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A Practical Approach to Machine Builder – Operator Collaboration

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Has the Time for Servitization Finally Arrived?

The Service Relationship is Changing

The relationship between machine builders, their products, and their customers is evolving. Many machine builders who traditionally followed "sell it and forget it" or "service it because you have to" models are moving to more closely aligned service relationships. Why? Manufacturers recognize they have a strategic opportunity to drive higher revenue and better profit margins by transforming their service approach. And in some cases, their customers demand it because they need to get the most out of increasingly complex machines to drive their own productivity and profitability.

Time for a Practical Approach

This shift is not new. Service transformation, sometimes called "servitization," has been discussed for well over a decade. We wrote about the trend in The Service Lifecycle Management Approach as far back as 2003. Since then, some companies and industries have made progress. The concept is well defined, and the enabling technology has come a long way.

But few machine OEMs have been able to fully embrace the model, and reaching the highest level of service maturity still faces people, process, and technology challenges. Fortunately, it's not an "all or nothing" proposition. Machine builders have plenty of room to improve. And, even if they never reach the ultimate goal, there is value along the way. This eBook explores five practical steps manufacturers can take to improve machine builder – operator collaboration and increase value for both themselves and the customers operating their machines.

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Recognize the Opportunity

Improving Service Benefits OEMs and Operators

Improving service performance is a win-win. It brings machine builders new revenue, higher margins, better customer relationships, and a steadier income stream. In addition, transformation can provide strategic value by creating machine performance knowledge to improve engineering. It can also support significant business transformation, opening up the potential for new business models like "Product as a Service" (PaaS) or "Machines as a Service" (MaaS), where the machine builder takes on responsibility for delivering productivity instead of hardware. Finally, it can improve sustainability by optimizing energy use and supporting circular economics where machines could be resold, remanufactured, or harvested for valuable components and materials instead of scrapped.

Transformation also helps customers better operate and maintain increasingly complex equipment. In turn, it allows them to increase uptime, plan for downtime, raise productivity, optimize performance, improve efficiency, reduce cost, and cut power consumption.

The Potential for Transformation is Proven

The value of improving service through tighter relationships and digital transformation is well documented. There are practical examples to follow. Other industries, including aerospace, have paved the way, proven the value, and developed best practices. There are experienced consultancies that know how to transform to servitization. Supporting technologies, including the Industrial Internet of Things (IIoT), analytics, Enterprise Asset Management (EAM), and Service Lifecycle Management (SLM), are more mature and accessible.

The Potential for Transformation is Proven

It's hard to argue with the value, but it's a significant change. Technology has advanced faster than companies can adapt. Collaboration requires a level of trust and accountability between partners. Some operators may not want their data connected to the internet or consider their operational data and processes part of their intellectual property and be reluctant to share it. Making the transition can also be a financial hurdle. Shifting how and when manufacturers record revenue is a major change, especially for those producing expensive machinery.

Machine monitoring benefits translate into real business results. The vast majority, 86%, say that their company's profitability has increased by monitoring and optimizing machines using the industrial IoT. Over one-third, 35% say it has increased significantly.[2]

A PRACTICAL APPROACH TO IMPROVE MACHINE BUILDER – OPERATOR COLLABORATION

The Value of Machine Builder – Operator Collaboration

Operator Value

Throughput
Uptime
Reduced risk
Plan for replacement
Reduce manufacturing backlog
Auditability
Optimized operation
Predictability
Lower capital expense
Reduced cost
Prevent unplanned downtime
Plan for long lead-time parts
Lower spare parts inventory
Fixed costs
Reduce energy consumption
Extend the useful life of the equipment
Less need for experienced technicians on staff
Keep up with upgrades
Make faster replacement economically feasible

Machine Builder Value

Reduce service labor
Reduce repeat service calls
Better productivity
Repeat business
Replacement orders
Reduce parts inventory
Consumables
Operationalize service knowledge
Lower warranty cost
Reduce travel and onsite visits
Support less experienced technicians
Better leverage knowledgeable technicians
Make scheduling service workers easier

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Take a Practical Approach with Room to Grow

Innovate, Experiment, Learn, and Improve

Although the vision is more attainable, it may not be easy for every company to achieve. What can machine builders do now to start down the path toward value? We recommend that they understand the big picture but start small. But starting small doesn't mean the project has to be limited to a proof of concept. There are practical ways to create value now and make progress toward the future state as they gain experience improving service in a digital model. Machine builders can take tangible steps toward greater maturity by:

- Improving collaboration with their customers
- Learning from the experience
- Repeating what works
- Extending their success
- Expanding to new areas

Create a Value-Driven Strategy

It's essential to develop a practical plan, however, before spending a lot of time and energy on the project. Incremental adoption and improvement are not substitutes for strategy. The most important step is working with customers to research potential improvements and how they add value for both the machine builder and the operator. It's important to look for the win-win, communicate it with the customer to get alignment, and then get started. Do the research to target improvements that will make a difference and be worth building on.

For example:

- What challenges do your customers face while operating your equipment?
- What would they value if you could change the situation?
- What would "change the game" for them?
- What are they willing to pay for it so that you can share in that value?

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1. Improve Equipment Data

Know your Equipment

One of the most fundamental steps machine builders can take toward transformation is getting an accurate view of their equipment in the field. Providing technicians and operators with current configuration and service information helps them efficiently operate, troubleshoot, and fix machines.

Machine builders should create rich digital twins to capture and communicate machine details. But, creating complete machine knowledge may not be as easy as it sounds. Today's machines are highly complex, and each one may contain a unique combination of components, assemblies, and software. Understanding those details in context is critical. It allows service planners, for example, to create custom maintenance instructions, service BOMs, and service plans for each unique configuration. This rich detail can also help compensate for shortages of experienced service and operation technicians, which are common in both machine builders and operators.

Manage the As-maintained Equipment

The as-built is helpful, but it's not the complete picture. Complex machines typically operate over long lifecycles. Companies should collaborate to close the loop and gather revised configurations after repairs, software upgrades, or modifications. Maintaining the "as maintained" digital twin may be challenging due to information gaps between the Engineering and Service departments and a lack of communication between machine builders and operators. This information may need to be consolidated and contextualized into the PLM backbone from multiple systems, such as PLM, EAM, and SLM.

Companies that extend the digital twin to the current state of the equipment make service and operating information more valuable, create a single digital thread of information between design and service, and require less interpretation and decision-making in the field.

Lifecycle Focus of the Digital Thread

As-Designed
The basics - tracking by configuration and revisions

As-Built
Tracking by lot or by unit, ideally including serial numbers for at least critical components

As-Maintained
Tracking updates to a product as it is upgraded, modified, and maintained, ideally incorporating mechanical, electrical, and software elements. Potentially including as-installed information in some industries.

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2. Improve Service Response

Put Data into Action

Another valuable transformation is putting machine data into the right hands to improve service. For example, having current equipment data available during planned maintenance or unplanned events lets service planners make sure the right technician comes out with the needed skills and certifications. It also ensures they bring the right parts and tools to execute the service plan.

Machine builders should make their equipment digital twin available to service planners and technicians so that configuration-specific, as-maintained service information is accessible. Again, this information may be maintained in several systems, including PLM, ERP, and SLM, but should be consolidated and contextualized into a comprehensive digital twin that extends to service. This provides service knowledge that technicians can access for unique service BOMs and instructions to support their configuration. This service knowledge could be provided in a field service app or created in new, easily accessible mobile apps for technicians and operators. Sharing this information based on the digital twin, perhaps supporting virtual and augmented reality, puts data at the point of need and can help support less experienced personnel.

Put Data Directly into Action

A trusted digital twin of the machine can also support remote diagnostics, decision-making, and service. Service experts can leverage machine data to remotely collaborate with operators to help them self-service equipment, saving time and money and better leveraging experience experts. In addition, self-service and remotely fixing equipment can help improve productivity and throughput for operators.

Companies can gain significant value by **empowering service managers, technicians, and operators** with an accurate digital twin to provide operating and service information reflecting the current state and configuration of the machine.

A PRACTICAL APPROACH TO IMPROVE MACHINE BUILDER – OPERATOR COLLABORATION

3. Connect and Communicate

Identify Opportunities

The next opportunity to improve service performance is to look for ways to collaborate about equipment in real-time (or near-real-time). The first step is to understand what you should collaborate on and implement an equipment monitoring strategy. The strategy should start by identifying a problem to solve that is both achievable and valuable. Although some broad approaches may include capturing as much information as possible and looking for data correlations, these first steps should be much more targeted. For example, these first collaboration efforts may be as simple as monitoring whether the machine is operating, running the right software version, or giving error codes. Or they may report whether the machine is operating within specifications to identify anomalies.

Start Machine Monitoring

Once opportunities are identified, it's time to connect equipment and monitor data. Although many companies connect via the IIOT and monitor in real-time, there are other options. Connecting via a Virtual Private Network (VPN) or periodic physical data downloads without connecting to the plant network may suffice. There may

be some challenges, such as enabling older equipment by adding sensors and communications capabilities. Or companies may need to work with their customers to get access to data behind the firewall, perhaps by putting edge devices in place in a DMZ. Lastly, the monitoring strategy may benefit by connecting data across systems such as ERP, Enterprise Asset Management (EAM), SLM, or PLM. The key is to keep it simple and provide the right information in time to resolve an issue fast enough to improve productivity or profitability.

Collaborate with Operators, Techs, and Engineers

It's not enough to connect equipment. Machine builders and operators must also collaborate on how to act on the information. They must find a way to notify the right people, perhaps using custom applications, alerts, or dashboards, and provide the proper context from the digital twin so they can make the right decisions. In addition, companies can close the loop with designs by providing real-world performance feedback to engineers.

TECH- CLARITY'S FIVE PILLARS OF MACHINE MONITORING AND OPTIMIZATION

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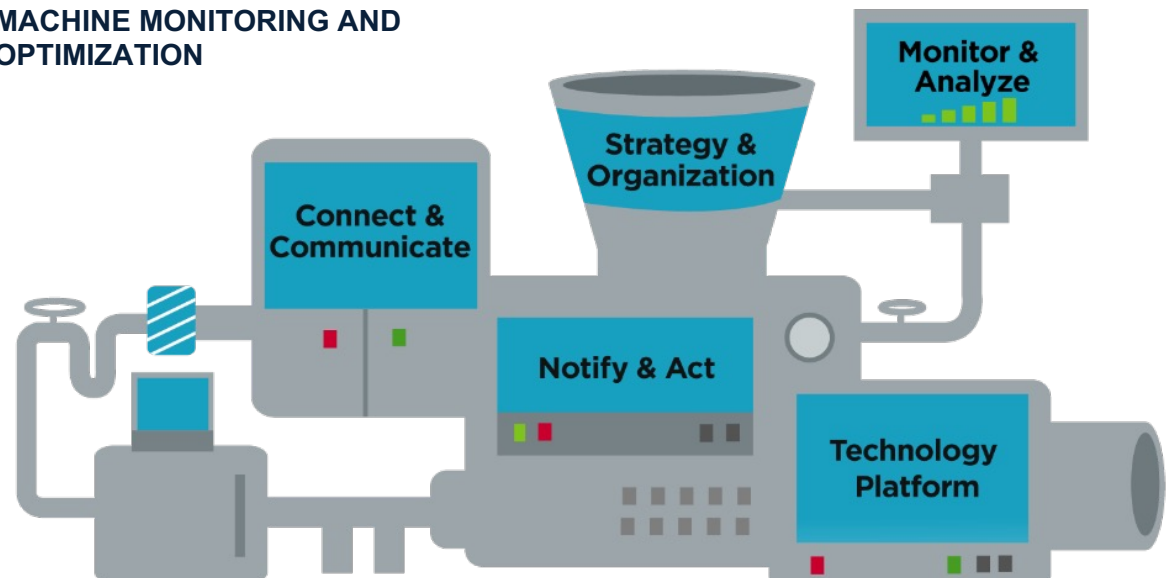
4. Increase Predictive Capabilities

Increase Value by Being Proactive

One of the primary goals of service transformation is to eliminate the need for unplanned service and the resulting cost and downtime. The goal is to identify potential critical failures and find ways to predict and prevent them. There are practical steps to take to do this. For example, not all predictive approaches require advanced algorithms.

Companies can identify warning signs by combining company knowledge, a connected physical machine, and its digital twin. First, operators, engineers, and service technicians can collaborate to determine the most disruptive issues. Then, they can work together to predict problems and specify the actions needed to mitigate them before the machine breaks down or suffers additional damage. Companies can often predict issues by monitoring machine attributes such as temperature, vibration, lubricant health, or other telltale signs of an impending problem. Doing this may require extra sensors to gather new operational data but may not require an advanced mathematical approach.
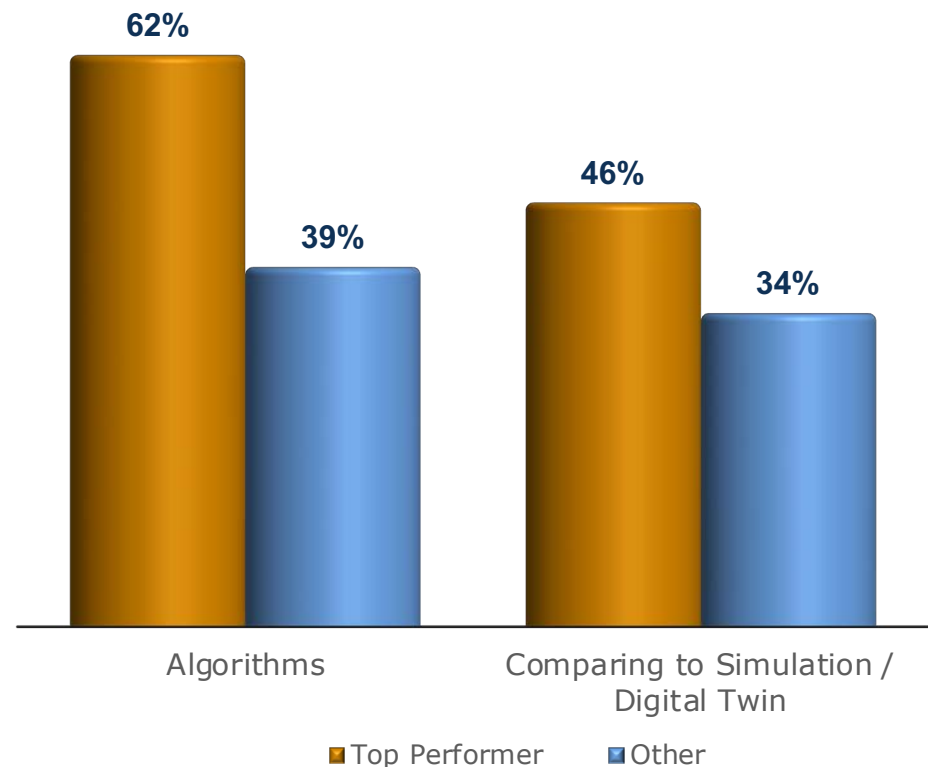
Add More Mature Simulation, Predictions

Some issues may require a more advanced approach to predict failure. In these cases, more complex data correlations that are very difficult or impossible to identify through experience may be the key to predicting errors. For example, they may require a combination of both operational (OT) and enterprise (IT) information. More advanced analytics, including artificial intelligence (AI) and machine learning (ML), can play a valuable role in predicting problems. Physics-based simulations based on engineering knowledge, for example to identify root causes, are also becoming valuable tools. Our research shows that Top Performers in machine monitoring are more likely to use

advanced methodologies to gather insights from machine data. They are 59% more likely to use algorithms and 35% more likely to compare machine data to simulations and/or a digital twin[2].

It's important to recognize that machine builders may not need to invent these analytics. Instead, software vendors and service providers can provide packaged analytics that may be suitable and require far less internal data science expertise.

TECHNIQUES TO GATHER INSIGHTS FROM MACHINE DATA BY PERFORMANCE CLASS[2]

Bar chart. Algorithms: Top Performer 62%, Other 39%. Comparing to Simulation / Digital Twin: Top Performer 46%, Other 34%. Legend: Top Performer, Other.

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5. Organize for Success

Change the Value Proposition

Perhaps the most critical step is for machine builders and operators to work together to explore mutually beneficial opportunities. This should start with the business in mind, not technology. While the ultimate goal may be to transition to a PaaS or MaaS model or implement a circular machine lifecycle, there are likely shorter-term ways to collaborate by shifting performance responsibility to the machine builder in a higher-value service level agreement (SLA). These arrangements should assure the operator of uptime or throughput and leave an upside for the machine builder if they overachieve SLA goals.

Manage the As-maintained Equipment

Many machine builders can start without machine monitoring or changing their business model by extending their existing capabilities. For example, they can start with better field service by providing technicians with the current state and configuration of the equipment so they can be prepared to service it. Or, they can enable less experienced or remote technicians with machine-specific service instructions. Much of this can be done with a digital twin based on the right foundational technology, which they may already have, for example:

- PLM for configurations and the digital twin
- SLM for service engineering and planning information
- EAM for internal asset maintenance data
- FSM for field service history
- ERP for spare parts
- CRM for trouble tickets
- Others as needed

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Get Started

Start Small, Then Expand

Although few machine builders have reached the highest level of digital transformation maturity, it's essential to get started. These techniques are becoming more prevalent and achievable. It's time to collaborate on a small but meaningful project that solves a real problem. This project should provide benefits for both the machine builder and the operator.

Choose a product line or focused use case and take an agile approach that gains value with a "minimum viable product" approach. Keep it simple so you, and your partner, can learn and extend based on experience.

Manage Change

Lastly, remember to manage the change. Educating management, personnel, and customers about the change and why it is valuable to them is critical. Next, develop a plan that addresses both business and technical requirements, and engage with engineers, operators, and service technicians to learn from their knowledge. Then, get started to create an advantage on your timeline before being forced to react to competitive threats.

Acknowledgments

About the Author

Jim Brown founded Tech-Clarity in 2002 and has over 30 years of experience in the manufacturing and software industries. Jim is an experienced researcher, author, and speaker and enjoys engaging with people with a passion to improve business performance through digital enterprise strategies and supporting software technology.

Jim is actively researching the impact of digital transformation and technology convergence in the manufacturing industries.

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Tech-Clarity is an independent research firm dedicated to making the business value of technology clear. We analyze how companies improve innovation, product development, design, engineering, manufacturing, and service performance through the use of digital transformation, best practices, software technology, industrial automation, and IT services.

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