

Original Equipment Manufacturers in the Age of Smart Systems

Part 1: Growth & Innovation Potential

Machine builders and equipment manufacturers need to address the true potential of connectivity and information-driven innovation. By integrating service and support automation directly into the fabric of machine solutions, new asset management platform technologies can help OEMs leverage the continuously evolving relationship between connected machines, smart services and customer value creation. This paper and supporting research highlights the productivity impacts and customer responsiveness gains new smart systems and digital platforms inform.

Virtually all equipment and machines now contain a wealth of information about their status, usage, and performance. Until recently, this information has gone largely unharvested and unleveraged, even though it can offer extraordinary business advantage to the companies that manufacture and service those machines, especially in terms of customer relationships. The new world driven by networked services is one in which every connected machine turns manufacturers, and in many cases others along the value chain, into a new kind of “smart service” business. It bends the traditional linear value chain into a “feedback loop” through which data rich heartbeats and insights will continually flow back through the complex business alliances that create, distribute, and service those systems. Unfortunately, while most “product-centric” businesses are now embracing the concept of growth-creating services, many are not developing new business models and not investing in new digital systems to realize the true strategic potential and value. These businesses are thinking services, but they’re not thinking “smart services.” Leaders are creating unprecedented performance and unique barriers to competition by combining a fundamental understanding of the role of after market support and its inherently unique business and operating requirements with an acute understanding of the strategic impact of intelligent machines, data management and analytics.

TABLE OF CONTENTS

MACHINE and EQUIPMENT MANUFACTURERS FACE DRAMATIC CHANGE	Page 04
THE AGE of SMART ASSETS and SERVICES	Page 05
THE STRATEGIC ROLE of SERVICES - CREATIVE CONTENTION	Page 07
SMART SYSTEMS JOURNEY: MOVING BEYOND SIMPLE, AFTER-MARKET SERVICES	Page 09
BUILDING COMPOUND VALUE for CUSTOMERS and USERS	Page 11
WHAT are the NEW STRATEGIC SERVICES OPPORTUNITIES?	Page 12

EXHIBITS

Exhibit 1: Smart Systems & the IIoT Are Enabled by Sensors, Connectivity & Data	Page 06
Exhibit 2: Connectivity Produces Data Value Across an OEMs Entire Value Chain	Page 08
Exhibit 3: The Journey from Simple to Compound to Complex Applications	Page 10
Exhibit 4: The Evolution of Smart Services Maturity	Page 13

MACHINE and EQUIPMENT MANUFACTURERS FACE DRAMATIC CHANGES

The industrial device, equipment and machinery universe encompasses a wide range of companies that develop and supply the equipment that other companies need to run their operations. The impact of original equipment manufacturers (OEMs) on the global economy cannot be understated. The breadth of equipment and products spans from components such as semiconductors and sensors to robotics and industrial machinery as well as complex test and measurement systems.

This paper identifies new forces acting on players and markets and seven key growth themes that tie closely to future OEM competitiveness which, in turn, are tied to several technology trends we believe will enable new customer solutions and new non-traditional growth opportunities. Digitization and the continued evolution of Smart Systems technologies will impact virtually every dimension of any OEMs growth strategy and operating model and will likely make the business look and feel very different in the coming years.

While it is difficult to generalize, most OEM segments are undergoing dramatic change due to broader forces at work in the marketplace but also because of the impacts driven by digital and Internet of Things technologies. The advent of connectivity for intelligent equipment and machines is enabling asset monitoring and tracking to ensure uptime, performance, availability, software version control, and location analysis for a wide range of applications. As networks continue to invade the physical world of sensors and machines, many OEMs have come to understand the significant value created from extracting and leveraging the machine data and usage information from their equipment.

As the Industrial OEM arena evolves past the last several turbulent years, multiple forces [such as global economic expansion] are likely to contribute to positive growth in the short to moderate term. The overall health of the global economy and global gross domestic product (GDP) growth historically tie closely to the growth of machines and capital equipment. For leadership teams in OEMs, identifying and understanding key forces and trends and their potential impacts on their specific product, machine or systems segment, will be critical for sustaining growth and performance in the long run. Management in equipment manufacturers and machine builders will face tough trade-off decisions related to new technology and innovation investments as well as rapidly evolving business and operating models.

Technologies, markets, customer needs and competitors are all changing rapidly. Consider just a selection of the many forces at work in the marketplace today:

- » As the economy has evolved to a more service-oriented and increasingly digital state, the importance of speed and agility as well as building new skills has increased dramatically.

- » Capital is increasingly available and abundant. The scale of financial assets is now roughly 8-10 times global GDP, making unique skills and new innovation concepts far more important than capital formation and also, are the true constraint on an OEMs ability to drive new growth.
- » Industries are consolidating into a “winner-takes-all” mode. Virtually any product or services segment likely had twenty or more significant competitors thirty years ago. Today that number is typically 3-5 globally dominant leaders in each segment collectively earning as much as 75% or more of the profit pool.
- » Wall Street demands and rewards quarterly profits and short-term performance in the name of driving shareholder value. Shorter management horizons and increased pressures from investors are what drives businesses today with less emphasis on longer term investments in new growth.

We would describe all of the above trends as “classic.” What we mean is the relationship of these trends to an OEMs core product business is predictable. For OEMs to succeed in their core product businesses they will need to continue to carefully set priorities and investments to address prevailing trends in the marketplace.

Innovation for the core business is, for the most part, sustaining, incremental and continuous. Performance measurement, repeatability, risk management, continuous improvement and financial discipline are the minimum requirements to help drive a continuing cycle of improved costs and higher levels of customer support.

However, we believe new digital and Smart Systems technologies will have an out sized impact on OEMs strategy and begin to turn long held beliefs upside down. For example, many managers believe that you can be big and low cost, or you can be focused and differentiated—but not both. Today’s Smart Systems and IoT technologies are enabling new modes of services delivery and creating new opportunities with data and analytics capabilities that either significantly reduce, if not eliminate, this classic strategic trade-off. This, we believe, is but one example of the extraordinary effects new systems technology will have on OEMs.

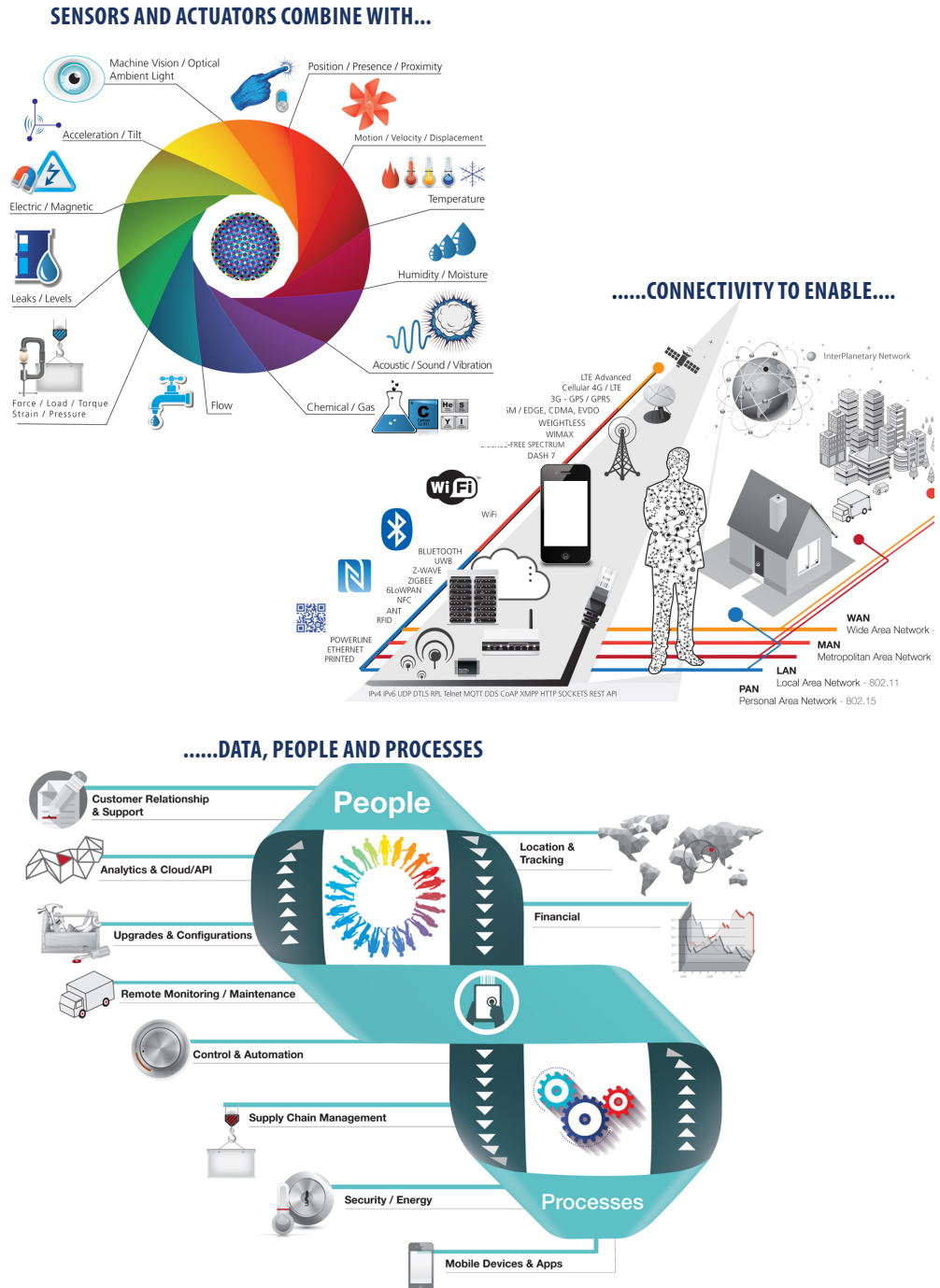
OEM Case: New Digital Business

A large diversified OEM set up a new digital business unit to aggregate its software capabilities, support its equipment segments and target new customer opportunities. The newly born digital team has collaborated with large customer accounts to drive definition of requirements and cooperate on the definition of new solutions, solution packaging, and pricing models to drive the greatest value for its customers.

THE AGE of SMART ASSETS and SERVICES

Today, it’s conventional wisdom to say that machine builders and equipment OEMs should embrace services as a means to generate growth and sustain value. The logic has been examined many times: services typically involve a recurring revenue stream,

Exhibit 1: Smart Systems and the IIoT Are Enabled By Sensors, Connectivity and Data



less fixed capital, and potentially much higher margins than those of a strictly product-centric business. Designed and executed properly, after sales services and support can prevent the downward spiral of commoditization, and create a nearly unbreakable bond

with the customer.

However, as the intelligence and computing capabilities embedded into machines rises and the capabilities to network the machine become pervasive, an OEMs new services must be wholly different than the service offerings of the past, and the customer must perceive these as having entirely new value. They must be “smart services” that are enabled by “smart [embedded] systems” and are fundamentally preemptive rather than reactive. Preemptive means actions based upon hard field intelligence. Smart services would thus be based upon actual evidence that a machine is about to fail, or that a customer’s supply of consumables is about to be depleted, or that a shipment of materials has been delayed, and so on.

Such “connected” services create new value by removing unpleasant surprises from the customer’s life—by preventing the customer from being blindsided by happenstance or outdated methodologies, such as time based maintenance. Further, the field intelligence makes product performance and customer behavior visible as never before, giving the manufacturer unprecedented R&D feedback and insight into the customer’s needs, and thus the ability to provide ever greater ongoing value. Gathering and analyzing the necessary field intelligence is not a role for human beings because of their natural predisposition to error. The only way to achieve it is to have the machine’s “intelligence” continually delivered back to its creator.

THE STRATEGIC ROLE of SERVICES - CREATIVE CONTENTION

Products and services, while complementary, have historically had opposite strategic goals and divergent operational models. As a result, each business type has had to seek out its own distinct strategies. The traditional machine builder and equipment manufacturing business typically defined services and after sale support as subservient to the product, as no more than a “bootstrap” business with little upfront investment. This model is rapidly disappearing. The ability to closely couple machines and equipment and a wide variety of new support services has emerged as a requirement to stay ahead.

The two thrusts need to be mutually supportive without inhibiting one or the other. However, trying to coordinate and leverage the respective roles of products versus services often creates contention. Many leading manufacturing organizations have come to understand that each have distinctive strategies, operating modes and organizational requirements, and most importantly, that services cannot rely on products to be its “role model.”

OEM Case: Service Innovation

A pump, valve and seal manufacturer wanted to improve the efficiency of its extensive service organization while increasing its value-add to its customers across oil and gas and utility sectors. It added connectivity to its pumps and valves to enable remote monitoring activities and drive new service values, while working with partners to handle data management and analytics capabilities.

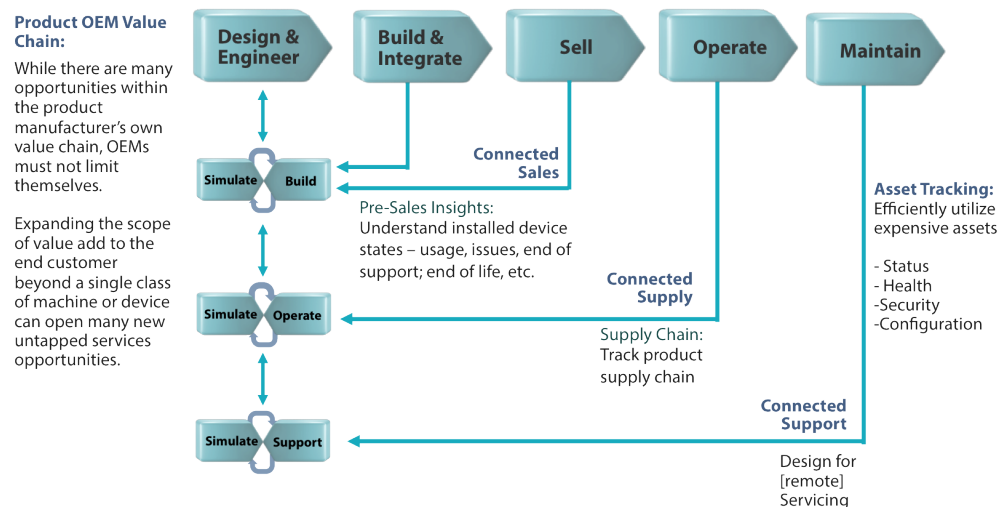
The best companies have come to see the continuously evolving relationship between products and services as a fertile ground for innovation. The two need to be interwoven and mutually supportive, and increasingly, success in either goes to the company that effectively utilizes the combined potential of both, but only when services has been designed for its own unique destiny.

As products evolve, so do the attributes of the services required to support the product. Each impacts the other in an ever changing set of relationships. The salient characteristics of each model are often very fluid in nature. Understanding this critical evolving relationship is the key to effective and profitable service delivery. Service business design requires organizations to address several critical aspects of their business, including:

- The overall strategic role of services;
- The uniqueness of the business model and the delivery schema; and,
- The required organization structure and skills requirements.

The electronic linking of machines, users, channels and support specialists, will continue its inevitable march forward, but the value of networking machines and equipment and, in turn, automating and orchestrating support functions will become ever more tightly coupled. This linkage must become more cooperative and interrelate in a mutually advantaged way; “creative” contention, not negative contention.

Exhibit 2: Connectivity Produces Data Value Across an OEMs Entire Value Chain



SMART SERVICES JOURNEY: MOVING BEYOND SIMPLE AFTER MARKET SERVICES

A networked machine generates information value over its entire lifespan. Machine builders and equipment manufacturers can know where the device is located, when it was installed, critical specifications, diagnostics, availability of spare parts, usage patterns, support status and so on.

Traditional customer relationship and equipment support programs yield only intermittent, uneven and incomplete windows into how customers interact with a machine. Once a machine is shipped to a customer, the manufacturer loses sight of who buys it, how it is configured, what its use is and what the customer experiences with it. When machines become networked and support is automated, the environment in which they are utilized becomes more “aware” and responsive. Eventually, this environment helps customers optimize their processes, save money, and become significantly more efficient.

Up until now, most of the discussions concerning machine and asset data, analytics and customer support automation focus almost exclusively on “simple” monitored values such as alarms and alerts. Return from simple applications, while extremely valuable, is limited to the manufacturer’s service delivery efficiency. Contrary to what current market offerings depict, however, the value of connectivity does not have to end with just simple applications focused on a single class of device or machine.

As technologies mature and open standards become the norm, applications based on deeper, peer-to-peer interactions between devices, machines, systems and people will drive more “compound” and dynamic value streams. This opens up new collaborative business model opportunities that have the potential to drive much greater value for the customer.

Moving from “Simple” to “Compound” applications involves multiple collaborating systems with significant interactions between and among devices, systems and people. No longer is the focus solely on the product supplier’s ability to deliver support for their product efficiently. Rather, value is brought to the customer through business process automation and optimization.

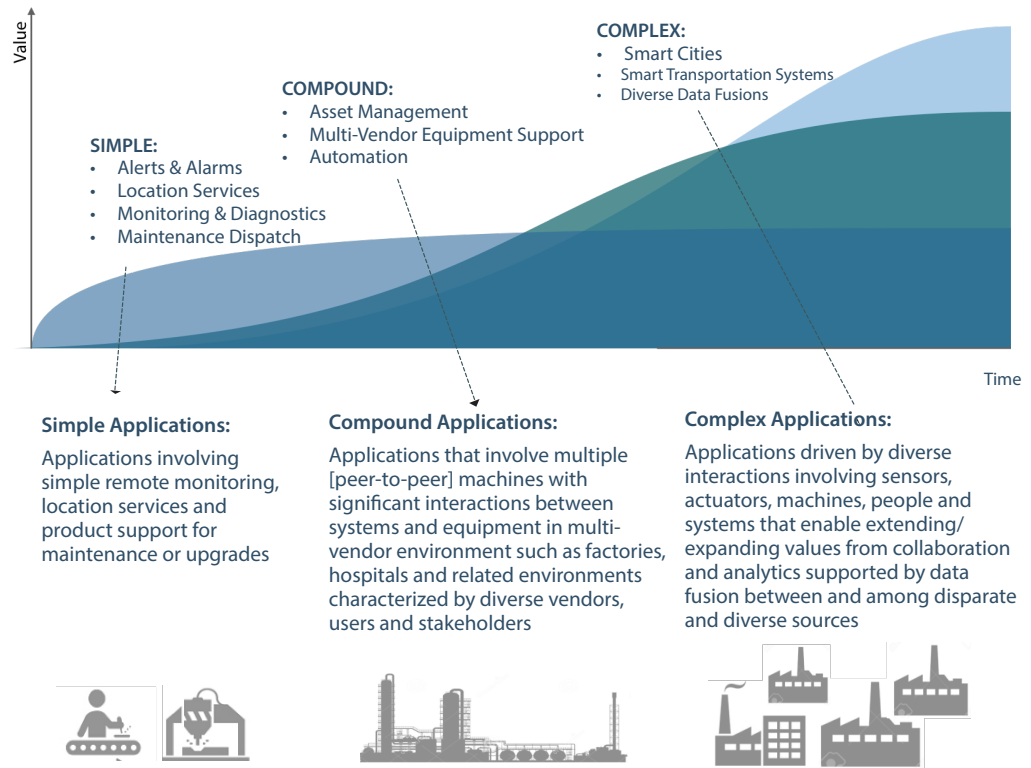
Consider any of the larger diversified industrial players that sell complex machines like turbines, compressors, and the like. In the power turbine business, for instance, major electric utility customers have good reason to loathe equipment failures. At the least, any downtime creates huge opportunity costs for these customers; often it means they have to pay hefty regulatory compliance fines.

OEM Case: Creating Multidimensional Value

A cleaning equipment manufacturer needed to improve the life-cycle of its equipment while driving better customer and user experience.

Through a combination of internal development and third-party support, the OEM created set of self-service analytics tools to enhance its customer support and consulting activities. These capabilities are now allowing the OEM to redesign its equipment and services to increase machine lifespan and customer satisfaction.

Exhibit 3: The Journey From Simple To Compound To Complex Applications



To reduce that risk, players like GE have invested heavily in monitoring and diagnostics so they can deploy a technician or engineer ahead of a failure (preemptively) as opposed to doing so according to a schedule based upon prescriptions (pro-actively) or, even worse, after the power has gone off (reactively). For one thing, this has a dramatic effect on the profitability of these players maintenance services. Most manufacturers cannot charge more than \$100 to \$130 per hour for their technical support because of price and benefit pressures from local competitors. But because of efficient network-enabled services, leading players can charge \$500 to \$600 per hour for the same technician who has become a subject matter expert.

But, in the end, these are still examples of simple applications largely focused on a machine builders or equipment manufacturer's own value chain. They are simple "hub and spoke" remote support. While there is value in these models, there are significant untapped opportunities for providing new compound value for the users and customers.

BUILDING COMPOUND VALUE for CUSTOMERS and USERS

We have observed many new and creative value added services and business model innovation opportunities which, for the most part, often appear too “aggressive” or “risky” for the typical industrial B2B players. Machine builders and OEMs often miss new opportunities because traditional machine and product-focused company cultures have all too often defined services as subservient to the product, as no more than a “bootstrap” business with little up-front investment or innovation.

Smart Systems, Assets and Service’s true potential lies in the integration of diverse machines, information systems and people—its ability to connect billions upon billions of smart sensors, devices, and ordinary products into a “digital nervous system” that will smoothly interact with individuals and the physical world. The nature of compound and complex smart system applications is just beginning to be understood where the information value generated by these capabilities positions players to take on significant additional tasks for the customer, such as:

- » Managing and automating a customer’s spare parts inventory and service delivery chain for maintenance processes providing vastly improved levels of service and responsiveness;
- » Providing the customer’s first line support staff, the machine builders’ service technicians and other third party support personnel with complete access to a unified machine maintenance record that captures all of the machine’s performance data, history and knowledge about the status of the equipment enabling faster and more effective maintenance processes;
- » Analyzing the history of the equipment in use against diverse data sources such as weather patterns and peak usage requirements to optimize its performance; and,
- » Providing entirely new services to the customer such as “security as a service” where security and privacy for all devices, machines, networks and data is provided as a managed service.

Customers are looking to equipment manufacturers not just for high-quality equipment, but also for help in optimizing their ability to supply consistent and high-quality products and services to their customers. This evolution will allow machine builders and equipment manufacturers to tie their revenue and pricing models directly to the value and related benefits they provide.

Taken one step further, applications that drive interactions between and among devices, sub-systems, machines and people across operational and enterprise systems will potentially allow extending and expanding values from third party collaboration and large scale data integration and analytics that, while complex, will drive the highest possible value from smart systems and assets.

OEM Case: New Customer Values

A leading provider of test instruments for maintenance support has used a number of acquisitions to expand beyond simple support services. It has combined asset management software with its equipment to expand scope of services the OEM can provide to its customers, while driving significant efficiency through existing services and its customer's internal maintenance organizations.

If you place this evolution into a much larger context – say how the Internet of Things will impact our planet's resources – the potential impacts become even more profound. Even with the productivity improvements we see today, modern electricity and power delivery systems are still extremely inefficient. Over 20% of electricity generated each year is never consumed from the grid. This represents more than enough energy to power an entire region like the United States or Europe for an entire year. Utilizing network and data management technologies to make the grid more efficient would allow us to retire well over 1000 coal-fired power plants. Combining sophisticated sensors, real-time connectivity, and massive computing power to leverage the data from these operational systems, can equip businesses for the next level of optimization across virtually all sectors of the economy.

WHAT ARE THE NEW STRATEGIC SERVICES OPPORTUNITIES?

When machines and equipment become networked, the environment in which they are utilized shifts to a much more “aware,” and responsive support environment. Eventually, this environment helps customers optimize their processes, save money, and become significantly more efficient.

Leadership in many of these complex machine builders and equipment OEMs are really only just beginning to understand the opportunities driven by the complicity between service business design, networked systems and embedded machine intelligence. It is this set of relationships, not the technology alone, that will benefit but also challenge many machine builders and equipment manufacturers.

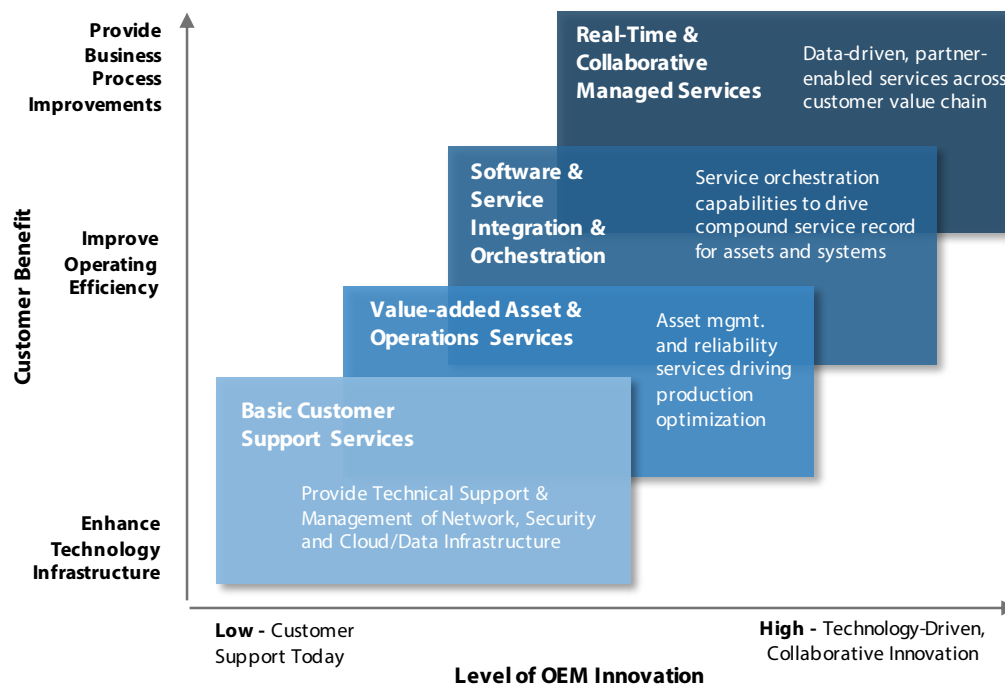
In a unified network environment, information becomes currency, and can be shared and utilized collaboratively. For many machine builders and equipment OEMs, what might have started a handful of years ago as a traditional “after-market” services view of the opportunity has quickly evolved to a broader understanding of the impact of digital technologies, the challenging transformation they inform and the related benefits, including:

- » **Cost and Service Lead Time Reductions:** Machine OEMs that have implemented equipment monitoring and health solutions have been able to remotely connect to their networks, including after-hours when customers have no staff on-site, and remotely diagnose and schedule downtime required for the fix, therefore potentially saving the customers hundreds of thousand of dollars. Service centers can be automatically linked to interrogate the machine to find out

what happened and ensure that technicians and operators are equipped with the correct diagnosis, spare parts and support plan before initiation of any on-site activities, thereby reducing the technician time while also improving the overall uptime for the customer. These actions obviate the need for manual support and “truck rolls” while ensuring maximum availability.

- » **Agility and Flexibility:** An “aware” networked machine strategy introduces the capability to apply changes almost instantly to many responding partners and customers. With less need for direct human interactions, updates are now sent automatically and support changes to intelligent products are deployed much more efficiently.
- » **Improved System Support Knowledge:** Implementation of new digital operations and asset system technologies allows for improved services on several fronts. Customers, who are accustomed to being “blind” to the state of their machines have gained visibility. With performance data available at any time for service providers and customers alike, partners have been able to signal and flag potential problems, and also are now in a better position to predict possible future failures or to advise on a course of action to save cost or improve availability or throughput.

Exhibit 4: The Evolution of Smart Services Maturity



- » **Better Leverage of Machine Builder's and Customer Support Ecosystem Capabilities:** Deploying asset management platforms in combination with data management and analytics can help customers orchestrate the many differing services and support “persona's” throughout their operations - first-line maintenance, OEM service technicians as well as third party supplemental services providers. New tools provide customers with compelling options for equipment, systems and staff optimization opening the door to new collaborative relationship opportunities between machine OEMs peer equipment providers and users.
- » **“Stickier” Customer Relations:** Due to the visibility provided by new asset management platforms, there is much more visibility of an OEMs installed base of machines and their respective configurations and effectiveness of support. This has, in turn, improved relations as customers and their OEM partners become much more responsive and ultimately more proactive. This is largely driven by the data stream captured from the customers' equipment and is increasing the chances of supporting a customer need before they even know of its existence.
- » **Collecting Valuable Information Drives Multiple “Compound” Values:** Asset management systems are collecting information from machines and equipment that has considerable leverage with users, customers, and OEMs. When the OEM and end user can access to data and information about the complete history of the machine - its usage, performance, and beyond - this data can inform improved machine and system designs and reveal where features and functions can be added or improved in the machine design. Product developers and R&D organizations will gain immediate feedback on how a particular product is used, which features are most popular and what problems typically arise.

ABOUT HARBOR RESEARCH

Founded in 1984, Harbor Research Inc. has more than thirty years of experience in providing strategic consulting and research services that enable our clients to understand and capitalize on emergent and disruptive opportunities driven by information and communications technology. The firm has established a unique competence in developing business models and strategy for the convergence of pervasive computing, global networking and smart systems.

For machine builders and OEMs, new network integration, data management and analytics for machines open many new services and value adding opportunities to capitalize on.

While the opportunities are plentiful and the value potential is enormous, OEMs cannot hope to develop the required capabilities and solutions without making fundamental changes to the way they do business. Part 2 of this paper will dive into specific business model implications and critical success factors for OEMs that want to drive new and sustainable growth in the age of Smart Systems and Services.