments

Provide regulatory clarity and continuity

- Clearly define PM-WANI positioning under telecom and data governance frameworks
- Reduce ambiguity for ISPs, PDOAs, and platform providers

Maintain policy consistency to encourage long-term investment

Adopt Outcome-Based Public Wi-Fi Metrics

- Complement hotspot deployment targets with metrics such as active users, data consumption, hotspot density and utilisation levels
- Establish standardised reporting methodologies across the PM-WANI ecosystem

- Publish periodic national and state-level public Wi-Fi adoption indicators
- Use outcome-based metrics to guide policy interventions and investment priorities

7.2 For PDOAs and Platform Providers

Build full-stack platform capability

- Integrate authentication, billing, compliance, and analytics
- Provide end-to-end operational support for PDO networks
- Position PDOA as the core operating layer of the ecosystem

Resolve user experience fragmentation

- Enable unified or interoperable app access
- Reduce connection steps to near-zero
- Ensure seamless onboarding and repeat usage

Expand monetisation beyond connectivity

- Integrate advertising and sponsored access models
- Enable referral-based revenue streams
- Support local commerce and service discovery

Adopt multi-tenant, ISP-enabled platforms

- Offer white-label PDOA solutions for ISPs
- Enable rapid onboarding without infrastructure duplication
- Support distributed scaling across regions

Focus on cluster-based deployment

- Prioritise high-density zones such as markets, transport hubs, and campuses
- Build network effects through local concentration
- Avoid isolated hotspot deployment

7.3 For ISPs and Network Providers

Adopt the ISP-as-PDOA model

- Extend FTTH networks into public Wi-Fi
- Leverage existing infrastructure and customer base
- Use PM-WANI as a natural extension of broadband services

Participate in platform-led aggregation

- Integrate with PDOA platforms for scalability
- Avoid fragmented and standalone deployments
- Enable interoperability across networks

Enable Wi-Fi offload as a strategic layer

- Shift high-volume traffic to Wi-Fi networks
- Reduce spectrum congestion in dense environments
- Improve indoor connectivity performance

Develop localised distribution ecosystems

- Partner with retailers, institutions, and community spaces
- Build distributed PDO networks
- Strengthen last-mile engagement

7.4 For Public Institutions, Municipal Bodies and Asset Owners

Leverage public infrastructure as digital access assets

- Enable PM-WANI deployment across schools, colleges, hospitals, transport hubs, libraries, community centres and public buildings
- Treat public Wi-Fi as a digital service enabler rather than a standalone connectivity project
- Prioritise utilisation and service outcomes over infrastructure deployment targets

Adopt sustainable operating models

- Partner with PDOAs and local service providers for ongoing operation and maintenance
- Avoid infrastructure-only deployments without clear ownership and revenue models
- Incorporate lifecycle sustainability into all public Wi-Fi initiatives

Integrate public connectivity with digital services

- Use PM-WANI to support e-governance, education, telemedicine, digital payments and citizen services
- Enable seamless access to public digital platforms through Wi-Fi-enabled environments
- Encourage local content, community services and citizen engagement initiatives

Facilitate high-density public access zones

- Prioritise deployment in markets, transport corridors, tourism locations and civic spaces
- Create contiguous coverage zones rather than isolated hotspots
- Coordinate deployment with Smart City and urban digital infrastructure programmes

7.5 Cross-Cutting Strategic Priorities

Shift from infrastructure to usage metrics

- Measure success through active users and data consumption
- Move beyond hotspot deployment counts

Enable network behaviour over fragmented access

- Ensure portability and seamless connectivity
- Build continuity across locations

Scale through aggregation, not duplication

- Integrate supply through platform layers
- Build demand through unified access

Focus on execution over design

- Leverage existing policy framework
- Prioritise alignment and implementation

Notes

Notes