How Digital Transformation is Changing the Business Value of Connectivity to Machines

ARC Market Report
June 2019

Most manufacturers have been connecting their machines in some form for a generation. However, with the evolution of digital transformation in manufacturing, it's critical to consider the benefits, drawbacks, costs, and value for providing new or enhanced connectivity to these machines today. ARC Advisory Group has surveyed and interviewed a number of experts who connect and utilize industrial machinery to gain their insights. The results may surprise you.

By Craig Resnick and Allen Avery

CONTENTS

Executive Overview

Most manufacturers have been connecting their machines for a generation. Networking of PLCs, DCS, etc. has been going on since the 1970s. Then in 1996, the OPC Foundation began developing interoperability standards by creating and maintaining open specifications to standardize communication of process, alarm and event, historical, and batch data to connect machines from multiple vendors and between different vendors' machines and devices. Most are connecting their machines for process monitoring and control, HMI/SCADA, historian, MES, and other traditional manufacturing applications.

Most manufacturers have been connecting their machines in some form for a generation. However, with the evolution of digital transformation in manufacturing, it's critical to consider the benefits, drawbacks, costs, and value for providing new or enhanced connectivity to these machines today. ARC Advisory Group has surveyed and interviewed a number of experts who connect and utilize industrial machinery to gain their insights.

ARC Advisory Group research estimates that more than 98 million automation products installed globally since 1996 employ OPC client technology. This, plus millions of machines connected by a wide array of open industrial Ethernet network technologies, helps to lay the foundation for manufacturers to deploy systems that enable multi-vendor interoperability that can move machine data horiziontally and vertically from the plant or factory floor up to and through the enterprise. These applications are critical to business, so the payback period of traditional connectivity to machines is very fast, often 12 months or less, according to ARC Advisory Group's research. Most manufacturers do not even measure the ROI or payback period for connectivity, taking the need for connectivity to machines as a given.

Today's technogies that enable connectivity to new and existing machines also help to provide manufacturers with a start to their digital transformation journey. Industrie 4.0 and IIoT solutions help to predict how machines and processes will behave, which is key to proactive maintenance, future productivity, and driving new value. Connectivity to machines and other plant floor assets is essential to any Industrie 4.0 or IIoT implementation. Without connectivity, none of the benefits of Industrie 4.0 or the IIoT can be realized.

But when production lines, machines, and equipment are connected, digital transformation promises to connect things, people, and systems to deliver

organizational value. But it's often not an easy task to provide seamless connectivity across all these domains.

With the evolution of digital transformation in manufacturing, what are the benefits, drawbacks, costs, and value for providing new or enhanced connectivity to these machines today? ARC Advisory Group has surveyed and interviewed a number of experts who connect and utilize industrial machinery to gain their insights. Topics of these surveys and interviews include how connectivity to machines supports their operations, what approaches manufacturers are taking to provide connectivity to their machines, how much time respondents estimate they spend now to connect to these machines, and how much they expect to spend in the future. Also part of the discussions are the benefits and drawbacks of providing connectivity to machines, the value and ROI these manufacturers are deriving from machine data, and any negative consequences these manufacturers are seeing from not being able to provide connectivity to their machines.

Many Manufacturers Have Started Their Digital Transformation Journeys

Providing horizontal and vertical connectivity to machines within industrial operations has been pursued by some time as a means of achieving performance improvement and operational excellence. Most specific data and actuator points in an industrial system are there because they are needed for control, safety, regulatory compliance, and operations and maintenance purposes. These points are typically connected to a particular system or application that may share data with other systems or applications. Industrial companies use information from these connected entities to lower costs, optimize processes, and execute efficiently.

Most specific data and actuator points in an industrial system are there because they are needed for control, safety, regulatory compliance, and operations and maintenance purposes. However, an impressive number of manufacturers have also started their digital transformation journey, leveraging connectivity to enable transformative business improvements.

However, an impressive number of manufacturers have also started their digital transformation journey, leveraging connectivity to enable transformative business improvements. The ability to serve up data from machines on the plant floor and process analytical output from enterprise systems for operational improvement has driven massive savings and new

revenue opportunities. Providing connectivity enables digital transformation technologies, which offer the insights on how to improve performance and reduce downtime through remote diagnostics, troubleshooting, and predictive maintenance capabilities. Enabling machine access to a variety of sanctioned internal and external parties is enabling manufacturers to increase machine uptime and improve operational performance.

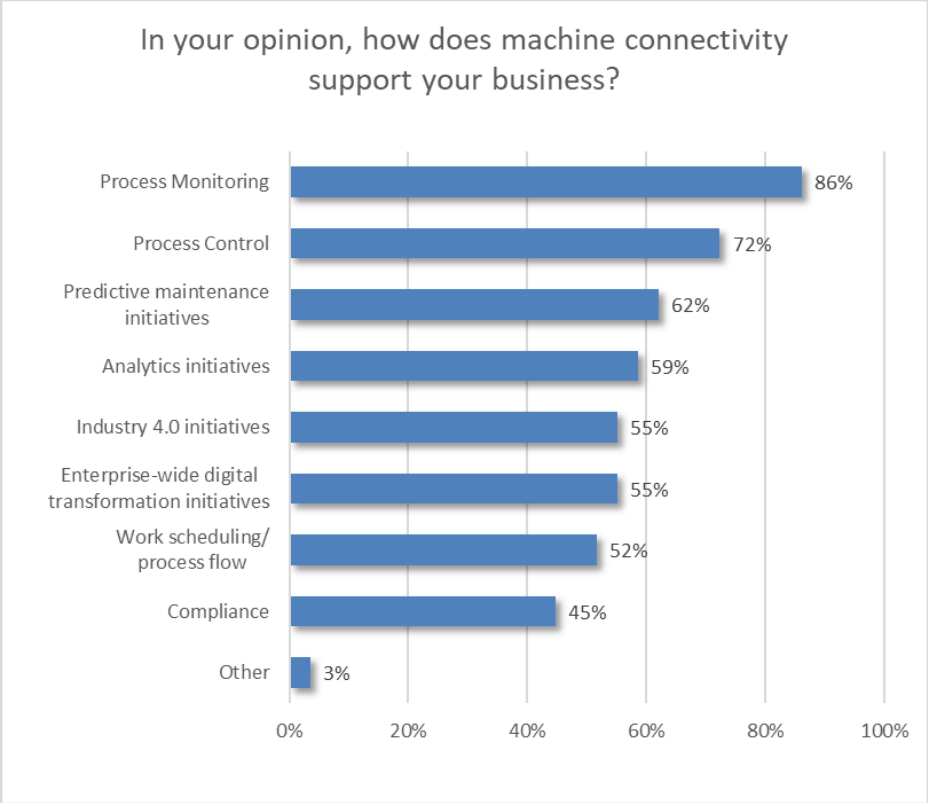
Digital transformation and the growth of IIoT are also driving manufacturers to host compute power as close to machines as possible, at the "edge" of their networks. As the digitization of industrial systems proceeds, analysis, decision-making, and control are being physically distributed among edge devices, edge servers, the network, the cloud, and connected systems.

Digital transformation and the growth of IIoT are also driving manufacturers to host compute power as close to machines as possible, at the "edge" of their networks. As the digitization of industrial systems proceeds, analysis, decision-making, and control are being physically distributed among edge devices, edge servers, the network, the cloud, and connected systems. Computing and analysis functions will be deployed where it makes the most sense for the application, so connectivity to both new and existing machines must be designed to leverage IIoT, the cloud, and the edge.

ARC Advisory Group has found that a large number of surveyed manufacturers have started their digital transformation journeys and are already performing predictive maintenance and advanced analytics. Manufacturers whose machines are already connected to, for example, HMI/SCADA and other traditional applications are having an easier time starting their digital transformation journeys. Manufacturers are connecting in a wide variety of different ways, ranging from using PLCs or control systems to low cost embedded sensors connected to edge devices that are subsequently connected to the cloud.

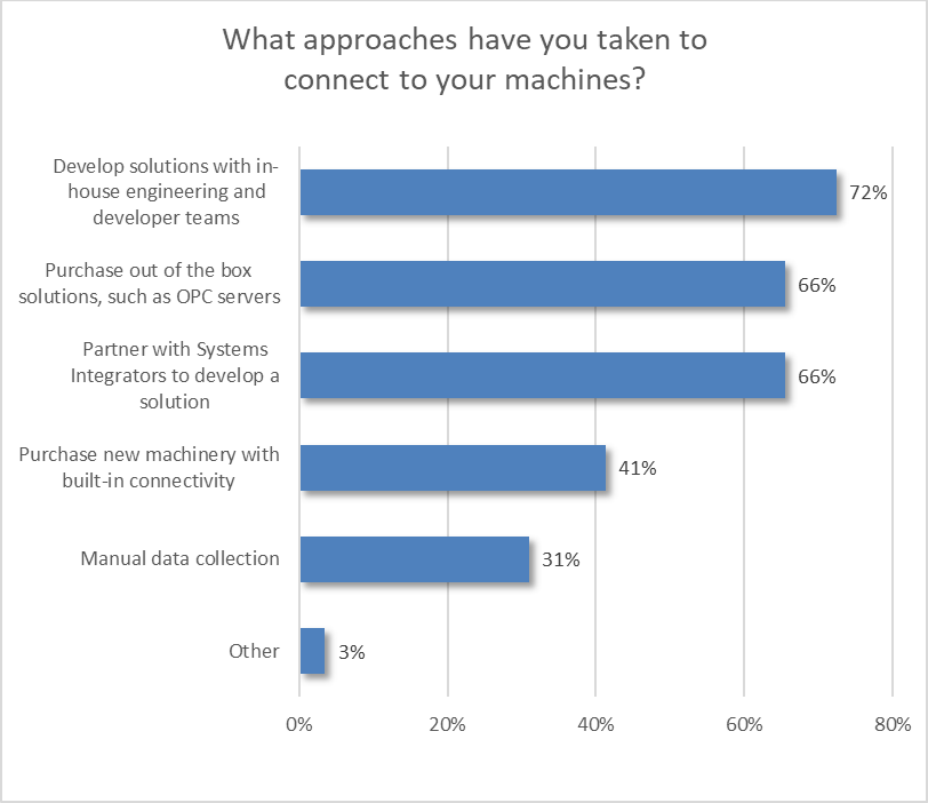
The Dynamics of Providing Connectivity to Machines

Most manufacturers have connected their machines and are harnessing that connectivity to great effect in many functional areas. Additionally, many reported significant operational and financial benefits from connecting their plant equipment.



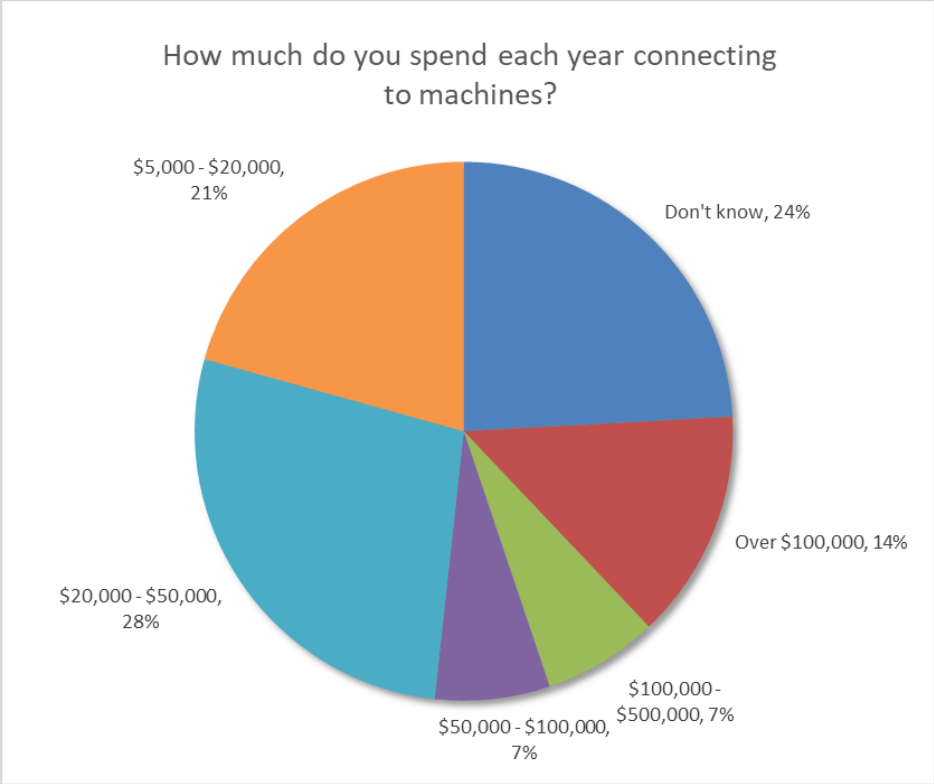
Providing connectivity to machines supports a number of key functions and initiatives around the plant, according to respondents. An overwhelming majority indicated that connectivity to machines is used for process monitoring and control, likely as part of a SCADA or HMI. More than 60 percent reported connectivity supported predictive maintenance applications, while more than half of respondents indicated that connectivity supported analytics and Industrie 4.0 initiatives and is key in starting digital transformation initiatives at their organizations.

ARC Advisory Group recommends that manufacturers embrace and accelerate the use of analytics, IIoT/Industrie 4.0 initiatives, and digital transformation programs to best leverage the business value of the available data and information that results from providing connectivity to machines.



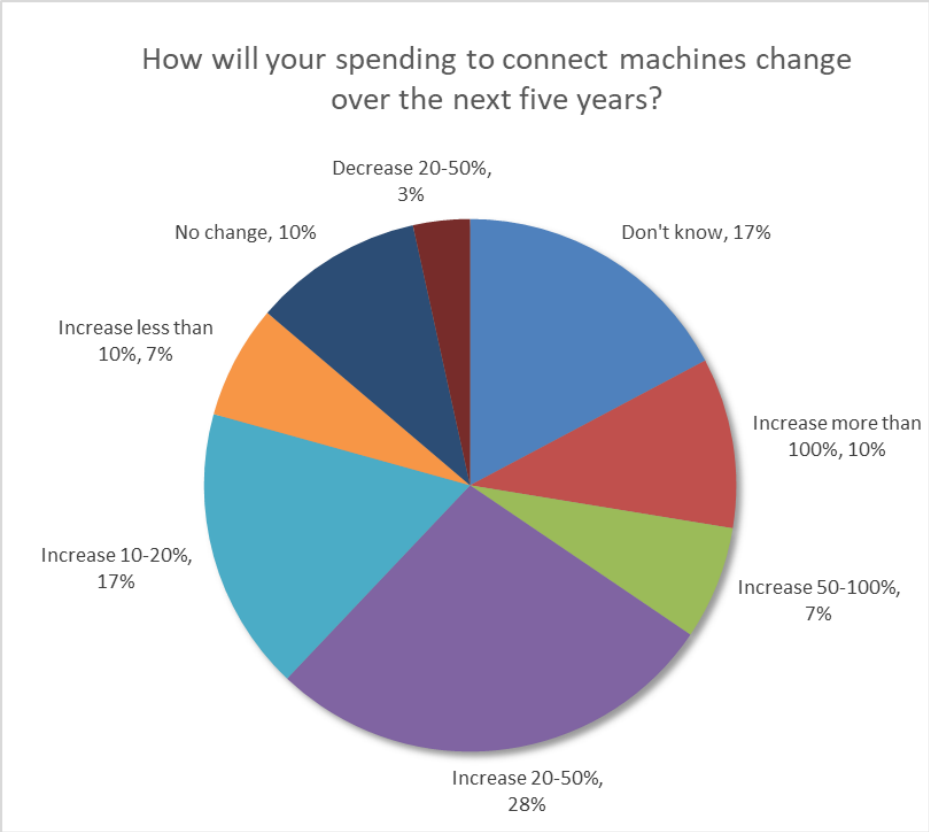
As time and expense of implementing connectivity to machines are top concerns of respondents, ARC Advisory Group recommends that manufacturers, machine builders, system integrators, and suppliers to machine builders use a third-party solution to speed up implementation, which will lower the total cost and speed up the timeline of providing machine connectivity, avoiding in-house solutions in which the time and expense would be substantially greater.

To provide connectivity to machines in their organizations, respondents are more likely to take a blended approach to getting the job done. The most popular method is using in-house resources, followed up by buying out-of-the-box solutions and partnering with systems integrators to implement machine connectivity. Buying machines with inherent connectivity is a lesser-chosen route.



The annual cost to to provide connectivity to machines varies significantly among respondents. Nearly a quarter are unsure of their organization's costs. The connectivity price tag spanned from over $100,000 per year to as low as $5,000. Nearly 50 percent of respondents reported an annual connectivity spend of $5,000 to $50,000. The wide range of costs could indicate that some companies have only partially provided connectivity to their machines.

ARC Advisory Group recommends that manufacturers take the need for connectivity to machines as a given and focus on ways to increase the efficiency of providing connectivity over the long run through better training and utilization of both internal and external resources.

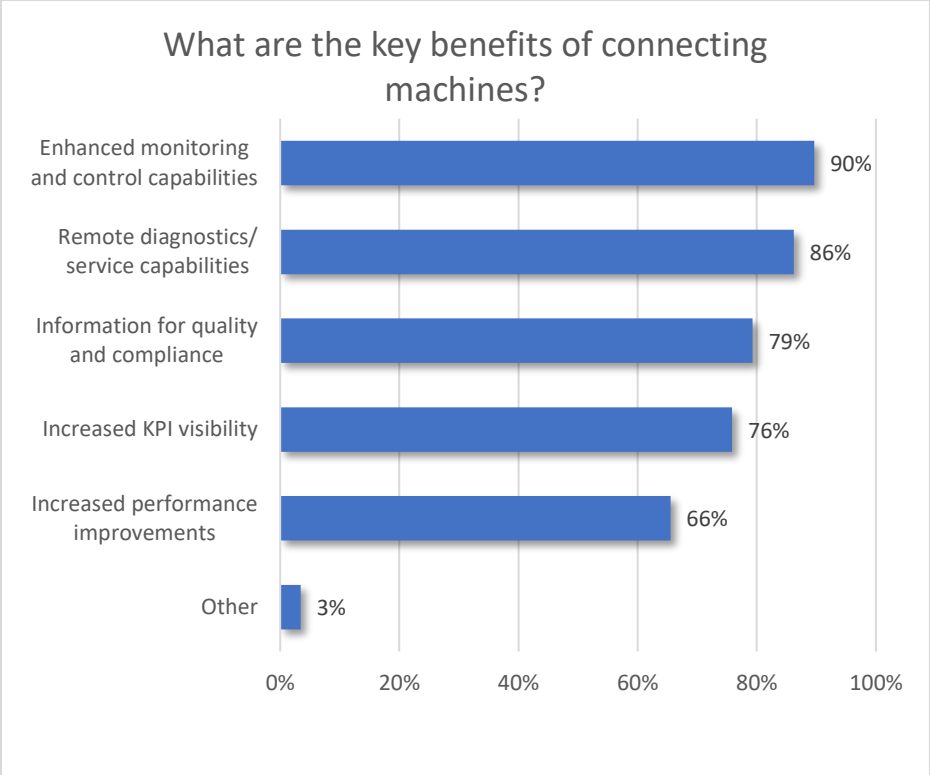


Most respondents expect their organizations to spend more on connectivity to machine initiatives over the next five years. About a quarter expect modest increases up to 20 percent, while nearly 30 percent expect spending to rise from between 20 to 50 percent. Some respondents think spending will increase between 50 and 100 percent from current levels; about 10 percent believe it will double over the next five years, indicating that most organizations will be rapidly increasing their digital transformation initiatives.

ARC Advisory Group recommends that manufacturers must budget more funds to spend more on machine connectivity over the next five years, estimating a minimum of a 20 to 50 percent increase in machine connectivity costs, to keep up with the requirements and technology necessary for digital transformation.

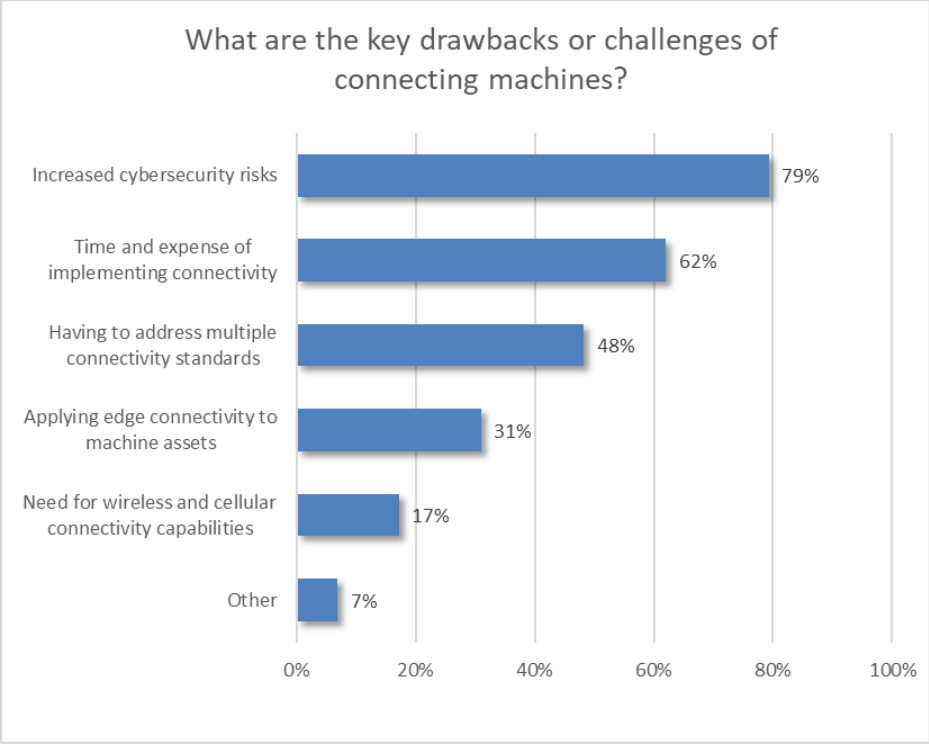
The Impact of Providing Connectivity to Machines

Providing connectivity to machines affords many operational benefits to organizations, including increased visibility into machine performance. Many respondents reported substantial financial benefits from connecting machines.



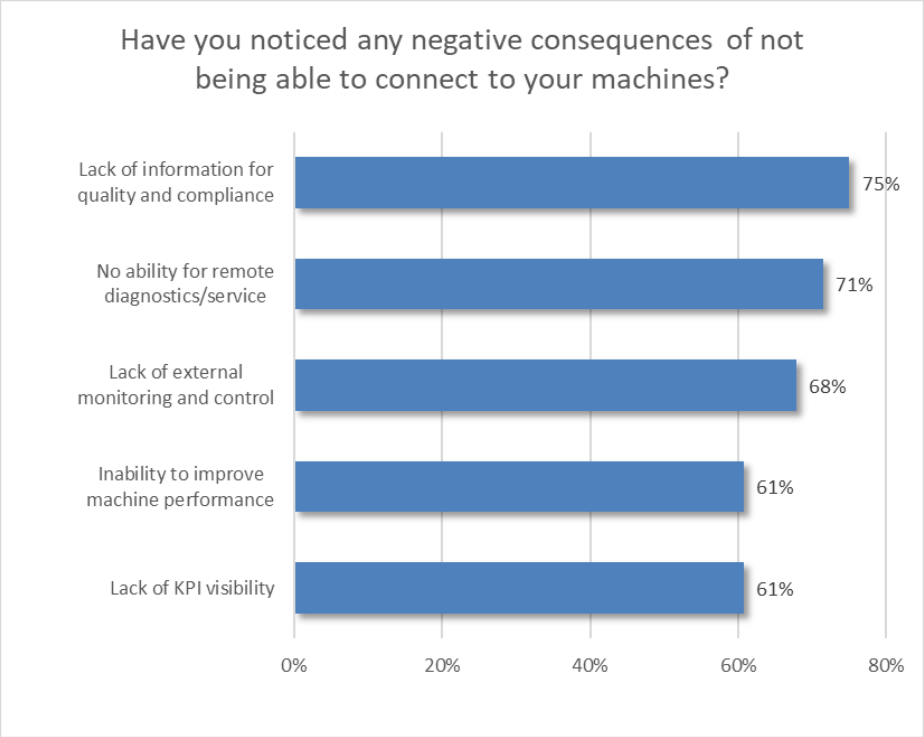
ARC Advisory Group recommends that the first step manufacturers focus on the digital transformation process is the ability to optimize the management of the existing machines from any location, and that the remote diagnostics capabilities of providing connectivity to machines must be leveraged, so machine builders and system integrators can derive ongoing operational expense (OPEX) revenue from servicing their machines and prevent or minimize issues that could result in unscheduled downtimes.

Asked about the benefits of providing connectivity to their machines at their organizations, respondents overwhelmingly cited improved monitoring, control, and remote diagnostics capabilities. This is consistent with the primary functions for connectivity that respondents indicated earlier (to support monitoring, control and maintenance). Support for compliance, increased KPI visibility, and machine performance improvements also ranked highly.



To understand the other side of the equation, respondents were asked about any drawbacks or challenges they saw in providing connectivity to their machines. Topping the list, as it does in many other ARC surveys and conversations, is increased exposure to cybersecurity risk. Another significant issue manufacturers face is the time and expense incurred when implementing connectivity projects. These concerns are typically associated with building your own connectivity, with manufacturers considering using, for example, a third-party tool with a wide breadth of connectivity.

ARC Advisory Group recommends that machine builders and system integrators must leverage the expertise of cybersecurity technology providers, partners and consultants to ensure manufacturers that the safety and security of the connected machines has been designed in and can be updated as technology progresses.



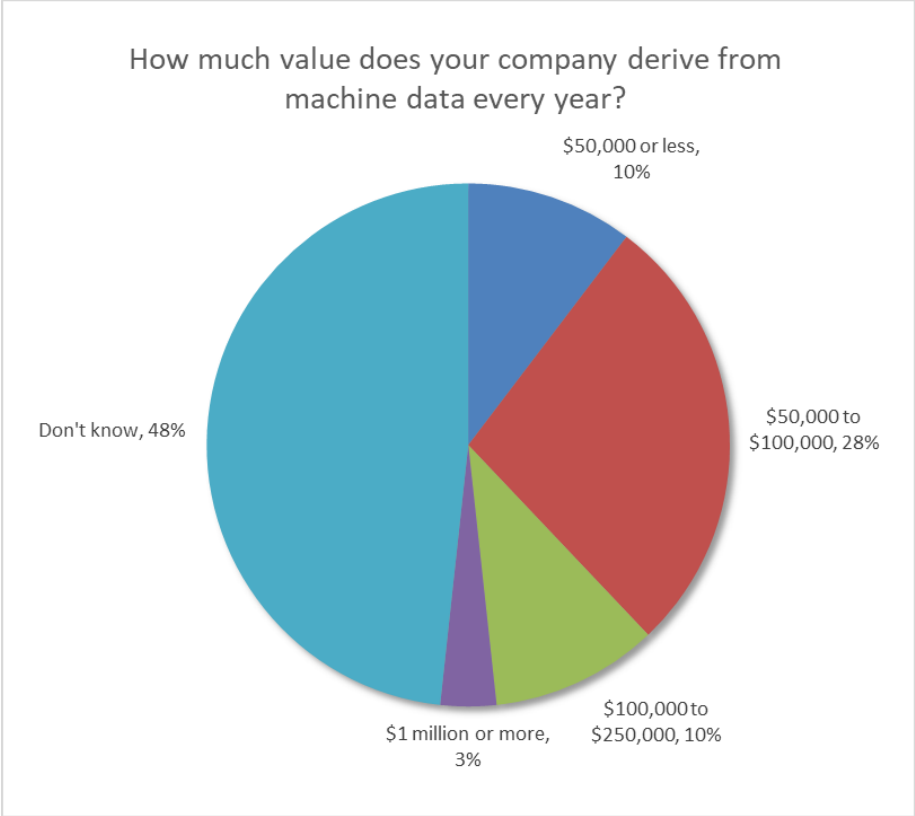
Despite any concerns about providing connectivity to machines, the negative consequences of not being able to provide machine connectivity far exceed the concerns. Issues reported by respondents overlay well with the benefits they have gained or hope to gain from machine connectivity. The top response is not having information to support quality initiatives or regulatory compliance, followed by lack of data for remote diagnostics, and an inability to monitor or control machines or production processes. This indicates that digital transformation initiatives are more apt to be accelerated when quality or regulatory compliance information is required and/or there is a regulatory need for data.

ARC Advisory Group recommends that machine builders and system integrators should focus on providing machine connectivity solutions that help manufacturers achieve their quality initiatives and regulatory compliance needs by providing the necessary quality or regulatory compliance information.

The Payoff of Providing Connectivity to Machines

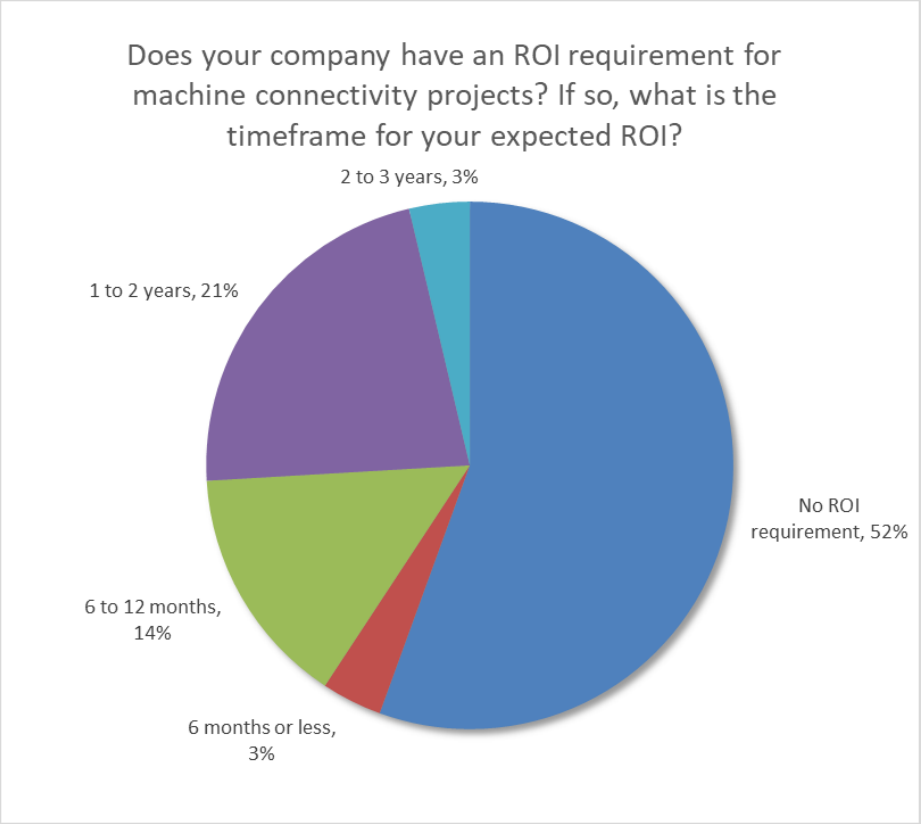
While providing connectivity to machines offers many operational benefits, it can also provide financial efficiencies and gains for manufacturers. Our survey sought to quantify these benefits and assess manufacturers'

guidelines for getting a return on their investment in connecting machines at their organizations.



Asked about the value their companies derive from data collected from providing connectivity to their machines each year, many respondents were hesitant to provide an estimate. Of the remaining half, however, most see benefits in the $50,000 to $100,000 per annum range, while a select group reported windfalls of $1 million or more. This indicates again that most organizations are taking the benefits for connectivity to machines as a given, and ROI or payback period does not need to be calculated to invest in connectivity to machines.

ARC Advisory Group recommends that manufacturers are able to take the value for connectivity to machines as a required necessity and focus on ways that they can increase the value of the connectivity over the long run through digital transformation.



Given the crucial role of machine connectivity in implementing a digital transformation strategy, ARC suggests that owner/operators adopt a less stringent ROI or payback period requirement for connectivity initiatives, it appears that payback can be expected within a year for many projects.

Perhaps an indication of strong faith that providing connectivity to machines will deliver a fast payback period, more than half of respondents reported that their organizations have no ROI or payback period requirement for machine connectivity projects. Among those that do, nearly a quarter expect a payback over the 1- to 3-year timeframe. A smaller, but still significant group hoped to see a return within a year or less.

Respondent Demographics

Our survey and interviews have generated significant interest among manufacturers and system integrators. Manufacturer respondents represent a range of different industries within the process, hybrid, and discrete manufacturing sectors, and a number of systems integrators offered their input on their experiences implementing connectivity to machines for their customers.

More than half of survey respondents are located in the Americas, and almost a third in Asia. About 15 percent of respondents' hail from the EMEA region.

The types of machines that are connected at respondents' companies ranges from the complex, such as robots and packaging machinery, to simpler machines, such as fans and compressors. Top responses of types of machines include robotics, packaging, HVAC equipment, compressors/pumps/fans, and material handling, followed closely by machinery used for electronics and food & beverage manufacturing. A good number of responses are for machinery used in oil & gas, printing, plastics & rubber, converting, and pulp & paper applications, followed closely by machinery used in semiconductor, rolling mills, metal forming & cutting, and glass/ceramic/stone manufacturing. Other respondents utilize machinery for elevator/escalator/door, mining, lumber & wood, and crane/hoist/monorail applications.

More than half of survey respondents are located in the Americas, and almost a third in Asia. About 15 percent hail from the EMEA region.

Nearly half or respondents are managers or supervisors. More than a third consider themselves individual contributors. Upper management levels represent 15 percent.

About half of respondents perform process automation or engineering functions while 15 percent are IT staffers and 15 percent business development, with 20 percent a mix of product development and management, operations, and corporate management.

In terms of job level, nearly half of respondents are managers or supervisors at their organizations. More than a third consider themselves individual contributors. Upper management levels are also well represented, with 15 percent coming from the executive suite.

About half of respondents perform process automation or engineering functions at their companies, while 15 percent are IT staffers. The business development function is similarly represented, with a mix of other departments representing in the survey, including product development and management, operations, and corporate management.

Summary and Conclusions

In today's increasingly complex global competitive environment, real-time information is vital to help manufacturers at both the plant and enterprise levels make decisions that improve efficiency and effectiveness, bringing intelligence to their business. Leveraging this real-time information requires

connectivity to all machines and assets, which also acts as the foundation of digital transformation.

Digital transformation leverages IIoT, cloud computing, mobile devices, social networks, advanced search engines, and Big Data analytics to create the information-driven enterprise. However, many machines that have been connected for many years are not utilizing digital transformation technology. As a result, these machines are not being properly utilized to provide this abundance of big data and information, which combined with analytics can be used to provide artificial intelligence and machine learning capabilities.

Based on the ARC Advisory Group's survey and interviews of experts who connect and utilize industrial machinery, ARC strongly recommends for manufacturers, system integrators, and machine builders to connect new and existing machines. Connectivity will enable individual plants and entire enterprises to maximize the business value of digital transformation.

Based on the ARC Advisory Group's survey and interviews of experts who connect and utilize industrial machinery, ARC strongly recommends for manufacturers, system integrators, and machine builders to connect new and existing machines. Connectivity will enable individual plants and entire enterprises to maximize the business value of digital transformation. And as time and expense of implementing connectivity to machines are top concerns, ARC Advisory Group recommends that manufacturers, machine builders, system integrators, and suppliers to machine builders use a third-party solution to speed up implementation, which will lower the total cost and speed up the timeline of providing connectivity, avoiding in-house solutions in which the time and expense would be substantially greater.

Analyst: Craig Resnick, Allen Avery
Editor: Paul Miller

Industry Sector Breakdowns Used in Report

Process

- Cement & Glass
- Chemical
- Electric Power Generation
- Food & Beverage
- Metals
- Mining
- Oil & Gas
- Pharmaceutical & Biotech
- Pulp & Paper
- Refining
- Textiles
- Water & Wastewater

Discrete

- Aerospace & Defense
- Automotive
- Electronics & Electrical
- Fabricated Metals
- Furniture & Wood Products
- Machinery
- Medical Products
- Plastic & Rubber
- Printing & Publishing
- Semiconductors

Founded in 1986, ARC Advisory Group is the leading technology research and advisory firm for industry, infrastructure, and cities. ARC stands apart due to our in-depth coverage of information technologies (IT), operational technologies (OT), engineering technologies (ET), and associated business trends. Our analysts and consultants have the industry knowledge and first-hand experience to help our clients find the best answers to the complex business issues facing organizations today. We provide technology supplier clients with strategic market research and help end user clients develop appropriate adoption strategies and evaluate and select the best technology solutions for their needs.

You can take advantage of ARC's extensive ongoing research plus the experience of our staff members through our Advisory Services. ARC's Advisory Services are specifically designed for executives responsible for developing strategies and directions for their organizations. For membership information, please call, write to, or visit our website:

ARC Advisory Group, Three Allied Drive, Dedham, MA 02026 USA • 781-471-1000 • www.arcweb.com

3 Allied Drive Dedham, MA 02026 USA 781-471-1000