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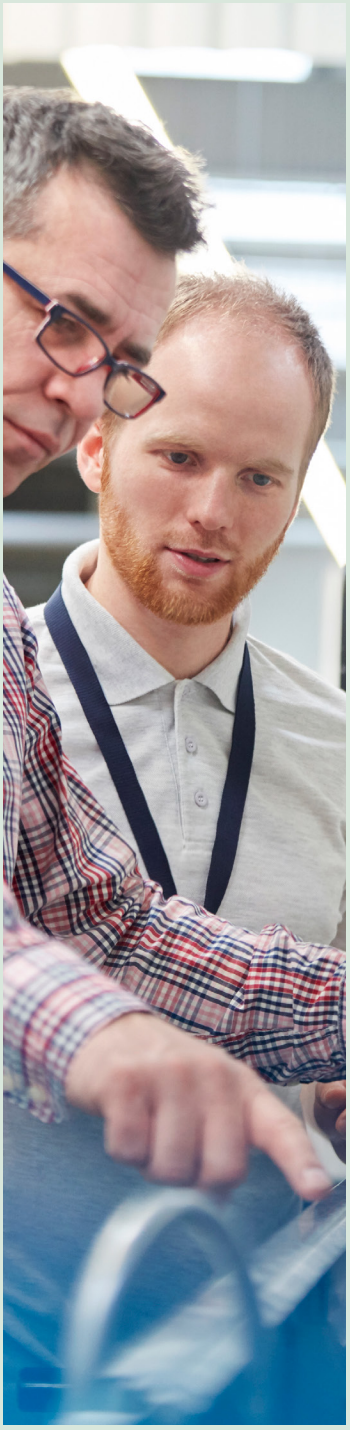
WHITE PAPER



HARNESSING AI FOR SMART FIBER ROLLOUT LIFECYCLE MANAGEMENT

Abstract

The fiber optic network is expanding across domains with unprecedented rates that calls for more articulate and sophisticated planning and management services. This whitepaper discusses possible benefits of the integration of state-of-the-art technologies, including Artificial Intelligence (AI) and Machine Learning (ML), into fiber network design rollout services and field force management. By means of AI-enabled solutions, telecommunications operators can significantly improve overall service quality, optimize network design, and hasten response times for new service connections and assurance services.

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Introduction

The global industry is witnessing huge transformation in the post-pandemic scenario, powered by technology, more so by Generative AI. The solutions of industry-specific needs are deeply dependent on fiber networks, as they require a strong network backbone. And Fiber deepening is more critical for Public 5G Rollout expansion and Private Networks as well. There is a unique connect between artificial intelligence and fiber optic networks, with each driving the growth and innovation in the other. Just as AI applications will grow in sophistication and data requirement, resilient fiber optic infrastructure becomes increasingly needed. In turn, the high speed and efficiency of fiber optic networks enhance the processing and analysis of data by AI systems at speeds never seen before, opening new innovations across industries

Based on Fortune Business Insights reports, the global fiber optics market is set to record a compound annual growth rate of about 8.9% from 2022 to 2030 and reach over USD 8.22 billion by 2024, growing up to USD 11.5 billion by 2030. But is the industry ready for such a growth rate? Do we have the technology that can meet such future demands for fiber rollout? Let's have a thorough understanding and discussion on the various stages of the network planning life cycle, its challenges and possible AI-driven solutions to improve the adoption rate.

Fiber Network Planning & Life Cycle Operations

Fiber network roll out processes pass through different phases from planning to operations. An estimated 20-25 percent of the total labor goes into desktop related activities involving planning, design, and network inventory management. Majority of the fieldwork is done at the stage of Network Construction and on-field activities during the Activation and Assurance stages, which contributes to a major percentage of capital expenditures. Understanding the different phases and activities involved during various stages of network rollout is important before dwelling into complexities and challenges. This helps to provide a complete perspective on the subject matter for better enablement in understanding the problem-solving process.

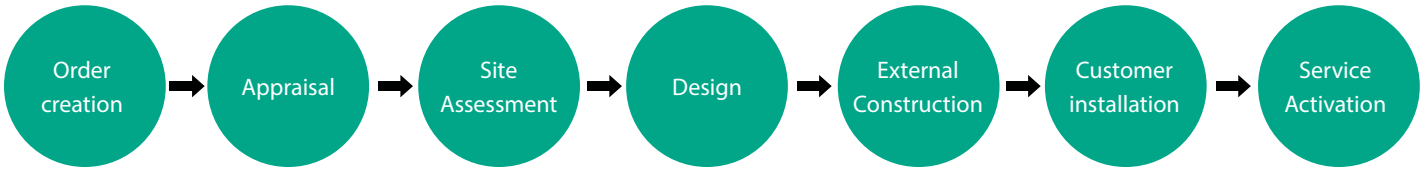

Figure 1: Network Rollout Process

A. Capacity & Demand Management:

In this pre-planning phase, the demand and capacity for a particular area are determined to kick off the planning process. The planning activities are a combination of automation including network usage data analysis and involves human functions, including the marketing.

B. Inside Plant (ISP) Plan and Design:

This is the intelligent part of the optical network, where the planning and design for the exchanges and aggregation networks take place. It also covers the in-building planning of large multi-dwelling units. The processes of planning and design are carried out predominantly in a semi-automatic fashion with the involvement of technology and human interventions.

C. Outside Plant (OSP) Plan and Design:

This is possibly the most crucial phase, as it lays the cost and effort required to connect an end user. It involves planning and designing the network equipment, cable, and infrastructure on the streets to connect the end-user premises with the exchange. A lot of engineering and fiber standards must be followed to ensure connectivity is effective; this, therefore, is also a highly manual and resource-intensive process

D. Network Construction:

This phase arguably be described as the most cumbersome and capital-intensive activity in fiber rollout lifecycle. This includes trenching along roads, diversion of heavy traffic, laying network equipment and cables, and ensuring that all is implemented according to the design specifications. This machinery-intensive construction requires very high CAPEX and labor input investment.

E. Network Activation:

The Order to Activate stage encompass number of last-mile activities, including the installation of termination devices, customer support, appointment scheduling, and field force support services. In addition, this stage covers quite significant field and back-office services, such as contact center operations and field fleet management

F. Service Assurance:

This phase is one of the most important stages focusing on Customer Experience and managing the brand of a telecommunications provider. It involves extensive field force activities to handle any problem that may pop up for an active customer. This department requires quite substantial OPEX to manage field fleets and contact center operations to offer extensive support to customers and field activities.

Table 1: Network Rollout phases

To summarize, the typical flow of activities throughout the lifecycle, along with the associated costs and efforts distributed across the various stages, is illustrated in the figure below.

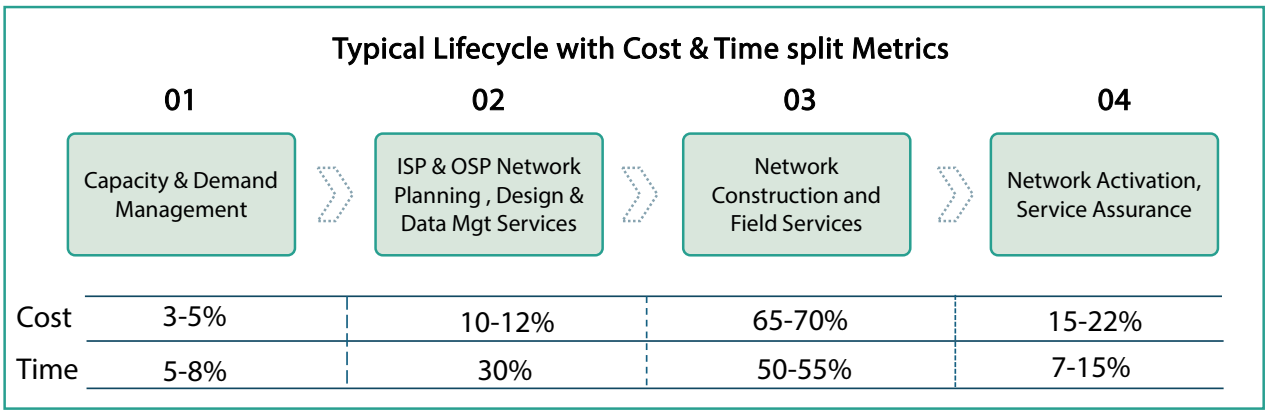

Figure 2: Fiber Network Lifecycle Cost & Time Metrics

Challenges in Network Rollout Life Cycle

Having understood the phases and activities of the Fiber Rollout, now let us look at the typical challenges faced by service providers and NetCo providers for an optimized Fiber network rollout.

The categories include analyzing potential geographies to maximize service uptake, developing optimal plans and network designs, ensuring construction adheres to planned timelines and budget constraints, enhancing customer experience through timely activations, and maintaining high customer advocacy by ensuring reliable network availability and speeds.

The table below depicts key challenges under these categories and highlight the impact it can cause across Cost, Quality and Time.

Category	Challenge Description	Impact
Develop Optimal Network Plan	• Concerns with quality of Inventory Data • Plan & Design done with data limited to local telco network • Terrain, Environment, elevation& Zone (e.g.: mountain, crossing river, railways etc.) not considered • Historic As-builts and construction data not considered • Fragmented & legacy IT landscape with highly manual data consumption for design • Very high cycle time with multiple systems and handovers	• High Average Handling Time • Medium to high rework and rejections • Increased construction cost due to in-field changes • Overall impact to time and cost
On-Time Construction	• Multiple in-fled changes happening including the changes to design considerations, machinery required due to wrong terrain, traffic diversion requirement due to no zoning considerations, delay due to no weather checks.	• Increased construction time and blowing budgets
Order Fulfillment and activation	• Data quality issues for Last mile network elements • Multiple appointment requirements due to challenges with accurate technician fleet management • Multiple Customer and field interaction requiring high contact center involvement. • Fragment IT and system landscape causing increased interaction time	• Dented Customer experience • High Field costs due to multiple truck rolls • High contact center costs due to multiple interactions and systems.
Service Assurance	• Lack of related Assurance ticket correlation • Lack of consideration of natural events like weather for ticket suppression • Lack of systemic Field fleet management and on-field diversions • Lack of predictive outage analytics and customer communication • Lack of proactive assurance to prevent any outages. • Very high contact center interaction and high interaction time	• High truck roll & multiple truck rolls for same issues. • Impact to customer advocacy and experience • Increased OPEX for service maintenance.

Table 2: Rollout Challenges and Impact

Potential Solutions to address the challenges

To effectively address these challenges, a multi-faceted strategy to effectively improve Average Handling Time, customer experience, and cost efficiencies for both the telecommunications company and its clientele is highly recommended. The core areas which will bring in efficiency are as follows.

AI, GenAI & Automation:

Use of advanced automation technologies including AI, GenAI for efficient operations, predictability for Cost-Quality-Time, reduced manual intervention, and facilitation of delivery efficiency and improvement.

Contracts and Operational Model:

Review and enhance the contracts and operational model for flexibility, scalability, and alignment to business objectives.

Partnerships & Tenure:

Foster strategic partnerships and leverage long-term relationships to enhance service offerings and innovation.

Process and Interaction Streamlining:

Simplify and standardize all processes and customer interactions to reduce complexity and minimize handling time, thereby increasing customer satisfaction.

Among these methodologies, our research indicates that artificial intelligence and automation can bring in higher cost efficiencies at a faster pace for Fiber Network rollout.

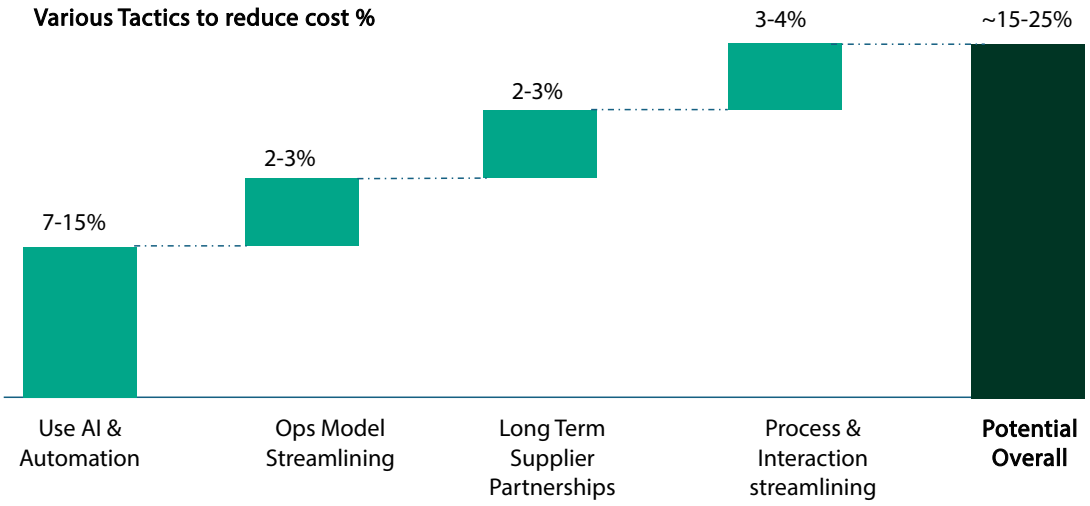

Figure 3: Rollout Optimization Tactics

AI-Driven Automation Strategies to Accelerate Fiber Rollout

The current stage analysis reveals that conventional automation is already in place and operational to some extend within large telecommunications ecosystems to address various concerns. However, with the support of traditional AI and the evolution of generative AI, there is a significant opportunity to achieve extreme automation, delivering results more rapidly with enhanced precision and accuracy. We will explore some potential AI driven solutions that can facilitate faster and cost-effective network rollouts

Solution	Description
A. Intelligent Network Design and Planning The solution to address all the contributing agents that cause design re-work, minimize on-field variations, and meet the capacity demand that would be required in the immediate future. This will indeed promise more accuracy and reliability for the network design and planning process.	• An Intelligent Network Plan/Design generator too; with a trained model having GIS/ Terrain/Zoning data/Historic As Built/local council forecast data. These data to form the base for new Plan/design generation • Zero touch automation that will integrate with source and destination to create the Initial Network Plan • A Zero-disruptor solution that will act as an overarching layer on top of legacy fragmented IT landscape

B. Gen-AI MOP / Bill of Material Generator The solution is designed to significantly enhance the accuracy and reduce the time required to generate design deliverables and BOM/BOQ requirements	• Generative AI can accurately gather specific network design patterns and determine the necessary equipment and labor requirements to produce detailed construction documentation, including Bills of Materials and Quantities. This capability helps the telecommunications providers to plan budgets more effectively and ensure construction projects are completed within the timelines
C. Image / Video Analytics for Field Surveys and preplanning Image analytics solution can obtain the field images from the satellite imagery sources (e.g. google street view) and can eliminate >80% need of field force to perform the survey	• Implement image analytics to assess existing utility capacities. Integrate these existing infrastructure capacities into new design plans to minimize construction costs.
D. Field Turf Optimization The solution featuring flexible technician routing aims to reduce multiple truck dispatch rates, enhance same-day appointment completion rates, and, through dynamic work allocation, minimize idle time per task to maximize technician productivity	• AI-ML bases solution to create heatmap based turfing and routing for technicians on the field. • Data driven near real time tech routing and integrated workshare environment based on next best available technician to attend a fault or Activation.
E. Field Technician & Network Designer Support Co pilots The solution is designed to eliminate the need for human interaction in responding to low to medium complexity queries and deterministic solutions. This also significantly support to bring down the need for highly skilled network designers.	• During the construction phases, extensive back-and-forth discussions between the desk team and the field team usually occur due to the design data and on-field discrepancy. These interactions can delay on-ground construction due to the time required for the desk team to validate requests and provide new solutions if necessary. Deploying generative AI-based co-pilots can support the field force by providing immediate responses to any design-related questions and there by improved time. • During the design phase, for any minor design updates and changes in network alignments, the design team often needs to refer to multiple inventory systems and sometimes manually write SQL queries to fetch the necessary input for updating the designs. This process is often extremely time-consuming and can be very prone to human bias. Generative AI-based co-pilots have the potential to alleviate this process significantly by allowing queries to be presented in a natural language format that the system processes and generates the needed information
F. AI Driven Service Assurance With an aim to reduce truck rolls and avoid Opex wastage.	• Ability to bring in Service to Network alarm correlation and noise reduction to improve truck roll pattern. • Implement geo-based alarm and ticket suppression to manage truck roll surges caused by weather events or planned outages. • Implement fault prediction management to enhance remote resolutions and significantly reduce truck roll wastage.
G. Virtual Agents and Omni Channels for Customer Contact Centre. Leverage technology to enhance the experiences of customers, field agents, and desktop agents, with the goal of improving overall average handling time (AHT) and reducing human dependency in contact centers.	• Virtual agent with Gen-AI capability for addressing the first-layer interactions for Customers and field force. • Contextual and Semantic search capability for live agents to remove swivel-chair approach for identifying issues. • Intelligent nudges and Gen-AI content creation capabilities for quick responses and improving Agent / Customer experience. • Utilize interaction analytics to identify patterns and make data-driven decisions to minimize future interactions

Table 3: AI & GEN-AI for Network Planning LC

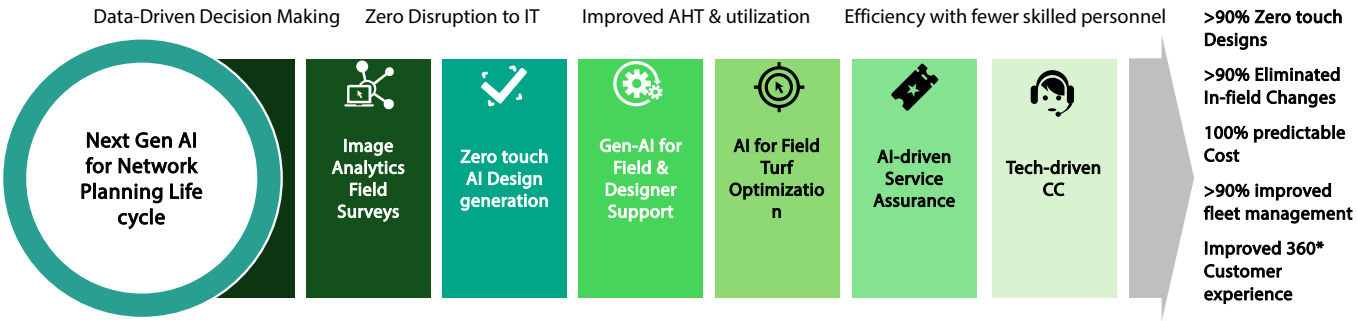

Figure 4: A new look for Next Gen AI enabled Network Life Cycle

Conclusion

The demand for higher bandwidth and reliable networks is growing, which forces telecom operators to invest heavily in connectivity. Telcos across the globe are being put under immense pressure from competitors to reduce costs, accelerate time-to-value, enhance customer experience, and maintain market share while improving the same. This whitepaper aims to explain the challenges faced and to demonstrate how AI can accelerate success for a telecommunications company at various lifecycle stages of Fiber Network Rollout.

It is evident, however, that engineering standards, budget sizes, rollout targets, IT ecosystems, and data quality vary across regions and different telecommunications companies. While a framework solution may work in solving common challenges that various telecommunications companies face, there is certainly a need for pointed AI solutions to ensure quicker return on investment, to capitalize on quick wins, and to meet market commitments. This paper has been structured in that direction to share the possibilities of AI in Fiber rollout journey for all its stakeholders.

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Thank You

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