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REIMAGINING ICT DEPLOYMENTS WITH INTELLIGENT BUILD AND CONSTRUCTION DIGITIZATION

By Subbu Maiyappan and Manja Thessin, RCDD, RTPM

The recent acceleration in the adoption of digital technologies has been remarkable. Automation and technologies, such as artificial intelligence (AI), predictive analytics, and the Internet of Things (IoT), are enriching everyday lives and driving change everywhere.

People find themselves in an unprecedented period of demand for network infrastructure. The ICT industry is facing added pressure due to significant challenges in the supply chain and a constrained labor market. This means that funding is no longer the main constraint to deploying digital infrastructure. Amid this spike in demand for connectivity, the challenge has shifted to the need for efficiency.

As the digitization and virtualization of business and society continues, more and more demands are placed on the ICT industry because of the immense amount of potential it holds. To realize this potential, the industry must undergo a transformation. A paradigm shift, one that alters the way businesses operate on a fundamental level, is needed in today's demanding climate.

CHALLENGES FACING THE ICT INDUSTRY

The ICT companies are up against an irrefutable fact—a shortage of high-quality talent. It is nearly impossible to browse today's headlines without coming across multiple references highlighting the tough talent environment. This phenomenon has been building for some time. Over the last ten years as baby boomers have begun to retire, younger generations have not shown the same amount of interest to enter the industry. The ICT talent requirements are often specialized and require training. As companies are faced with getting technicians onto job sites as quickly as possible, good practices and training in areas of process and governance are often neglected.

ICT professionals and companies are under insurmountable pressure to deliver infrastructure projects within shorter timelines. This is further exacerbated by schedule compression caused by project delays.

Construction project delays are an industry-wide norm. Large construction projects typically take 20 percent longer to finish than scheduled and are up to 80 percent over budget.[1] The construction industry is lagging significantly behind in embracing efficiency improvements.

It is estimated that construction labor productivity has grown at only 1 percent over the past two decades, which is less than half of the cross-industry average of 2.8 percent. Inefficiencies are seen as having the biggest impact on project timelines, bringing with them consequences such as cost and time overruns.

Miscommunication and poor project data account for 48 percent of all rework on US construction jobsites. Workers, on average, spend five and a half hours per day hunting down project data, such as revised drawings, material cut sheets, and other information relevant to the job. Four hours in an average week are spent on rework-related activities, such as managing the mistakes on a project that resulted in rework, assessing the associated costs, and determining why the mistakes happened in the first place.[2] It is hardly surprising that this has a negative impact on the project's schedule.

Email is still the prevalent industry-preferred medium of document collection and reporting. The handoff of data is manual and inefficient. Operating with a manual approach in today's fast-paced, complex environment often delivers unintended consequences, such as fragmented information handoff between the workforce and systems, loss or misinterpretation of information, lack of project visibility, and data integrity, as well as lengthy post-commissioning and closeout processes.

The complexity of project documentation requirements is relative to the project scope. The larger the project, the more teams and scope requirements there are, and ultimately the more project documents there are to collect, track, and maintain. The more projects in progress, the higher the risk on accuracy, timeliness, and completeness. Owners and contractors often work from different versions of reality. Unless frequent onsite audits are conducted, there is often no real-time visibility into project execution, forcing stakeholders to trust reports from the field and make assumptions. It is difficult to audit and act on things that cannot be seen.

It is widely known that historical performance analytics can lead to better outcomes and risk management. The use of paper and fragmented reporting makes it difficult to capture and analyze data. Incomplete and inaccurate records also regularly incite disagreements between owners and contractors on such matters as project progress, change order reconciliation, and claims management.

Receiving payment for goods and services is the lifeblood of any company. With payment timelines often at 90 days or longer, making sure that project payment applications are approved in a timely manner is essential for a company's cash flow. Most ICT contractors are quite adept at planning and performing the contracted work, but there is often a gap between work completed and work documented in a manner acceptable to the customer. This approval process is usually completed with a closeout package (COP). The COP must demonstrate that the contractor completed all tasks satisfactorily.

Managing, developing, and delivering accurate COPs and gaining quick acceptance is a detailed, costly task often underestimated during the bidding process. Incorrect COPs may result in return visits to the site, rework by project managers and administrators, a strain on business relationships, and concurrent delays in payment.

The average cost of rework on projects exceeds 12 percent. Design deviations, which include unapproved changes, errors, and omissions, account for roughly 80 percent of the increased costs, while approved construction scope deviations make up only 20 percent.[3] Inefficiencies and stoppages due to rework are costly to all parties concerned and often result in significant losses in time and quality.

LEVERAGING DIGITAL TRANSFORMATION

It has become increasingly clear that the traditional approach to infrastructure deployment management is no longer feasible. Enabling fast, consistent, and accurate deployment of networks requires a paradigm shift, a complete life cycle solution that addresses key infrastructure deployment challenges. Automation and data coordination are essential to operating with the principle of build it right the first time.

A solution is needed connecting the individual silos of data—combining passive infrastructure, the construction process, and mobile and cloud technology to create a single, integrated, interactive source of data for ICT builds. An ecosystem of tools is coming into existence that can be woven together into an optimized solution to address this, combining everything from manufacturing to network turn-up and activation. This is called an intelligent build solution.

An intelligent build solution combines elements of construction digitization, software-as-a-service (SaaS), electronic identification, such as radio-frequency identification (RFID), near-field communication (NFC), and artificial intelligence (AI). These are not new concepts. They are part of the digital transformation reshaping all areas of business today, fundamentally changing how companies operate and deliver value to their customers. All these technologies help organizations compete in a digitally transformed world that will improve the customer experience through real-time, data-driven transactions, while uncovering new opportunities for growth.

Every business must embrace digital transformation if it has ambitions to scale. Research suggests that digital transformation can result in productivity gains of 15 percent, as well as contribute to a 4 to 6 percent reduction in project costs.[4] Additional benefits cited are greater levels of visibility into project execution and the opportunity this offers to offset the efficiency impacts brought on by the lack of a skilled workforce.

FIBER BLOCKCHAIN–A VISION

An end-to-end intelligent build solution is designed to augment traditional ICT business systems and operations. Imagine a digital journaling solution that captures the life of an optical fiber cable or passive optical component and follows it from cradle to grave—from the time it is made in the manufacturing plant, to its installation into a network, through subsequent moves or reconfigurations, until the end of its life when it is eventually decommissioned.

By managing data collection, checklists, and reporting for multiple phases of a project, including automating project planning and design, supply chain visibility, installation support, project tracking, testing, project closeout, post-installation commissioning, analytics, and maintenance, this digital journal increases transparency and accountability for any deployment. This is facilitated via a mobile app and a cloud service solution that is managed and delivered via a blockchain. See Figure 1.

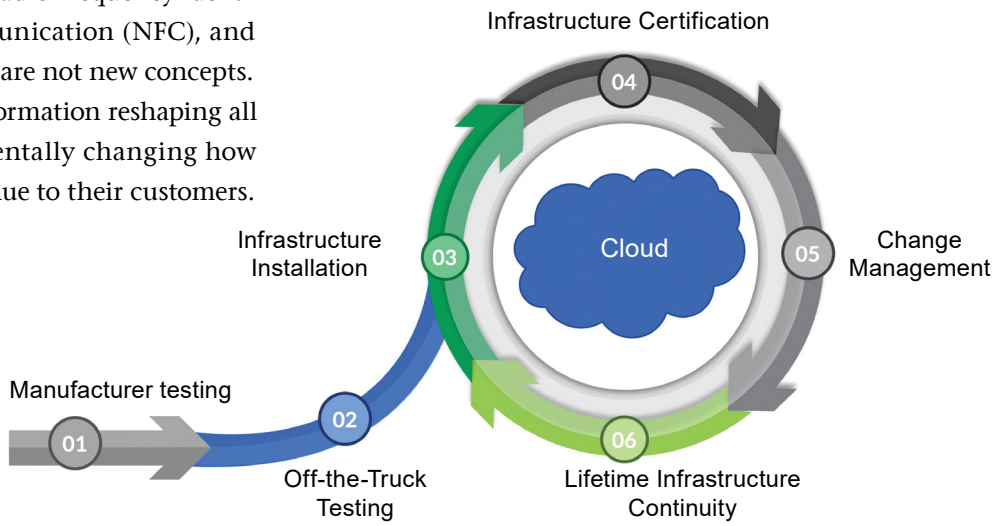

FIGURE 1: End-to-end intelligent build digital journal life cycle.

The digital history is initiated by scanning a barcode or RFID tag that the manufacturer has placed on a cable or component. This creates a digital fingerprint that promptly crosslinks to manufacturer specification sheets, reference drawings, builds, and shipping details. The digital fingerprint can also provide access to manufacturing test data, such as optical time domain reflectometer (OTDR) traces, fiber end-face inspection results, and quality assurance (QA) inspection information, thereby creating a vital link and transparency between the manufacturer, ICT installer, and end-user customer.

Scanning the barcode or RFID tag at the time that a cable reel or component is delivered to site also serves to validate shipments for deployment projects. Real-time management of material receipts can be facilitated, eliminating inefficiencies due to lost paper shipping receipts or incomplete bills of lading. In the event of missing material, the ability to geotag where an item was last scanned means one has a better idea of where it is.

Many fiber deployment specifications require incoming reel inspections and testing. The manufacturer data available via the digital fingerprint allows for easy setup of incoming inspection test equipment by accessing the specified parameters. Upon test completion, the inspection test results are then automatically added to the digital fingerprint. This enables real-time comparison of incoming test results to the manufacturer's test results, quickly identifying cable that may have been damaged or otherwise compromised during handling and transport. This provides environmental sustainability benefits as well, as the amount of paper (e.g., shipping receipts, manufacturer test, QA data) is significantly reduced.

The intelligent build solution houses a powerful workflow management suite, incorporating many elements found in popular construction and field management platforms.

During the planning phase, site design documentation, technical guidelines, specifications, requirement checklists, and pre-construction photos are collected to create highly customizable project and implementation roadmaps, making the planning process highly effective. Network design files containing computer-aided design (CAD) or geographic information system (GIS) data drive the project's creation. Tester and splicer setups can be applied beforehand and easily deployed to field teams as part of the workflow.

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Technicians access to pre-loaded designs, scope requirements, and step-by-step work instructions via their mobile devices, provide assurance that the right work is occurring every step of the way. This additional layer of installation support and instant feedback has the potential of significantly reducing the risk of errors or omissions.

Enabled with integrated project management capabilities, one has visibility to progress across all sites and scope elements via easily interpreted map and graphic views. A project management dashboard provides visibility into a project via real-time data collection, eliminating the need to chase contractors and technicians for updates.

For example, workflow tracking provides feedback on progress and performance of field splicing teams. In the event of scope changes, engineers or project managers can modify the task list and test plan remotely through a portal. This instantly updates the work instructions for technicians in the field. Adding new events is easy. The old infrastructure setup is paired with the new infrastructure requirements, facilitating a clean change management process.

Automated testing enables real-time instrument control using data prepopulated from the design source, such as cable running lists, ensuring accuracy, speed, and quality control. The testing application captures the raw data files and screen shots from the testing instrument, providing notes and photos all organized and instantly captured once the test is completed.

Using machine learning (ML), the app can recognize errors, spec deviations, and offers live mitigation instructions. Testing and splicing events are seamlessly uploaded to the project record. Instant and nightly summaries notify the team when testing or splicing activities have been completed and provides instant visibility to the test data.

The solution allows for fast automated closeout report generation using data collected via the platform throughout the life of the project. Data collected during testing allows for expedited system commissioning. Closeout reports including test and splice data, photos, punch list reports, and completed task checklists are immediately compiled as the data is collected from the field. The project manager works through an approval workflow and generates highly customized reports using customer templates. The closeout package provides a dynamic view of the complete network and its end-to-end results.

Cutting edge data analytics enable the data collected to be used for troubleshooting and maintenance, which can be a great benefit during retrofits when existing systems are repurposed and need to remain functional. Accessing the network's digital fingerprint provides visibility into the as-built state. This helps to provide system continuity without having to rely on tribal knowledge. Infrastructure updates and fixes are easily paired with the original network. No two networks are the same. An intelligent build solution enables access to the unique digital footprint of a network—from manufacturing, to receiving, to installation, and maintenance. See Figure 2.

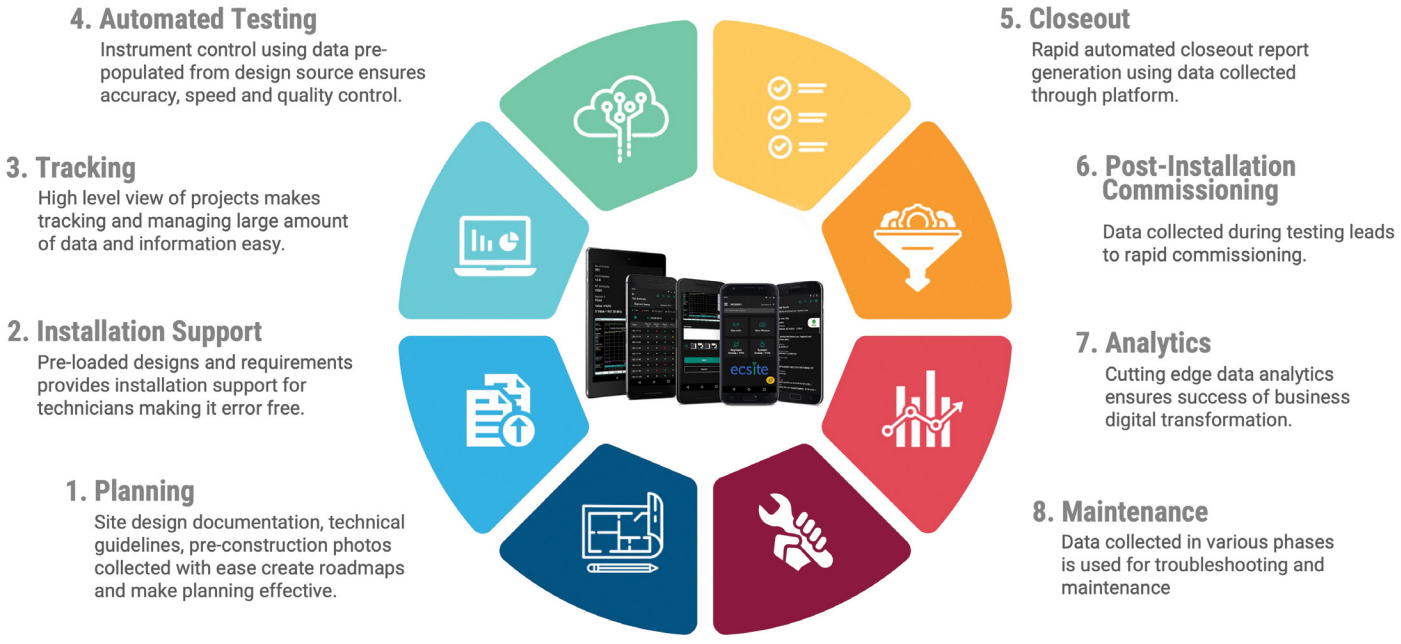

FIGURE 2: Intelligent build workflow management suite.

TURNING VISION INTO REALITY

The benefits of the intelligent build solution can be realized through a variety of opportunities across the ICT industry with applications ranging from massive data center builds to outside plant and enterprise connectivity projects, as well as outdoor small cell, macro fronthaul, and backhaul deployments. The following are detailed examples of ICT deployment use case scenarios:

- Data centers have become the foundation of the digital economy and are critical to our ever more digitized way of life. Moreover, ICT companies deploying data center infrastructure are all too familiar with the challenges that come with deploying thousands of fiber strands and massive amounts of network infrastructure components on vast construction sites that could have over a thousand workers employed during peak activity. Managing the stresses that come with the complexities of speed to deployment while balancing this with the unprecedented demands on the availability of a scalable workforce skilled in splicing and testing is a daunting prospect. The ability to scan, inventory, track, and organize materials based on a prebuilt workflow alone could avoid countless hours searching for the right materials to deploy. Fiber splicing and testing are the most time-consuming efforts of an ICT data center deployment project. They are also the most critical and prone to rework and inefficiencies. For the project manager and other stakeholders to have visibility into these critical activities as they are occurring is a game changer. Imagine having the ability to forecast milestone completions based on real data, not on an installer's optimistic best guess. Other benefits, such as effective scope change management, detailed workflows for each installation team member, the automatic organization of test data as it is captured, as well as the visibility across the entire project, serve to drive significant increases in efficiency in deploying data center infrastructure, while minimizing rework and project delays.

- Cable operators, whether they are pursuing fiber-to-the-home (FTTH) deployments or pushing fiber deeper into their networks to support DOCSIS 3.1, have an increased desire for new methods of speeding deployment, lowering cost, and ensuring success. The geographically dispersed nature of these networks means working with a distributed workforce where the use of subcontractors is prevalent. An intelligent build solution converts geospatial field detail into digital labor and material scopes, construction workflows, automation, and optimization. Everything that must be spliced and tested is documented, generating real-time geospatial progress views of the status of the fiber build. This allows them to make data-driven decisions throughout their projects, enabling timely course corrections and adjustments, which can be a game changer on multi-year deployments.

Contrary to the ICT infrastructure deployment scenarios highlighted thus far, multi-site technology rollout projects are often performed in a much shorter time frame. The ICT companies whose core business is multi-site technology deployments know they require effective established processes and methodologies to complete these projects on time and within budget, utilizing local field resources often outside of their own company.

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The project manager must look at the performance of the entire project across hundreds of locations, each individual site-specific scope from beginning to end. Having consistency across all sites is critical. Such projects demand high levels of coordination, speed in logistics, and deployment, as well as reliability across the installation of a variety of cabling and device end points.

To minimize costly return trips, quality assurance, and validation of performance are critical steps during each site visit. Common issues, such as unskilled technicians with a lack of experience or incomplete knowledge of the scope or solution, can lead to costly revisits. These costly revisits are due to the delivery of an incomplete scope or documentation. All of this can be mitigated by deploying an intelligent build solution. Process workflows, scope documents, as well as form and report templates loaded into the application prior to deployment facilitate data collection, progress reporting, and incident management.

Customer-furnished materials and third-party integrator equipment can be inventoried, accepted, and approved by scanning RFID tags, validating that all critical components needed for the installation are accounted for. Scope documents, drawings, and detailed workflow instructions enable interactive engagement via the mobile app for less experienced installers. Test automation eliminates the setting up of test equipment parameters in the field and enables real-time visibility across multiple sites and crews. Workflow requisite input of photos provides instant feedback of site conditions, field coordination issues, as well as before-and-after installation conditions, essentially becoming the eyes of the remote project manager.

CONCLUSION

A report from Aberdeen Group suggests that "first-time fix" performance on multi-site technology rollout projects ranges from 71 percent to 89 percent.[5] With each truck roll costing up to $300, the 11 percent to 29 percent of sites that will require revisits, add up.[6] The ability to provide time-stamped feedback with global positioning system (GPS) coordinates enables live check-in and check-out from the worksite.

Artificial intelligence enables the application to deny system check-out if required deliverable documentation has not been provided. This effectively eliminates costly revisits due to missing or incomplete documentation. Closeout reports can be generated per individual site as each is completed or as a comprehensive package covering all locations at the end of the project. Spending several days, if not weeks, chasing multiple subcontractors and operations field teams for missing deliverable documentation are a thing of the past.

Bringing together elements of intelligent passive infrastructure, construction SaaS platforms, and the automation and digitization of test and splice equipment, intelligent build solutions can bring many benefits to end-customers, ICT installers, general contractors, and suppliers. A true cradle-to-grave solution enables greater efficiency and accuracy in builds, improves overall productivity, and brings labor savings by addressing the challenges and inefficiencies commonly present in deploying optical networks. Now, more than ever, it is critical that a full end-to-end solution be embraced to enable modern ICT network deployments.

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