



# Emerging Technologies

in Field Service

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## **SPECIAL EDITION:**

Edge Computing and Digital  
Transformation in the Service Sector

# Executive Summary

## 2020 was a year of unprecedented disruptions for field service organizations.

In addition to safety and health concerns, the shift to virtual operations and organizations' ongoing digital transformations resulted in a renewed emphasis on technology adoption and optimization. But the CTOs, innovation leaders, and field service teams that put new, cutting-edge technologies into service last year have just scratched the surface of what these digital tools can accomplish.

As field service organizations continue to mature their technology deployments, 2021 could be just as transformative, if not more so. One capability—edge computing—has the potential to dramatically improve the efficacy of the field service organization's computing capabilities.

This special version of the annual “Emerging Technologies” Field Service report will explore the sophistication of field service teams' technology programs, revealing how organizations are tracking the status and reliability of their assets while meeting customer demands for service using new software and hardware. In reading this report, you'll also learn how field service organizations are incorporating edge computing into their operations, gaining key insights into how this technology can transform data analysis, streamline service delivery, improve operational efficiency, and enhance the many tools and technologies your organization uses today.



# Key Findings

**66%** of field service organizations can **only track the service status, location, and usage** across complete lifecycles and in real-time **for about 50% or fewer of their assets or equipment.**

**41%** of organizations are **tracking profitability for their assets, contracts, and costs incurred by warranty and service in an at least partially automated streamlined process.** Meanwhile, 35% struggle or fail to track these metrics because there is a lack of available data.

**49%** of respondents **claim to be far along in terms of the sophistication of their current technology adoption programs**—19% are already assessing outcomes of their recent implementations, while 30% are implementing technologies.

**56%** of organizations have **unique technology or transformation initiatives for unique lines of business** and 55% use an incubator or another non-funded environment to test capabilities.

**74%** of companies will **devote 25% to 74% of their new technology budgets to edge computing** over the next 12 months.

**55%** of companies have **already adopted micro data centers**, in terms of edge computing technologies.

**86%** have already adopted (50%) or plan to adopt within the next 12 months (36%) **multi-access edge computing** (a.k.a. mobile edge computing).

**60%** of respondents consider **enhanced uptime for deployed assets one of the most important benefits of edge computing**, while 54% consider better operational efficiency and 51% easier communication with customers important benefits.

**65%** of companies are **struggling with legacy systems in their adoption of edge computing.** They are also struggling with a lack of industry standards (60%) and a lack of internal skills (55%).

**70%** of companies have a **plan to evaluate AI-powered solutions** in the next 12 months, and 56% feel confident that AI can help them to predict and react to outcomes without direct human involvement—51% claim AI is or will be a central tool in their technology arsenals as well.

# Paperwork is **the enemy.**

Going paperless improves **compliance.**  
**productivity.**  
**safety.**  
**training & enablement.**  
**technician satisfaction.**  
**first-time fix rates.**  
**asset uptime.**  
**customer satisfaction.**  
**data accuracy.**



DAVID BISHOP  
DIRECTOR OF SERVICE OPERATIONS  
**JOHNSON CONTROLS**

*“If there’s paper left in the business  
anywhere, it’s the enemy and it  
needs to be taken out.”*

# About the Respondents

100 field service leaders were surveyed to generate the data featured in this report.

The respondents represent organizations that occupy a wide range of service areas. Most of the respondents are from organizations that provide field services in sectors like utilities (13%), construction and industrial (13%), information and communication technology (13%), semiconductors (11%), and medical and scientific devices (11%).

At 72%, most of the respondents are directors. The remaining respondents are vice presidents or executives (14%), C-level executives (12%), or department heads 2%.

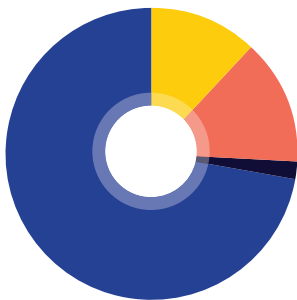
Exactly half of the respondents occupy a role in field service operations. Meanwhile, 34% of the respondents have a role in field service management and 16% have a role in field service technology.

## What best describes the area in which you provide service?



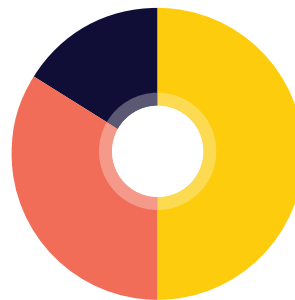
- 13% Utilities
- 13% Construction & Industrial
- 13% Information & Communication Technology
- 11% Semiconductors
- 11% Medical & Scientific Devices
- 8% Manufacturing
- 8% Transportation
- 7% Appliances & Electronics
- 6% Domestic Computers
- 5% Enterprise Network Equipment
- 5% Commercial Computers

## What is your seniority?



- 12% C-Suite
- 14% Vice President/Executive
- 2% Department Head
- 72% Director

## What is your role?



- 50% Field Service Operations
- 34% Field Service Management
- 16% Field Service Technology

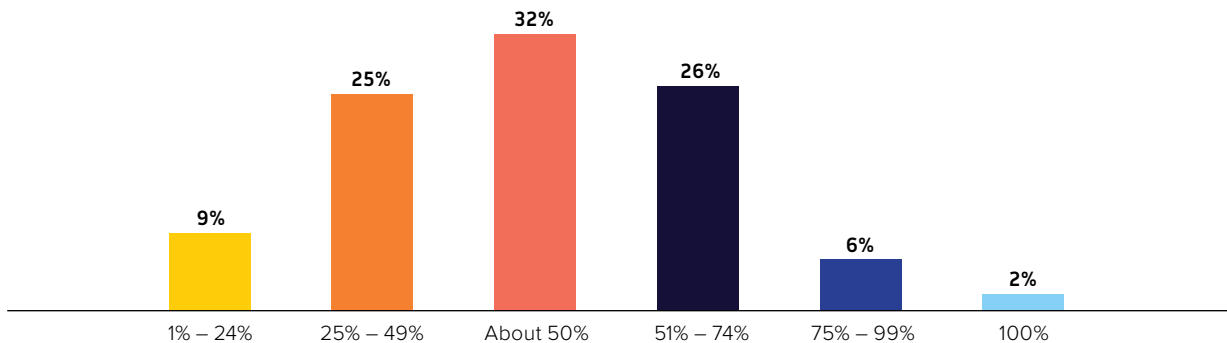
# Field Service Organizations Are at Various Stages of Technology Maturity and Asset Visibility

One of the most groundbreaking capabilities to mature among field service organizations over the past few years was the ability to gain visibility into assets deployed in locations across the customer base. By harnessing IoT technology, many field service organizations can collect data about assets in the field in real-time, even remotely. When paired with AI-enhanced

analytics, these technologies enable field service teams to include predictive and prescriptive maintenance as a service offering to customers.

Still, deploying these technologies takes time. There are often barriers to adoption as well, including difficulties in integrating IoT and data analytics tools with legacy systems.

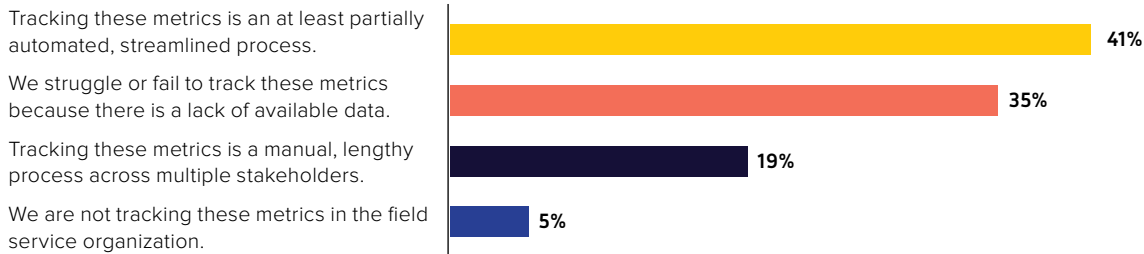
**For what portion (%) of your assets or equipment that are under warranty or service contract can you track service status, location, and usage across the complete lifecycle, and in real time?**



According to the results of this study, field service organizations are in various stages of maturity regarding this capability. For example, 66% of field service organizations can only track the service status, location, and usage across complete lifecycles and in real-time for about 50% or fewer of their assets or equipment. Only 8% of the respondents say they can track the status of 75% or more of such assets.

Gaining visibility into deployed assets will be the first step in realizing new field service models. In particular, this capability opens the possibility of creating new revenue streams through stronger service packages, real-time asset status updates for customers, and more. This type of visibility is also essential for tracking the profitability of assets and contracts compared to costs incurred by warranties and services.

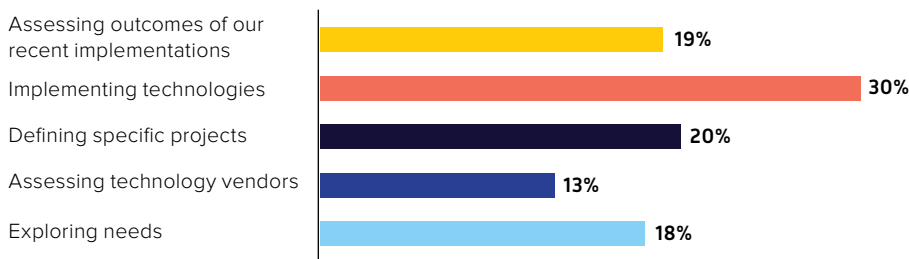
## How are you currently tracking the profitability for your assets, your contracts, and costs incurred by warranty and service?



Currently, 41% of organizations have at least partially automated the tracking of these metrics. However, the majority of respondents say their organization is either struggling to track these metrics due to a lack of data (35%), tracking these metrics manually (19%), or simply not tracking them at all (5%).

Adopting technologies that facilitate the tracking of these metrics automatically will be key to organizations' strategies moving forward. With real-time data and automation, field service organizations can more effectively track the ROI of specific assets and contracts. This data can then be combined to generate insights about products and services that contribute to revenue operations or lead to unnecessary costs.

## How would you describe the sophistication of your current technology adoption program?



Indeed, a slight majority of respondents (51%) say they have not yet implemented key technologies. They are exploring their technology needs (18%), assessing vendors for potential technology purchases (13%), or defining specific projects for which new technologies may apply (20%).

The remaining respondents are either in the process of implementing their technologies (30%) or are already assessing the outcomes

of recent implementations (19%). Each of these stages generally reflects the steps of digital transformation. They are also repeatable with different types of technology initiatives. The most sophisticated field service operations can make decisions based on insights from enhanced analytics, implement technologies at scale, and assess the results of their efforts in a way that stakeholders can understand.

## What level of emphasis is your company placing on emerging technologies and digital transformation?



When asked specifically about digital transformation, the responses reflect the results of the previous question. Most organizations are developing unique technology or transformation initiatives (56%) and using incubator environments to test technology use cases (55%). However, almost half of the respondents (47%) say that they have not yet determined if the new technology they are testing will help the business.

Meanwhile, only 37% say their technology initiatives have board- or C-level sponsorship—an essential component of implementation.

While it's clear that every field service organization surveyed in this study is serious about reaching their technology goals, they are at various stages of the decision-making, approval, implementation, and testing processes.

Although emerging technologies have the potential to transform field service operations and create new revenue streams, they do not come without a cost. Unsuccessful initiatives can be extremely costly, which often results in at least some trepidation about new technology purchases from decision makers. Field service organizations must be able to prove the efficacy of new technologies to decision-makers if they want to secure financial and organizational support to transform their operations.



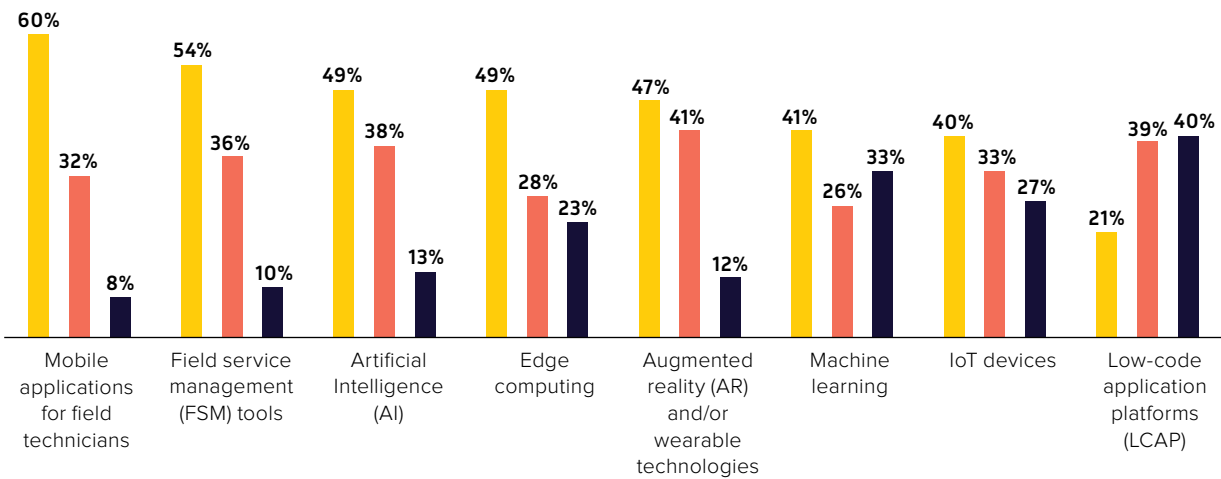
# Organizations are Prioritizing the Adoption of AI and Field Solutions for Technicians

Several new and emerging technologies hold promise in field service. Some of these technologies, such as mobile technology and enterprise software, have already seen widespread adoption across the industry. Others may be out of reach for some

organizations because they still need to deploy an infrastructure that supports them, but as companies' digital transformations continue to mature and evolve, many organizations will achieve service capabilities that would have been unheard of just a few years ago.

## Which of the following technologies did your organization adopt in the past 12 months?

- We adopted this technology within the past 12 months.
 ■ We plan to adopt this technology within the next 12 months.
 ■ We have no plans to adopt this technology.



Most of the respondents say their organizations have adopted mobile applications for field technicians (60%) and field service management (FSM) tools (54%) within the past 12 months. These are both technologies that enable the organization to schedule service appointments and communicate with field service technicians more effectively. Mobile applications are also more advanced than ever, sometimes enabling field service technicians to connect with remote experts to problem-solve.

Fewer respondents have already adopted artificial intelligence (49%), edge computing (49%), or augmented reality and wearable technologies (47%). However, there is significant interest in these technologies, as most of the remaining respondents plan to adopt them within the next 12 months.

The only technologies that significant portions of respondents have no plans to adopt are machine learning (33%) and low-code application platforms (40%), also known as LCAP.

Machine learning (ML) is an advanced application of artificial intelligence (AI) that enables systems to learn based on experiences, but without being programmed directly by humans. Deploying this type of technology could have significant benefits for field service operations, especially in workforce management applications. However, deploying ML is a challenge as it is often only viable in specific use cases. It's also difficult to scale and requires a significant amount of computing power.

Meanwhile, low-code application platforms (LCAP) and “no-code” application platforms enable organizations to develop and deploy applications quickly using a format that even those without computing or programming expertise can manage. These types of tools can help accelerate digital transformation.

## With which of the following statements about Artificial Intelligence (AI) do you agree?

▼ Agree   
 ▼ Disagree   
 ▼ No Opinion

We have a plan in place to evaluate AI-powered solutions in the next 12 months.

We feel confident that AI can help us to predict and react to outcomes without direct human involvement.

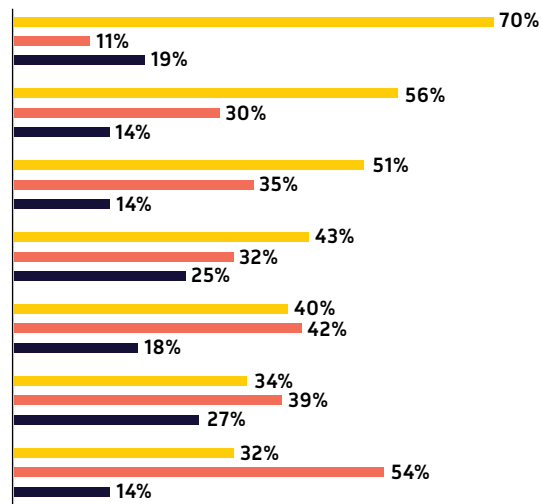
AI is, or will be, a central tool in our technology arsenal.

AI represents a paradigm shift equal in magnitude to the internet, personal computers, mobile, etc.

We have a sophisticated enough data infrastructure to power an AI solution.

AI powers more than one tool in our current technology ecosystem.

Our industry has sufficient use cases to justify an AI solution.



Concerning AI, the respondents show a clear interest in the technology but are skeptical about its applications in the industry. Indeed, 70% of the respondents have a plan in place to evaluate AI-powered solutions in the next 12 months, but 54% disagree that the industry has sufficient use cases to justify an AI solution.

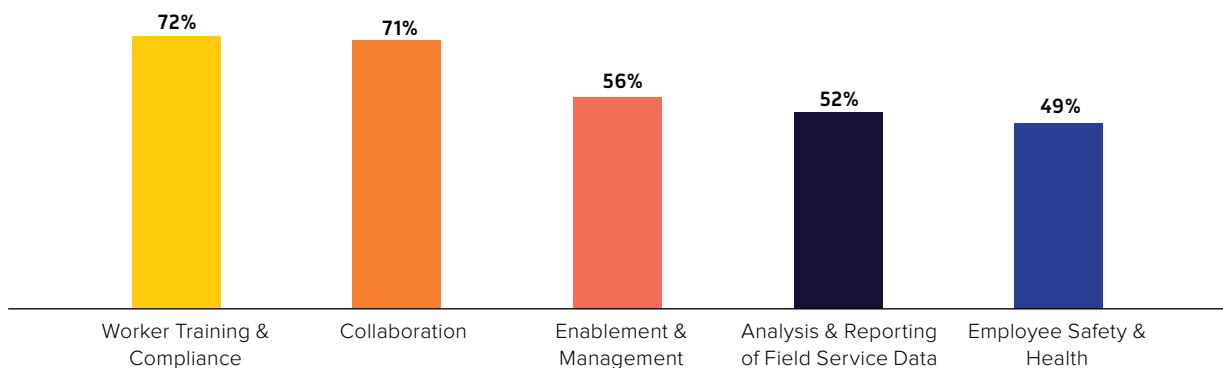
That said, 56% feel confident that AI can help them predict and react to outcomes without direct human involvement and 51% agree that AI is, or will be, a central tool in their technology arsenal.

Meanwhile, the respondents have mixed feelings about the transformative nature of AI. Most (60%) disagree that their organizations have

sophisticated enough data infrastructures to power an AI solution (42%) or have no opinion on the matter (18%). This may indicate why so many respondents are skeptical as to whether an AI solution is justified.

AI has the potential to automate and make predictions about several types of field service tasks. It could potentially draw insights automatically from data, diagnose problems in deployed assets, and identify solutions or fixes when assets break down. But all field service operations have unique needs, and the cost of deploying an AI solution must be justified by the value it adds to the operation.

## As it pertains to technology investments to empower your field technicians, which investments are you considering in 2021?



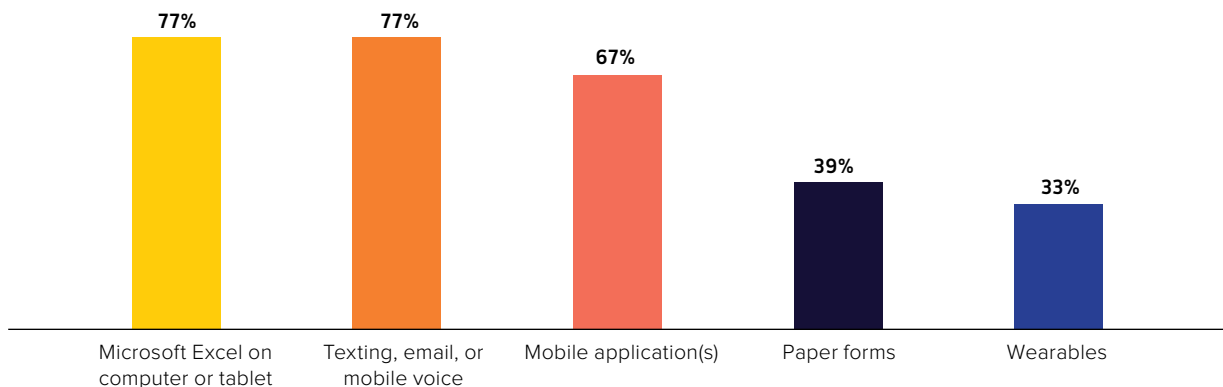
Intelligent machines aren't the only focus of field service organizations' digital transformations. Many organizations are investing in new technologies to empower their field technicians so they can become more productive and collaborate more effectively, even when they are miles apart.

A clear majority of respondents are considering investments in worker training and compliance tools (72%) and collaboration technology (71%). These types of investments will likely go to software solutions that streamline workforce management, enable clear and effective

communication, and provide technicians with more collaborative resources—such as digital access to remote experts—while operating in the field.

Meanwhile, 56% of the respondents are considering investments in enablement and management technologies, while 52% of the respondents are considering investments in solutions that help with the analysis and reporting of field service data. Although IoT technology can assist in this area, it is difficult to replicate the assessment of an experienced field technician. Technicians' ability to submit data to the organization is paramount to monitoring assets and tracking their profitability.

## How are your field technicians currently submitting data collected in the field?



Currently, field service technicians use a variety of tools to submit data they've collected in the field. For example, 77% of the respondents say their technicians submit data via Microsoft Excel through a computer or tablet while 77% say they rely on texting, email, or mobile voice to submit data. Interestingly, 39% of the respondents say their technicians submit data via paper forms.

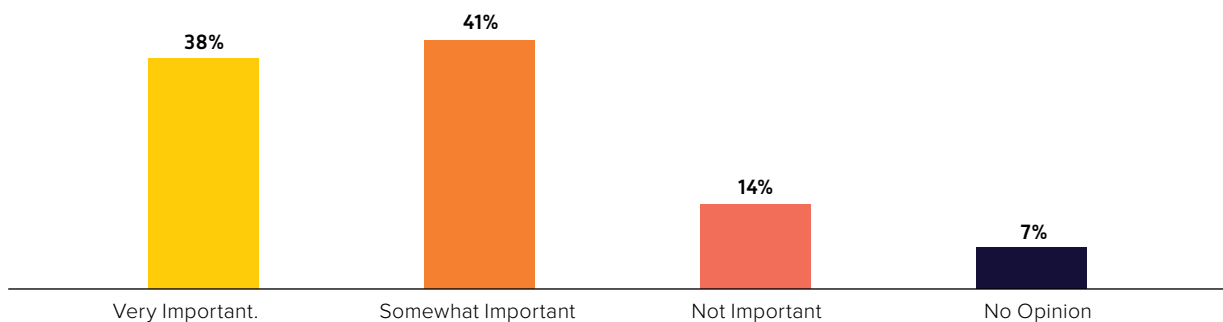
These organizations have an opportunity to streamline field data submission through the adoption of mobile applications. Although technicians may be accustomed to submitting

data on spreadsheets and through emails, simple mobile applications could help reduce errors and reduce the risk of unusable data being transmitted to the organization. They could also make data entry faster, saving significant amounts of field technicians' time.

It should come as no surprise that 67% of field service organizations provide their technicians with mobile applications to submit data. Significantly, about one-third of the respondents (33%) are from organizations that use wearable technology to gather and submit field data as well.

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### The number of cloud solutions has grown exponentially in recent years—but how important is the availability and option to adopt on-premises solutions for your business?



Many of the technologies that empower field service technicians are cloud-based. This allows the technicians to access field service tools from anywhere, even via their smartphones, in some cases. Cloud-based technologies have become popular because of this accessibility and because they don't require manual installations on-premises.

But field service organizations still prioritize the option to adopt on-premises solutions when possible. According to this study, 79% of field service professionals consider the availability of on-premises solutions somewhat important (41%) or very important (38%). Despite the cloud's dominance, these results suggest that many field service organizations would prefer to have direct control over at least some of their technology deployments.

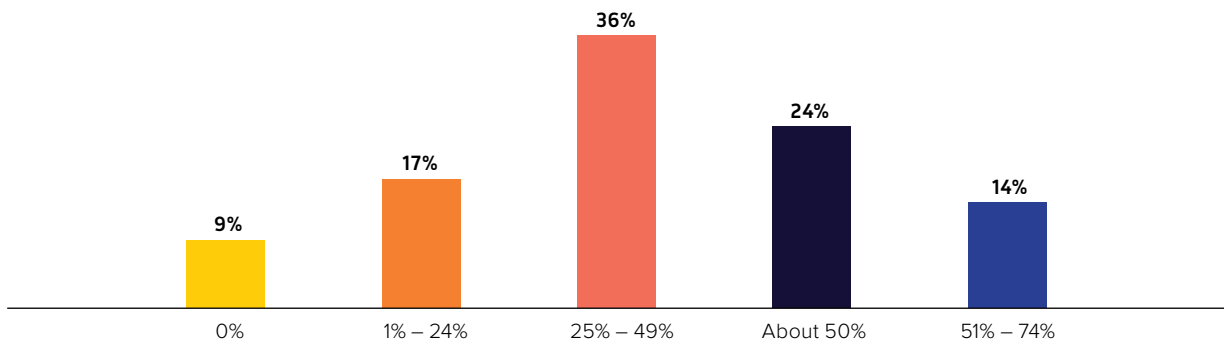


# Field Service Organizations Have Broad Plans to Adopt Edge Computing Technology

Edge computing is computing conducted near the source of the data being collected and analyzed. Instead of relaying data to a data center in another part of the world via traditional cloud networks, field service organizations can use edge computing capabilities to analyze data where it's collected, and where the resulting insights are needed most. As a result, organizations can overcome latency and bandwidth barriers, operate more efficiently, and reduce operating costs.

As a capability, edge computing will likely become more accessible as infrastructure is deployed to support it, including 5G networks. But many organizations can already take advantage of edge computing through their technology investments.

## What percentage of your organization's new technology budget will be devoted to edge computing over the next 12 months?



Currently, 74% of the companies surveyed will devote 25% to 74% of their new technology budgets to edge computing over the next 12 months. Most of these organizations will devote 50% or less of their budgets to edge computing, but 14% intend to devote 51% to 74% of their new technology budgets to the capability.

Nonetheless, some organizations may not be devoting their future technology budgets to edge computing because they've already made

significant investments. Most respondents (55%) represent organizations that have already adopted micro data centers—smaller, more strategically located data centers that provide the same essential capabilities as their larger counterparts. Exactly half of the respondents have also adopted multi-access edge computing—a network architecture that enables the placement of computation resources within a radio access network, or RAC.

## Which of the following edge computing technologies has your organization adopted in the past 12 months, and which are you planning to adopt in the next 12 months?

- ▾ We adopted this technology within the past 12 months.
- ▾ We plan to adopt this technology within the next 12 months.
- ▾ We have no plans to adopt this technology.

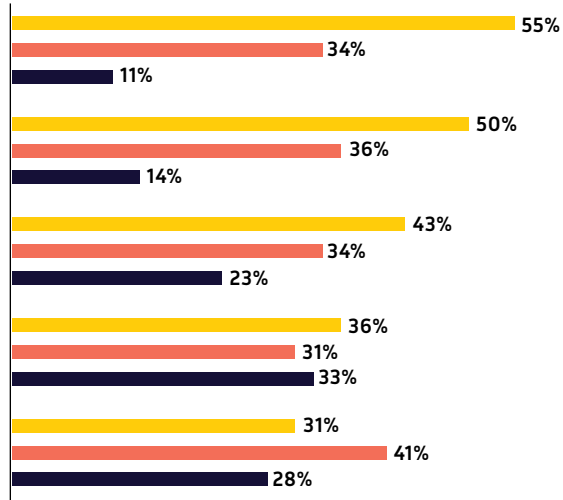
**Micro Data Centers** – smaller, more strategically located data centers that provide the essential capabilities of larger data centers.

**Multi-Access Edge Computing (Mobile Edge Computing)** – A network architecture that enables the placement of computational resources within a radio access network (RAC).

**Cloud of Things (CoT)** – A virtualized infrastructure in which computation is performed by powerful IoT devices themselves rather than the computing infrastructure, as in Fog Computing.

**Fog Computing (Fogging)** – A decentralized computing infrastructure, extending cloud computing resources to the most efficient locations via nodes that connect to the data center.

**Cloudlets** – small-scale clouds located at the edge of networks, which also connect to the larger cloud.

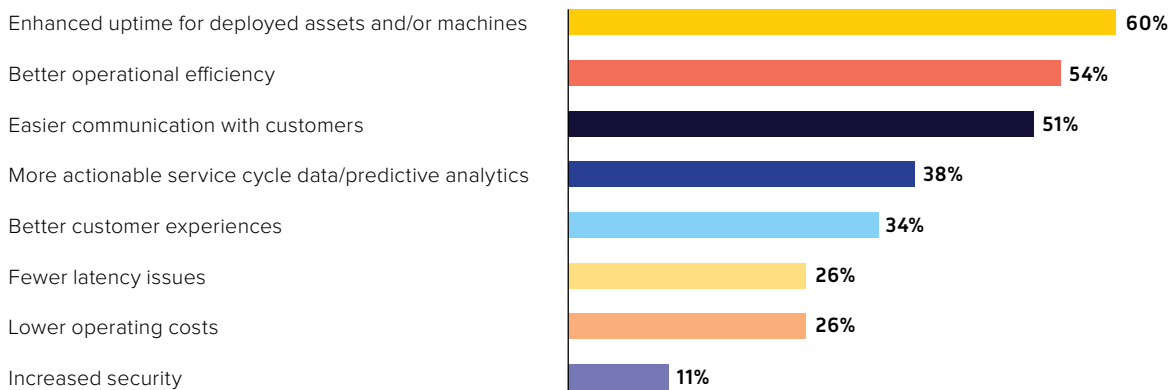


Both technologies provide organizations with ultra-low bandwidth computing in key locations. They can help field service organizations more effectively leverage technologies like IoT devices, augmented reality, and real-time analytics.

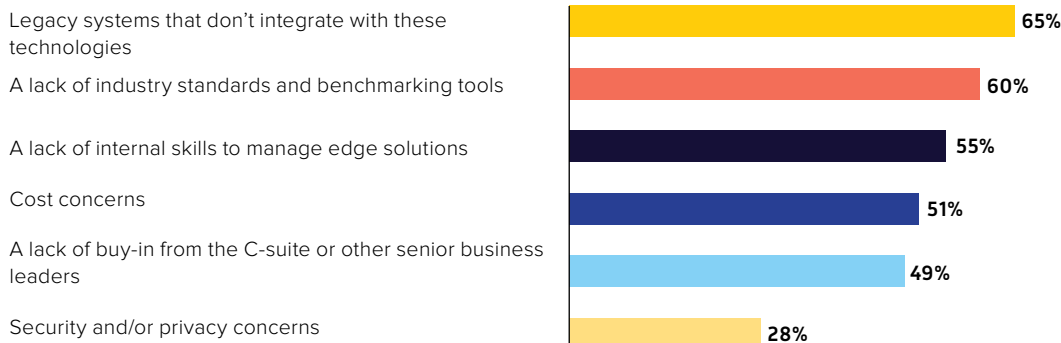
Although most of the respondents have not adopted the remaining edge computing technologies, significant portions of them intend

to adopt them within the next 12 months. Cloud of Things (CoT) technology could enable IoT devices deployed in the field to conduct complex computations themselves, bypassing the need to send data to a data center. Meanwhile, fog computing and the application of cloudlets could expand the reach of organizations' cloud infrastructure and make their cloud-based solutions more efficient.

## In your opinion, what are the most important benefits of edge computing for your field service operation?



## With which of the following challenges is your organization struggling in its adoption of edge computing?



In adopting and deploying these technologies, field service organizations can realize significant benefits. But much of the respondents' interest in edge computing appears to coincide with their desire to drive customer satisfaction. Sixty percent of the respondents say enhanced uptime for deployed assets and machines is one of the most important benefits of edge computing technology, while 51% cite easier communication with customers as an important benefit. Meanwhile, 54% prize better operational efficiency as a key driver of their adoption.

But to realize these benefits, most field service teams will need to overcome significant challenges.

Most respondents say their organizations are struggling with legacy systems that don't integrate with edge computing technologies (65%), a lack of industry standards and benchmarking tools (60%), and a lack of internal skills to manage edge solutions (55%). About half of the respondents (51%) are struggling with the costs of edge computing.

Despite the many benefits of deploying edge computing capabilities, they won't be realized until field service organizations find solutions to these challenges.

Legacy systems often remain at an organization because they serve an important purpose and can't be replaced. Although integrating them with new technologies can be difficult, many organizations can resolve legacy issues through the development and implementation of application programming interfaces (APIs) and other forms of technology integration. This can sometimes be accomplished by partnering with technology firms that specialize in legacy integration, which in turn addresses the organization's lack of internal skills for managing edge solutions.

As we've seen, there is significant interest in edge computing in the field service sector. The solutions field service organizations find today are what will enable them to leverage this groundbreaking technology well into the future.

# Conclusion:

## How Edge Computing Will Affect Field Service in the Next 12 Months

In their final line of questioning, researchers asked the respondents to describe how their organizations plan to utilize edge computing in the next 12 months.

Several respondents note that their organizations are dealing with ever-larger amounts of data in their field service operations, and edge computing promises to help manage the collection and analysis of that data. They also believe edge computing could help with some of their latency challenges.

“There is a huge surge in data across the industry and from the field,” says a C-suite executive in field service operations. “Edge computing will help us manage this data.”

Another C-suite executive says, “There’s a bit of latency in data from the field and it can be repaired with edge computing,” implying that edge computing could make their organization faster and more agile in its analysis of field data.

Another respondent, a field service management director at a utility company, believes edge computing could enable their organization to manage and analyze data as soon as it originates: “We want data to execute itself better right from the source,” they say. “There is a good feeling about edge computing for this purpose.”

Other respondents believe their edge computing investments will provide more support to their teams, especially those that are deployed and in the field. “Generating complete support for field service with technology will be possible with edge computing,” says a field service operations director at a construction or industrial company.

Another director says, “Developing a highly-responsive, virtually connected field service station is something we are working on, and edge computing will have a part to play here.”

Other respondents are planning on deploying edge computing to create “new data sources,” improve “machine-to-machine communication,” and “streamline field service processes.” One respondent envisions a more direct application of field service to “extend the life of the asset by helping us collect more data about it.”

Although some respondents note that their organizations have no plans for edge computing in the next 12 months, several among them say they are still interested in pursuing the technology. As organizations deploy more technology assets to the field, edge computing capabilities will take on more importance, especially as data volume expands. The capability will also become more accessible as data infrastructures mature around the world. In the foreseeable future, edge computing will play a significant role in field service operations’ digital transformations.



# Key Suggestions

- ▶ **Achieving full visibility into all your deployed assets should be a priority.** Currently, most field service organizations can only fully track the status, location, and usage of 50% or fewer of their assets. Gaining this visibility is the first step in realizing new service models, such as outcome-based service, and can facilitate the adoption of more advanced technologies like AI-enhanced analytics and machine learning.
- ▶ **Adopt technologies that help you track the profitability of your assets and contracts,** comparing gains against the costs you incur through warranty obligations and service appointments. IoT sensors, for example, can monitor asset uptime, transmitting data to applications that can log maintenance costs against revenue earned from the asset.
- ▶ Most organizations have unique technology initiatives and use non-funded environments to test their capabilities, but only 37% have board- or C-level sponsorship. **Use incubator environments to test use cases for new technologies, then use the results as value propositions in funding and support discussions with decision makers.**
- ▶ If you plan to adopt AI-powered solutions, **evaluate some potential candidates within the next 12 months,** as 70% of field service organizations are doing.
- ▶ Most organizations have already adopted mobile applications and field service management tools, but **there is significant interest in AI, IoT devices, and low-code application platforms (LCAPs).** If your organization has already achieved a moderate level of technology maturity, these are potential technologies to pursue next.
- ▶ Many field service technicians are still using spreadsheets and emails to submit data from the field. **Onboard a solution, such as a mobile application, to streamline this process.** You can also consider adopting wearable technology to automatically generate data during field service visits.
- ▶ **Edge computing has the potential to improve uptime for deployed assets, make operations more efficient, and make communications with customers easier.** Explore how applications of edge computing could positively impact your field service operations. If internal support and funding are a challenge, start with a small deployment to determine how effectively it improves customer outcomes and enhances data collection and analysis.

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