

Succeeding at Connected Operations with Edge Computing

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SITUATION OVERVIEW

The infusion of digital technologies into all aspects of society and business is a permanent shift. Using cloud and edge infrastructure, all industries are harnessing the power of data and digital tools to improve efficiency, sustainability, and safety and security. Embracing this shift and developing a strategy to navigate the digital-first world are choices that differentiate business leaders and set the foundation for rapid innovation and improvement. Many industries are well on their way to realizing the benefits of digitally enabled, connected operations. Access to IT services, whether in the cloud, in a company datacenter, or in a myriad of edge locations, is a foundational and essential element to enabling the shift to digitally enhanced, connected operations.

Understanding the Need for Digital-First Connected Operations

The shift to digital first is happening across all aspects of business, including operations, which IDC defines as the job functions and activities responsible for the safe, secure, reliable, and efficient execution of a physical process central to an organization's business. These operations can include producing and/or moving goods or services and maintaining assets, infrastructure, or facilities. Significant opportunities exist to improve business outcomes in operations using connected technology. Companies that primarily create value through these types of operational activities are deep in digital transformation to enable digital-first, connected operations. The connected operations transformation is the journey to:

- Monitor and conduct operations remotely.
- Improve efficiency of operations and reduce risk through the intelligent use of data.
- Improve worker safety with greater situational awareness.
- Enhance physical and cybersecurity with cloud-based analysis.
- Drive toward more sustainable operating models.

These are just some of the outcomes, all made possible through the infusion of digital technology into operations.

This transformation is achievable by using a mix of technology such as sensors, power and connectivity, edge computing, and cloud computing. These technologies digitize and connect operational assets and data across traditional silos and apply analytics to yield insights – all managed and executed through distributed remote and onsite working models. For example, in a school setting where IT resources are not locally available, remote IT experts may be able to detect a cybersecurity threat and prevent it to keep students safe and secure and classrooms online. In a manufacturing plant, analytics driven by sensor data

on critical infrastructure may be able to predict and prevent unplanned downtime. In healthcare, where technology has become more critical to care delivery, these remote and predictive capabilities may make all the difference in a patient's outcome. Ultimately, these connected operations capabilities help build a more reliable, connected, secure, and resilient enterprise that anticipates and predicts outcomes to optimize the way work gets done and ensure business certainty in a changing world.

Yet to build and maintain the technology capabilities necessary to support this transition to connected operations can be challenging. Edge computing is a critical enabler of this transition. IDC defines edge computing as the deployment of processing and storage resources outside of centralized datacenter and cloud infrastructure as close as necessary to where data is generated and consumed. While local compute resources have existed for years, the new connected operations model requires companies to shift their mindset away from cloud and the operations as two separate technology strategies. This new model seeks to unify cloud and operations under one edge-to-cloud architecture, approach, and set of management capabilities. This creates a few key considerations to overcome:

- **Skills.** The workforce needs to have the right skills to execute across technology settings and to be able to build alignment internally to drive change. This focus will require companies to engage with new ecosystem partners inside and outside of their organization.
- **Security.** Physical and cybersecurity concerns are high when connecting operations. This concern will require systems and processes that are tailored for this new paradigm. Yet, once connected to the cloud, the power of operational data can be harnessed to drive a host of new and enhanced use cases. Such data can enhance collaboration in the enterprise and enable remote operations capabilities that result in labor efficiencies while ensuring companies have resilient, remote operations capabilities.
- **Reliability.** As more of the local operations capabilities are directly supported remotely through the connected edge, reliability is a critical concern. The reliability of these edge resources becomes increasingly important to keep operations running.

In response to these challenges, and in pursuit of the connected operations opportunity, companies will need to navigate a host of strategic choices that can either result in being trapped in pilot purgatory and rework or put them on a path to long-term success that will yield a competitive advantage. To better help enterprises navigate these choices, IDC has conducted primary research through a global survey of over 1,000 IT and operations professionals across industrial, healthcare, education, and other verticals as well as a series of in-depth interviews with industrial enterprises. The findings and analysis of this research are presented in this white paper.

WORKLOADS AND CRITICALITY AT THE EDGE

The operational edge is the critical point where traditionally siloed IT and OT systems converge and enable connected operations use cases. The edge serves as the connection point that preserves the autonomy of local operations while unlocking the cloud and remote capabilities. This infrastructure also supports key use cases and workloads beyond establishing this cloud connection. Some of the top use cases and reasons for deploying edge resources are shown in Figures 1 and 2.

The following are just a few of the many ways that technology deployed at the edge is supporting industries as they shift to connected operations:

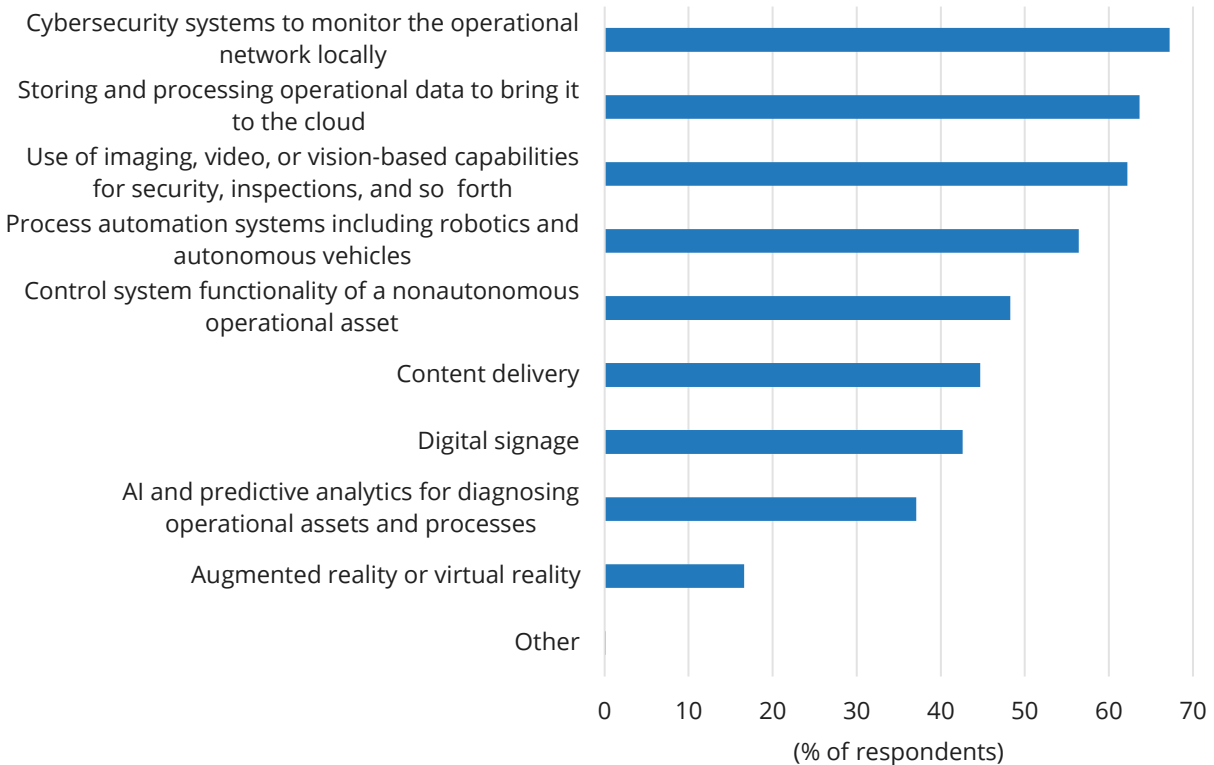
- **Education:** Enabling the connected classroom including remote schooling capabilities and in-classroom technology such as virtual reality devices and capabilities
- **Industrial:** Remote, predictive asset monitoring, tracking, and maintenance of assets from utilities to oil and gas and manufacturing; connecting operational data to the power of the cloud for analytics to optimize processes
- **Transportation:** Tracking and delivering maintenance to a variety of remote fleets and assets that are unmanaged and inaccessible to IT resources
- **Healthcare:** Managing connected medical devices responsible for direct patient care including managing software updates, tracking the location of assets, and delivering predictive maintenance on those assets; locally supporting cloud-connected medical record systems such as EMR

These business use cases require new technology and technology management capabilities to support the unique needs of these remotely deployed workloads.

FIGURE 1

Top Use Cases for Edge Infrastructure

Q. What are the use cases or workloads driving your organization's use of edge infrastructure?



Source: IDC, 2022

FIGURE 2

Requirements for Operational Workloads

Q. Why is your organization investing in edge compute to support these use cases or workloads?



Source: IDC, 2022

Organizations should consider the importance to a connected operation in ensuring local cybersecurity requirements are met. In addition, organizations should assess use of the cloud for supporting operations remotely or, even in some cases, executing process automation and control system functionality remotely. All of these workloads are absolutely mission critical. Indeed, in connected operations environments, companies cannot have a cloud strategy without an edge strategy that is ironclad and resilient itself. As such, the business and operations resiliency created by connected operations becomes synonymous with the resiliency of the edge infrastructure that enables it.

TECHNOLOGY CHALLENGES AT THE OPERATIONAL EDGE AND REMOTE SITES

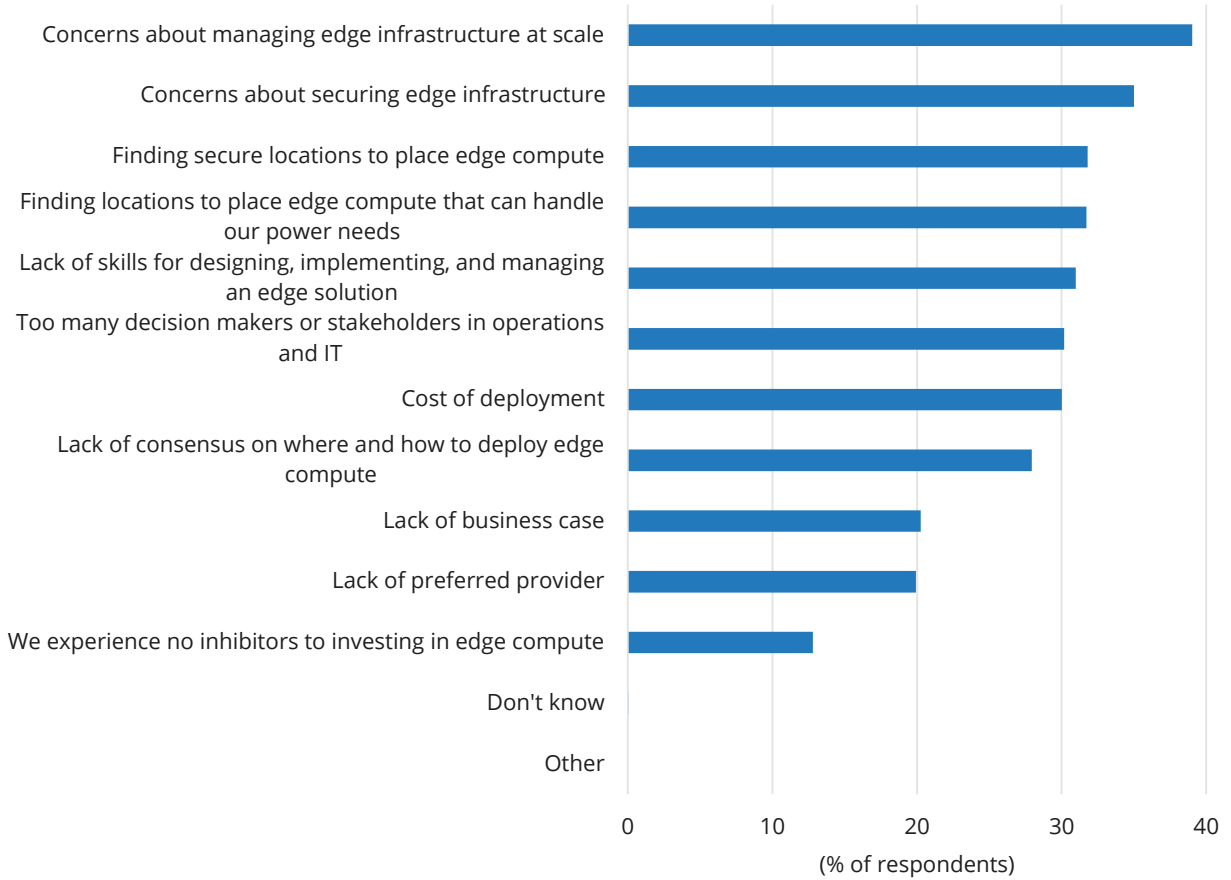
So what are the challenges that companies must overcome to ensure their edge infrastructure and, therefore, their connected operations strategy are resilient and reliable? These top challenges can be found in Figures 3-5 and are discussed in this section, but first, it must be noted that a winning connected operations strategy reliant on edge computing must address all of these issues – from skills to power, connectivity, security, and remote monitoring of the infrastructure at the edge to the cybersecurity challenges that connected operations brings about. Addressing these critical challenges proactively in deployment and ongoing management will help ensure the long-term viability and success of an edge compute strategy, ensuring value is realized across the variety of use cases that depend on it. The most important challenges and pitfalls to consider in this strategy are:

- **Physical and cybersecurity risk.** Data loss and protection of intellectual property are frequently cited as leading concerns for enterprises. But where internal or customer operations environments are concerned, these security risks extend beyond cybersecurity and data security and include physical security as well; consider that 25% of respondents reported having equipment purposely tampered with or removed by unauthorized people. These edge systems are becoming responsible in some cases for critical process and control system functionality, so the potential for harm to critical societal infrastructure and life and limb is now also a primary concern. Physical and cybersecurity go hand in hand in this respect, and companies must consider and address both to ensure longevity and success in their edge initiatives.
- **Environmental, power, and connectivity disruption.** Operations environments are inherently challenging environments for technology to operate in. These environments often lack connectivity or have slow connections, power surges and outages are common, and they experience extreme temperatures, dirt, dust, and humidity, as shown in Figure 4. Remarkably, over 25% of respondents have experienced natural disasters impacting the operations area, and nearly 20% have experienced fires near their edge compute infrastructure. The physical safety and security of edge compute resources is not always top of mind for companies looking to deploy them. To preempt these challenges, enterprises should incorporate enclosures, uninterruptible power supply (UPS) solutions, micro datacenters, and environmental considerations and mitigations into their selection and deployment of edge resources. Technology selection criteria must include the unique characteristics of the deployment environment. Given the highly critical nature of many edge deployments, and the need for resilient IT service, many organizations are deploying specialized infrastructure to secure and protect edge infrastructure and ensure reliability.
- **Skills.** It should come as no surprise that technology transformation will present novel challenges for technology professionals. However, what may be surprising is the scope of those challenges. The leading inhibitor for enterprises to invest in edge compute resources is their concern about managing this infrastructure at scale (see Figure 3). The lack of skills for designing, implementing, and managing these solutions also creates the need to address the "how" of edge computing before advancing too far. Complicating all of these concerns is the lack of onsite expertise and technical resources to support the systems, requiring remote management capabilities – a top challenge for companies looking to remotely monitor and manage those edge resources. System selection can alleviate these challenges through management tools and interfaces that simplify the work to be done. Increasingly, IDC observes enterprises choosing to procure and manage technology solutions through "as a service" models, which ensure complete and scalable use of a given technology. Respondents reported that if usage-based pricing models were available for edge deployments, 65% would procure >51% of their solutions in this way. Edge solution providers should also be considered as strategic partners in the deployment and management of edge solutions to help alleviate the skills challenges that are associated with them.

FIGURE 3

Inhibitors to Edge Investment

Q. What is/are the leading inhibitor(s) to your organization's additional investment in edge compute applications and workloads?

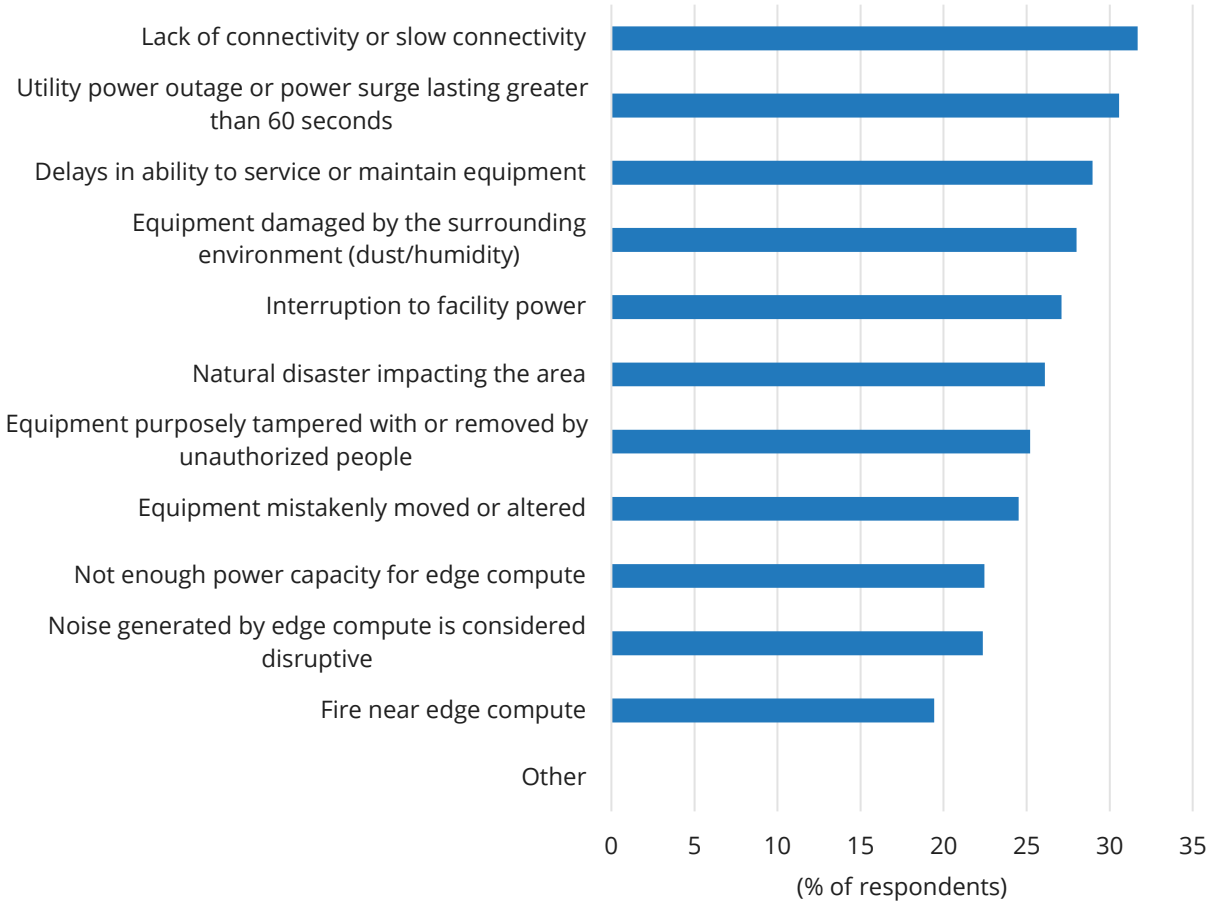


Source: IDC, 2022

FIGURE 4

Challenges at the Edge

Q. Which of the following has your organization experienced with its edge deployments?

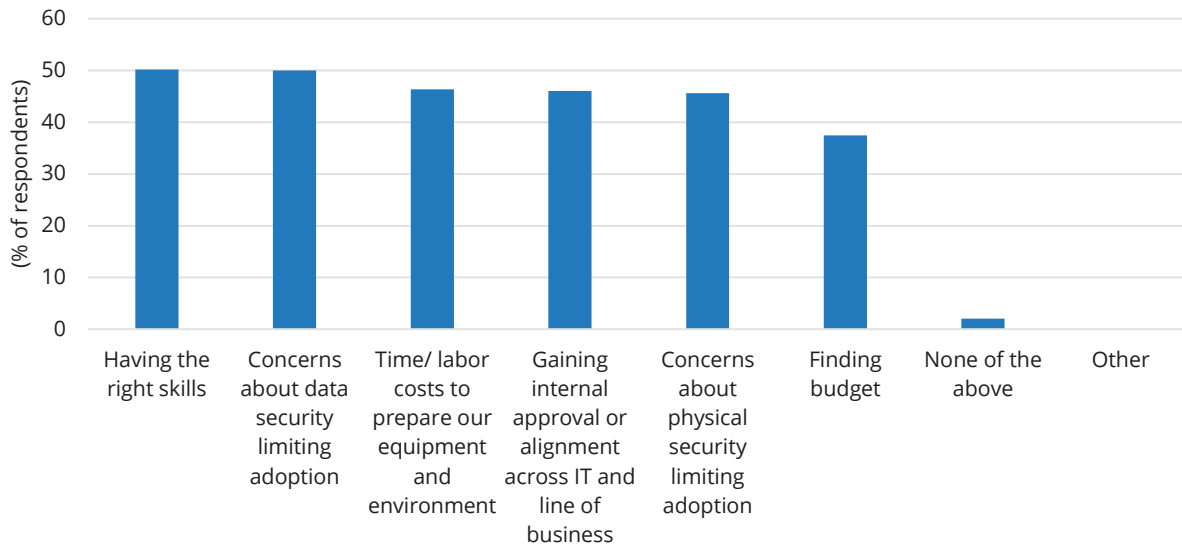


Source: IDC, 2022

FIGURE 5

Challenges in the Transition to Remote Monitoring

Q. *What challenges do you anticipate (or have experienced) in the transition to more remote monitoring and predictive maintenance of edge infrastructure?*



Source: IDC, 2022

The assistance of external service providers or full solution providers responsible for hardware, software, and services can play an important role in formulating a sound strategy. According to IDC's 2021 *Future of Operations Survey*, 87.2% of respondents reported that they have partnered with third-party service providers or full solution providers to develop their strategy and vision for the future of operations, inclusive of edge compute strategy. These strategies must address the aforementioned challenges and inhibitors to reduce business risk and ensure successful deployment and ongoing management.

FUTURE-PROOFING EDGE CAPABILITIES

The challenges and suggestions summarized in this paper can help organizations preempt disruptions and succeed at meeting today's needs in building the edge infrastructure. By definition, a successful edge infrastructure is one that supports a remote, connected, secure, reliable, resilient, and sustainable operation. But to ensure that this strategy remains aligned to future operational needs and scales up over time, the following strategic trends identified through IDC's research and analysis must be considered now:

- Virtualization and cloud connectivity is taking place across the operations technology landscape, just as it has in IT. As this takes place, interconnectivity of systems will increase, making open, interoperable platforms a priority. Companies should consider this open and interconnected technology landscape when selecting solutions today. Management of technology at scale will require holistic toolsets that can perform across this landscape encompassing both edge-deployed IT resources and other connected edge assets.

- IDC's research across multiple studies suggests that connectivity requirements will increase over time. This means companies must have a flexible strategy and access to an ecosystem of partners to plan for future capacity needs.
- Power needs will escalate as more compute infrastructure is deployed at the edge. Enterprises must consider how they will meet their sustainability goals while supporting their increased power requirements. Edge infrastructure systems should be selected with sustainability in mind from the ground up. Among those surveyed, 82% cited commitment to sustainability as a selection criterion for edge solution providers.
- The increase in connectivity and explosion of software deployments at the edge have increased the need for fast, simple deployment of infrastructure on demand to support them. Plug-and-play type of solutions will become increasingly important. That is why investments in complete edge solutions will be the primary focus of planned investments for 32% of organizations over the next 24 months compared with isolated software deployments, components of edge solutions, or services for existing systems. In addition, 27% of respondents will focus their investments on software deployments that will be hosted on edge systems, reinforcing the need for rapid deployment of additional capacity to support them.
- Resilience is a top business priority, and edge compute will become increasingly critical to enabling connected operations. This means that strategies must be in place to predict, prevent, and mitigate disruptions and threats to edge compute resources to ensure business resiliency.

DEVELOPING A STRATEGY FOR CONNECTED OPERATIONS

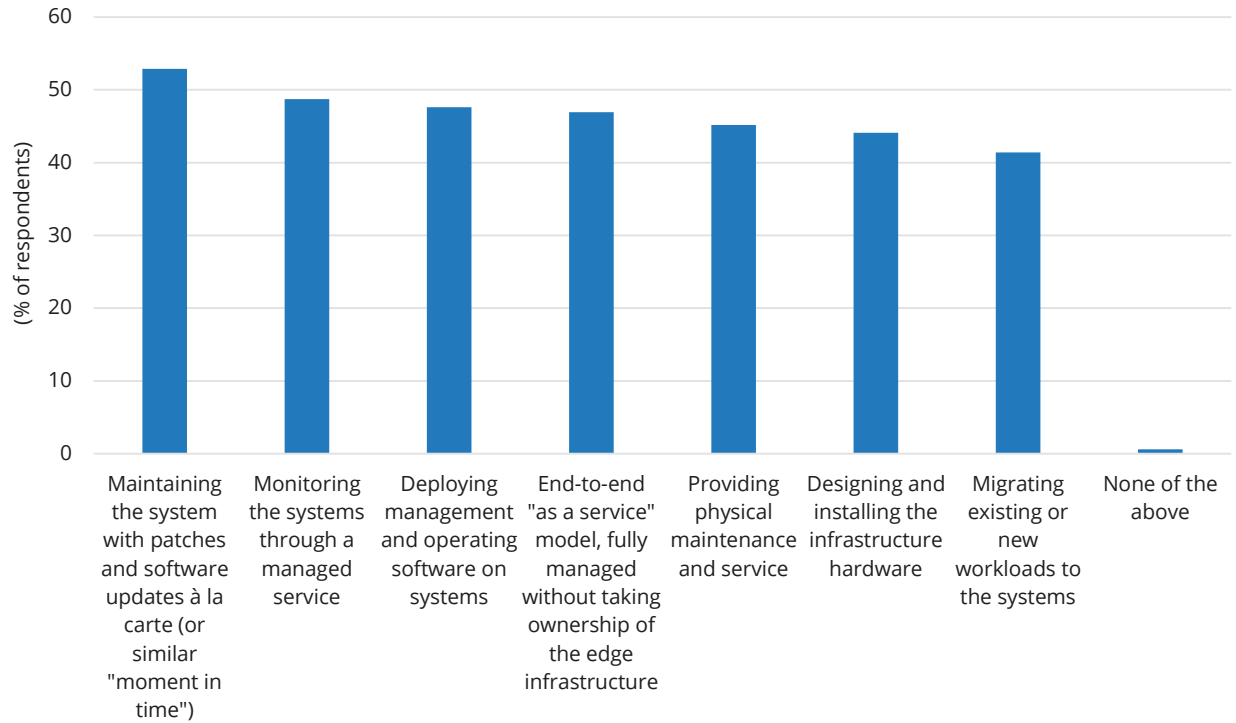
Building connected operations and driving digital business transformation require a foundation of dependable power and connectivity to ensure reliability of the technology systems that enable them. Edge compute infrastructure is the backbone of data and analytics capabilities, communication of operational data to the cloud, and execution of sensitive operational workloads. Investments must be made to ensure edge compute monitoring and management can be done remotely. Enabling remote monitoring for edge IT infrastructure and software will address concerns around power and connectivity and both physical security and cybersecurity. These investments will enable organizations to preempt potential business disruptions and threats.

Often, companies today are faced with many challenges that they feel unequipped to face alone. That is why there is a rising preference to treat technology providers as strategy advisors in these endeavors, as shown in Figure 6. And for these services to be effectively delivered in an operations setting, which carries unique requirements on an industry and setting basis (e.g., a hospital versus a factory), there are qualities that companies must look for when selecting partners and providers as described in Figure 7.

FIGURE 6

The Role of External Service Partners in Edge Initiatives

Q. For which of the following will your organization rely on services organizations with regard to your edge infrastructure deployment?

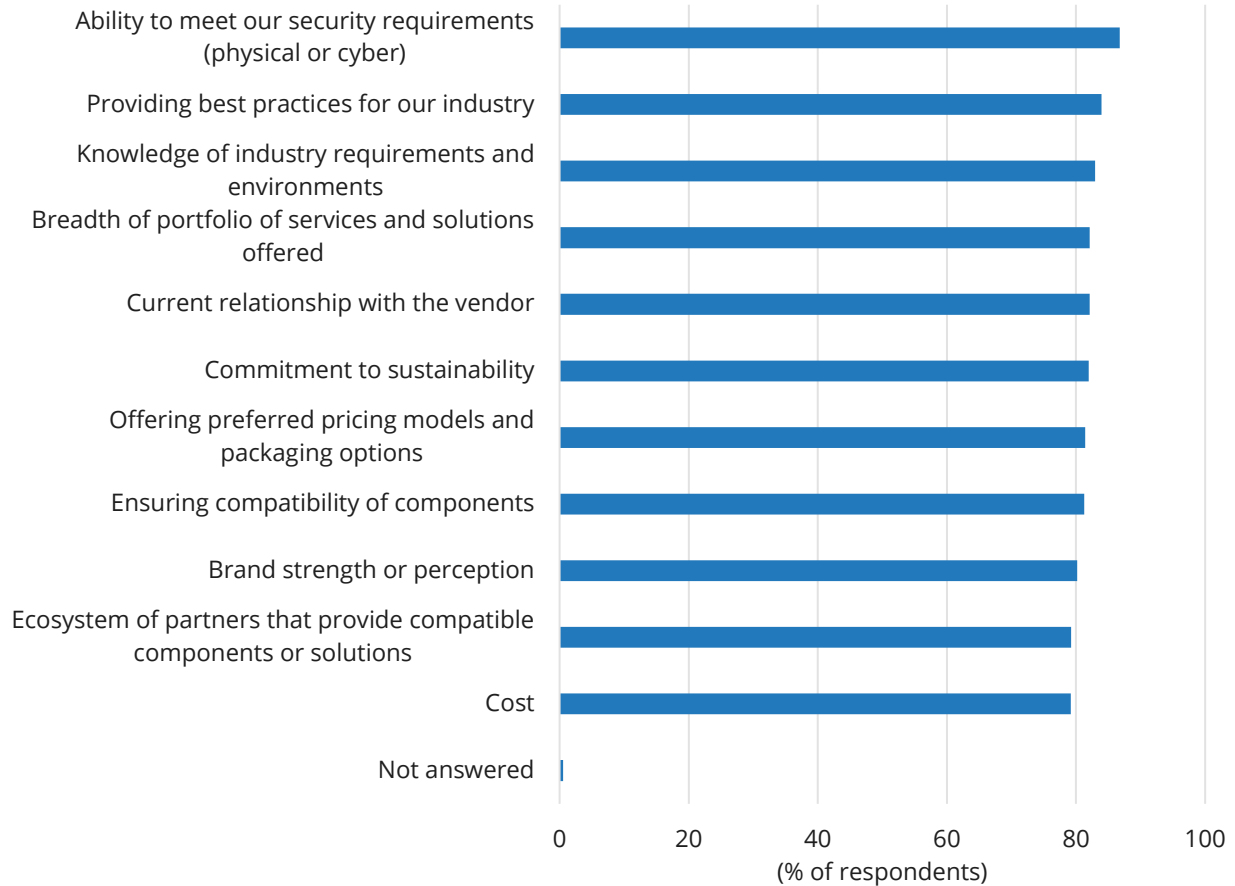


Source: IDC, 2022

FIGURE 7

Selection Considerations for Edge Solution Providers

Q. How important is each of the following in your selection of edge solution providers? (Ranked high to low)



Source: IDC, 2022

CONCLUSION

Resilient edge resources are the foundation for shifting to digital-first, connected operations. As organizations seek to become more operationally efficient, improve safety, and become more sustainable, they are leaning more on digital technologies. Based on IDC's research with organizations that are on the digital-first journey, the following are key considerations in developing and executing a successful connected operations strategy:

- As operations increasingly relies on technology, organizations will become vulnerable if and when that technology fails. Include resilient power and connectivity resources early in the edge planning phases to reduce the risk of downtime.

- The ongoing management of edge infrastructure will challenge all organizations. Having the right skills in the right place at the right time will be difficult if not impossible. Ensure that your edge resources are equipped to support continuous remote monitoring and autonomous operation.
- Consider trusted partners to provide industry best practices and service in situations or locations where it is not economically or physically feasible to do it yourself. Trusted partners can often predict problems before they occur.

By leveraging modern edge compute capabilities, considering and addressing potential pitfalls with a comprehensive strategy, and engaging with providers as trusted partners through this transformation, enterprises can place themselves on the path to becoming a resilient, digital-first, and data-driven enterprise.

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