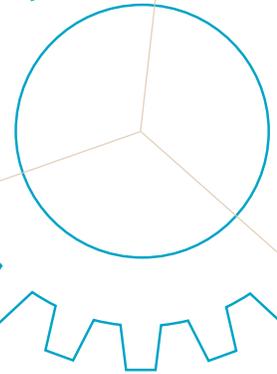
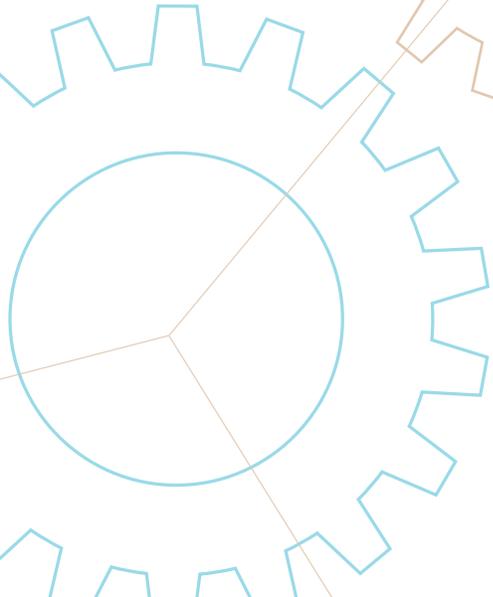
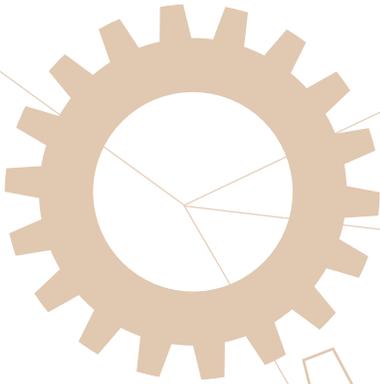




The Rise of Smart Operations:

Reaching New Levels of Operational Excellence

White Paper





Smart operations will be critical to future success

by enabling companies with limited resources to serve increasingly demanding customers with more speed.

Executive Summary

The Lean and Six Sigma (Lean Sigma) continuous improvement discipline has been at the center of operational excellence strategies in the manufacturing industry for decades. The new complexities of manufacturing — serving demanding customers with a rapidly increasing number of products and services — have tested the limits of Lean Sigma. In response, manufacturing firms are looking to technologies that instrument processes (e.g., the Internet of Things) and analyze information (big data/cognitive) in real time to supercharge value chains and create a new approach to operational excellence. This new approach is called smart operations.

Industry research from IDC shows that many companies are relatively immature in their efforts to transform their operating models but that progress will happen rapidly over the next three years. UPS conducted research to gauge the pace at which manufacturers are evolving. The results indicate that the gap is widening between the companies that are aggressively embracing smart operations principles and those that are falling further behind. Those companies that are taking the lead are much better positioned to achieve the level of operational excellence needed to be competitively effective in today's demanding markets.

The research also revealed another prominent success factor — the increasingly important role of external service providers. Manufacturing companies recognize that they must focus on their key internal competencies while leveraging the scale, technology and skills of those providers that can deliver crucial support processes.

Companies must assess how they are progressing relative to their industry peers. The data shared in this research should provide a model for evaluating a manufacturing company's maturity. A key first step for companies, regardless of maturity, is to articulate a strategy for transforming their current model to achieve the level of operational performance needed to be competitive. The next step would be to examine the operations' decision-making process to identify the most immediate opportunities for enhanced data acquisition and collaboration.

Third-party service providers can provide important support. Companies that are less aggressive in their smart operations investments to date could look to take advantage of the technology and process scale investments third-party providers have made in an effort to close gaps more quickly. For those companies that have started down the path with smart operations investments, third-party service providers can offer opportunities to scale processes faster and consequently magnify benefits.

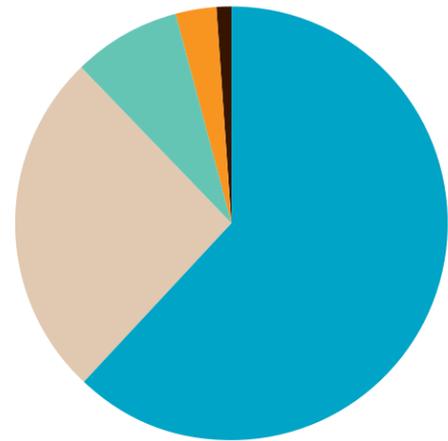
While companies don't have to do everything at once, urgency is nevertheless advised. It is projected that more than half of all manufacturing companies will be at advanced stages of operating model transformation maturity in three years, which means they are actively making investments today. Smart operations will be critical to future success by enabling companies with limited resources to serve increasingly demanding customers with more speed.

In This White Paper

This paper, based on primary research conducted by UPS and IDC, discusses current approaches to transforming operating models in the manufacturing industry. The hypothesis was that, despite substantial challenges for operations executives, investment in data acquisition, analytics and better collaboration including within the organization, with value chain partners and with external service providers will deliver a new level of operational capability. UPS and IDC conducted a study of over 100 manufacturing operation professionals and hosted an extended focus group discussion. This paper provides an analysis of research findings and offers guidance for companies seeking to elevate the level of their operational excellence.

Figure 1 — Use of Lean Sigma Improvement Methodologies

Q. How would you characterize your organization's use of continuous improvement methodologies such as Lean and Six Sigma?



- 62%** Use is organizationwide and is optimized
- 26%** Use is organizationwide, but results are uneven
- 8%** These methodologies are used fairly heavily, but not companywide
- 3%** There are some groups using these methodologies
- 1%** These methodologies are not used

n = 103

Source: UPS Smart Manufacturing Survey, IDC, January, 2016

Current Situation

The manufacturing industry is awash with conversations about smart manufacturing. The concept goes by many names such as industrial Internet, connected manufacturing and industry 4.0. Most of the discussion focuses on what happens within the factory. While the factory is an integral part of the smart manufacturing concept, the idea is much broader. Industry consultants are using the term smart operations to encompass the whole value chain in addition to the factory.

The Productivity Vise

The survey results indicate a broad adoption of Lean Sigma continuous improvement methodologies (see Figure 1). A substantial 88% of companies had corporatewide implementations, although the level of optimization varied; only 1% of companies didn't use any improvement disciplines at all.

Clearly, Lean Sigma has become a standard operating practice — and for good reason: it has helped companies achieve new levels of productivity and improved competitiveness. However, many manufacturing firms get caught in what one could call the “productivity vise.”

One of the unintended consequences of improving productivity is that it creates idle capacity because companies are able to meet demand with fewer resources. This creates pressure to fill that capacity, which often translates to sales organizations lowering prices, which, in turn, puts pressure on operations to become even more productive to sustain profit margins. Operations finds itself in a productivity vise as the cycle continues to play out.

Lean Sigma calibrates operations processes to a demand signal and executes with precision. The expectation is that the demand signal will be relatively stable. However, with increasingly demanding customers and an explosion of products and services to be delivered, manufacturers find it difficult to recalibrate in a timely way. As the vise turns, organizations become brittle and subsequently are unable to respond quickly to the changes that have become common in product markets. Lean practitioners have taken great pride in their ability to use simple tools (e.g., Andon boards and Kanban cards), but as was discussed in the

focus group, most executives realize they must use technology to instrument value streams and analyze data to respond faster to changing demand. Technology is also needed to break the productivity vise cycle.

Doing More for Customers Faster with Less Talent

The survey examined a wide set of challenges. Respondents were asked to select their three biggest challenges. All 13 choices were selected, with rates ranging from just under 15% to just over 30% of respondents (see Figure 2). This wide range indicates that executives must deal with a diverse collection of issues without the luxury of focusing on two or three issues that stand out.

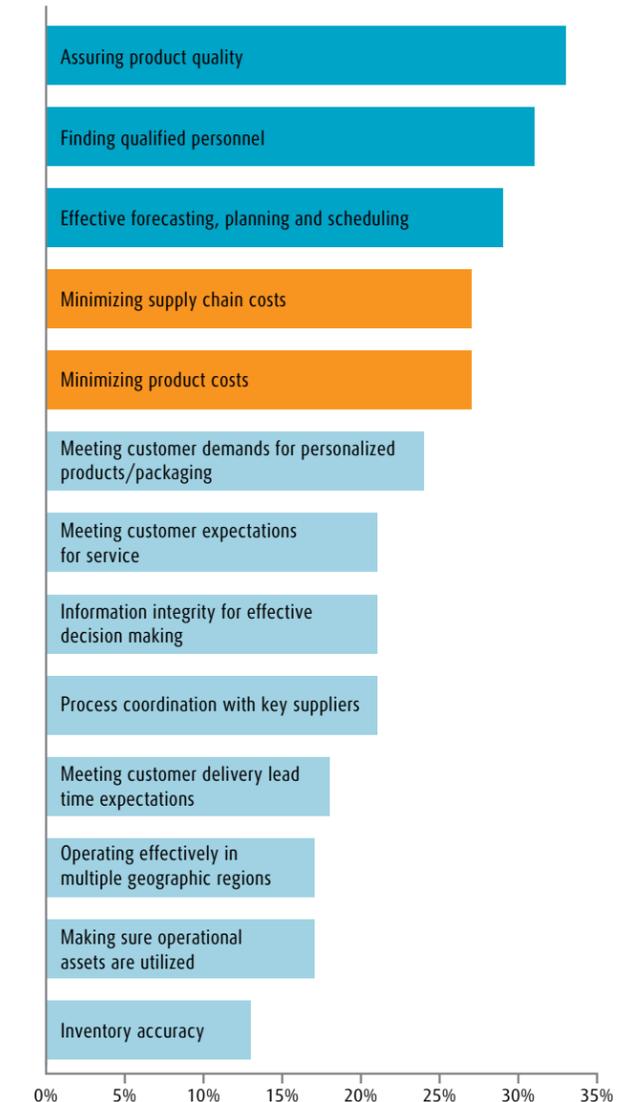
In most surveys of operational executives, managing cost is the number one issue. In this survey, three challenges received higher response rates than cost:

- **Product quality:** Delivering on customer expectations is a prominent challenge. Customers are increasingly expecting more customized products and want those products to be of the highest quality and delivered in a way that is tailored to their needs.
- **Qualified personnel:** A troubling shortage of skills exists in manufacturing operations. The aging population of manufacturing executives has not been offset by young professionals entering the field. Participants in the focus group highlighted that the preparation of new hires did not meet expectations. This situation was validated in the survey results as well.
- **Effective planning, forecasting, and scheduling:** Based on ongoing research in the industry, planning translates to speed. Companies want to get better at planning and scheduling in order to be in the best position to respond quickly to market demand.

These top 3 challenges — meeting customer expectations, finding talent and moving with greater speed — all magnify the need for a higher level of operational excellence, which breaks the productivity vise and delivers real competitive advantage. Overcoming these is driving companies toward smart operations.

Figure 2 — Challenges to Improving Operational Performance

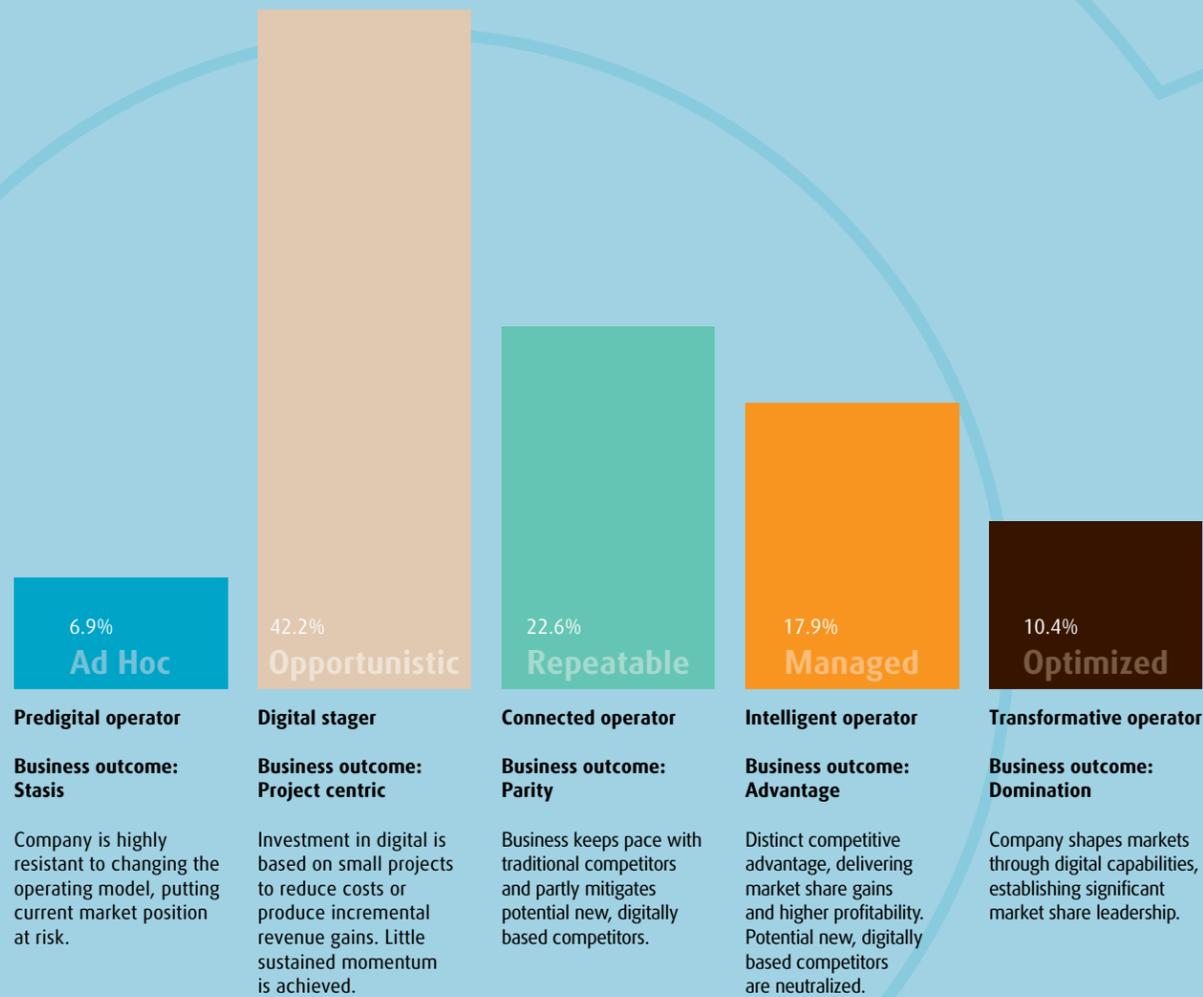
Q. What would you say are your organization's biggest challenges to improving operational performance?



n = 103

Source: UPS Smart Manufacturing Survey, IDC, January, 2016

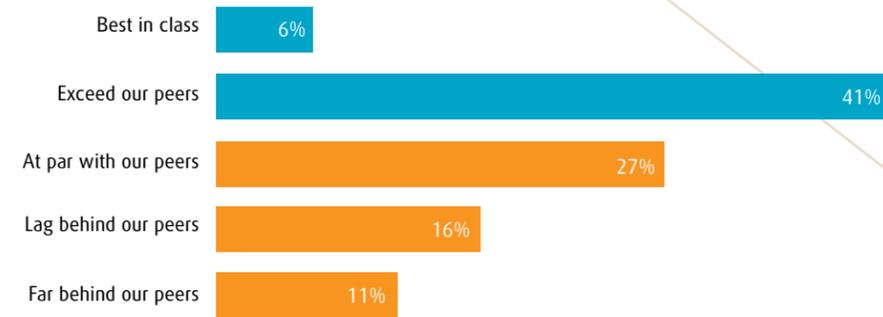
Figure 3 — Operating Model Transformation Maturity



Source: IDC, 2016

Figure 4 — Relative Investment Cadence of Survey Respondents

Q. How would you rate your organization's relative progress toward smart operations?



n = 103

Source: UPS Smart Manufacturing Survey, IDC, January, 2016

Progress Toward Smart Operations

Today, digital transformation is at the center of manufacturing business strategies. As one executive from a tier 1 automotive supplier put it, "We are no longer an automotive company, but a technology company in the automotive business." A key part of a company's digital strategy is the need to transform the operating model, which in effect means a move to smart operations that leverages the continuous improvement discipline established by operations management. Smart operations makes the discipline of continuous improvement stronger by introducing pervasive data acquisition, advanced analytics and higher levels of collaboration.

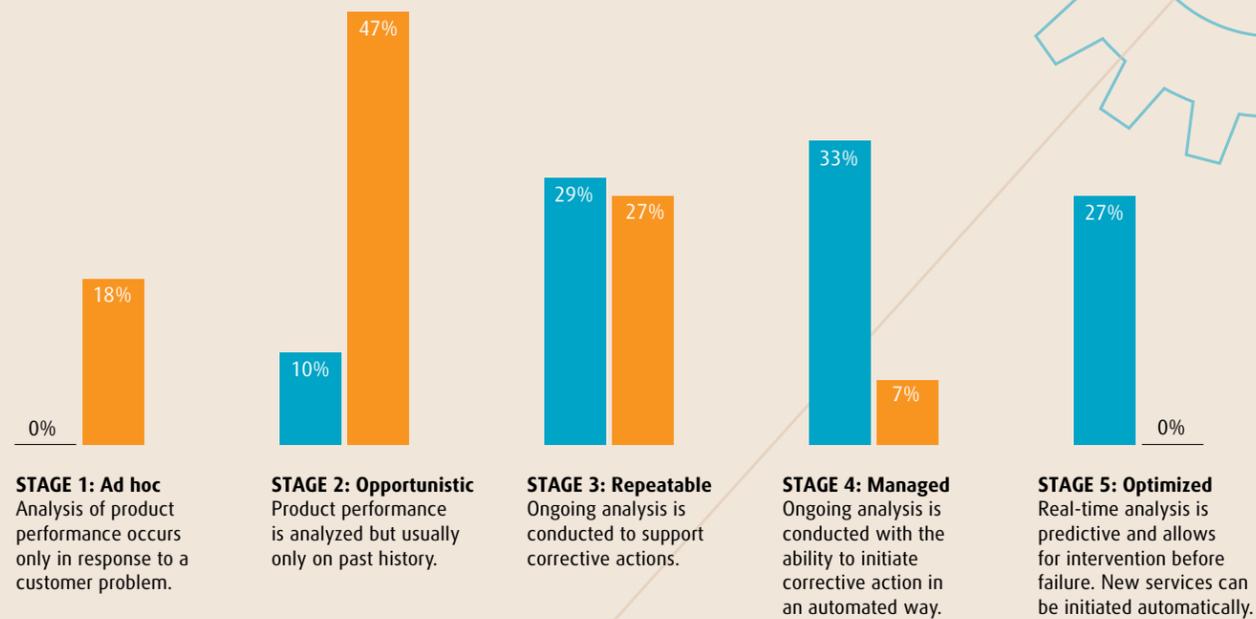
IDC previously conducted research to determine the relative maturity of companies in the pursuit of operating model transformation (see Figure 3). In this research, 65% of the companies were either at stage two or at stage three, indicating relatively low overall maturity.

Research from MIT Sloan revealed that those companies that have started to aggressively pursue transformation are enjoying 26% higher profits than those that haven't. We asked participants in our survey to evaluate whether they are ahead or behind their peers in investing in smart operations (see Figure 4). The results show that nearly half of the respondents consider themselves to be investing in smart operations more aggressively than their peers.

What is more interesting is what companies are doing to establish smart operations. We asked the respondents about distinct activities in five areas: connected products, connected assets, supply chain decision making and buy-side/sell-side value chain integration. Activities in these areas are all essential to moving toward smart operations. To better evaluate the answers, we separated those respondents that answered that they exceeded their peers or were best in class – what we refer to as "thrivers" – from the rest of the survey population – what we refer to as "survivors."

Figure 5 — Connected Products Maturity

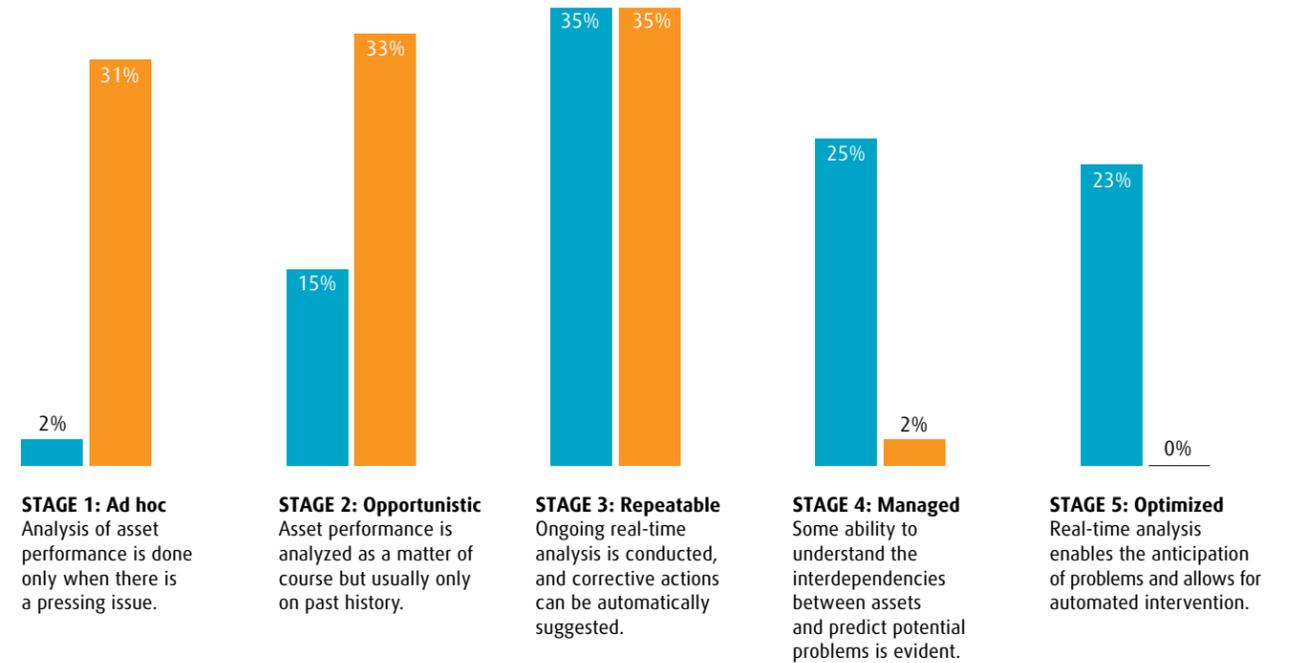
Q. Which statement best describes your organization's information analysis and remote control capabilities related to its products?



n = 48 for thrivers, n = 55 for survivors
Source: UPS Smart Manufacturing Survey, IDC, January, 2016

Figure 6 — Connected Assets Maturity

Q. Which statement best describes your organization's information analysis and remote control capabilities related to its assets?



Connected Products

Increasingly, the products manufacturers sell are connected to the cloud. This connectivity allows industrial companies to offer superior maintenance service or, in some cases, creates new revenue streams. We asked companies to rate their relative maturity in this area. The results show that thrivers had much higher levels of maturity than survivors (see Figure 5).

These results dramatically show that those companies further along on a path toward smart operations have become quite advanced in connecting their products. A full 60% of companies can initiate corrective action (e.g., repair) in an automated way and 27% of companies can provision new services directly to the customer.

Connected Assets

Similar to connected products, smart operations manufacturers will be able to monitor their crucial

operating assets and, at the most mature level, allow them to be self-adjusting. This capability is at the heart of smart operations factory efforts and delivers higher levels of throughput, higher-quality yields and higher resource availability. Like connected products, thrivers showed much higher levels of adoption when it came to connected assets (see Figure 6).

While 35% each of survivors and thrivers fall at the midstage of maturity where ongoing real-time analysis is conducted, the extremes are quite different. While 25% of thrivers have some ability to understand interdependencies, only 2% of survivors can do so. And for the most advanced level of maturity — where real-time analysis enables the anticipation of problems and allows for automated intervention — 23% of thrivers said they have this capability; among survivors, the percentage having this capability was zero. The instrumentation of assets, particularly those in the factory and the warehouse, is a distinguishing feature of companies that are more aggressive in establishing smart operations.



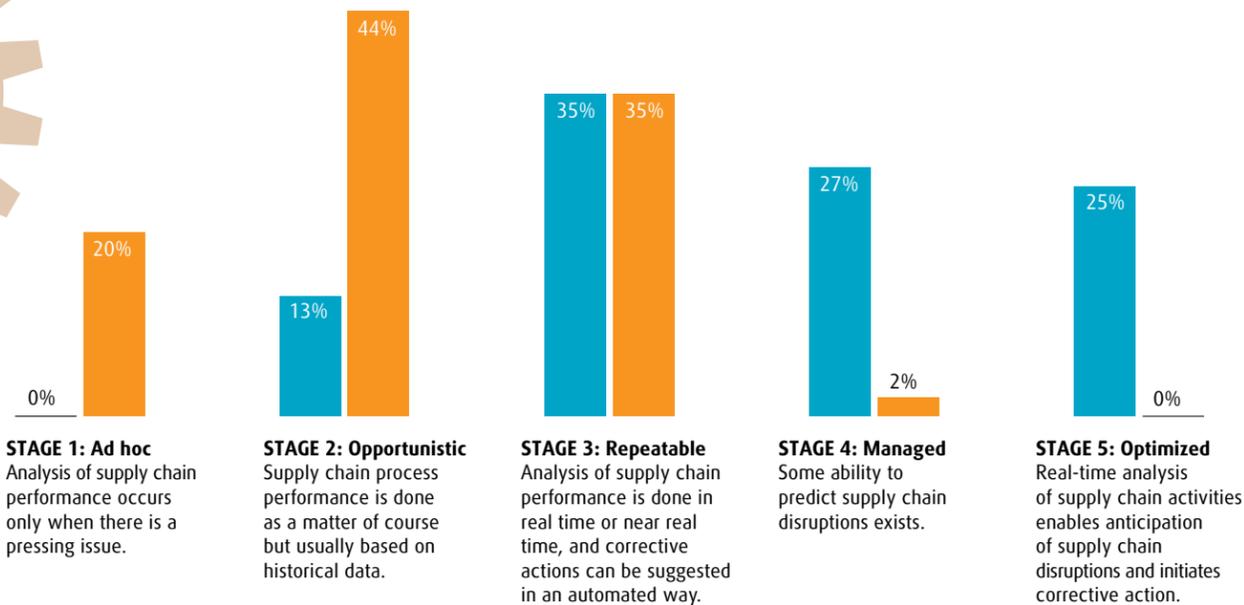
Supply Chain Decision Making

Perhaps the most critical factor in addressing the speed challenge in modern operations is the ability to make supply chain decisions. Delays are most often caused by anomalies and variability in the operations process. The availability of data and advanced analytic tools enables operations management to resolve these issues more quickly. The maturity model looks for companies that can extract data in near real time from any node in the chain and use that information in decision models. Again, thrivers demonstrated much higher levels of maturity (see Figure 7).

None of the companies in the survivor category have made it to stage five, and only 2% of them were at stage four. However, more than half of thrivers were at least at stage four. Supply chain decision making may be the most pivotal element of smart operations; the ability to use available information to make fast decisions will be crucial to making Lean approaches more resilient and effective.

Figure 7 — Supply Chain Decision Making Maturity

Q. Which statement best describes your organization's ability to make supply chain decisions?



Including the Value Chain Ecosystem

Smart operations must encompass all the suppliers and sales channel partners that make up a manufacturer's value chain. With a shortage of talent, more complex customer relationships and the need to move fast, success will be dependent on this competency. The last two elements of maturity that we tested in the survey were the levels of connectivity with these partners (see Figures 8 and 9).

In both sell-side and buy-side coordination, thrivers are substantially more advanced than survivors; 44% (sell-side) and 40% (buy-side) of thrivers reached at least level four, while only 4% of survivors were at that level. This result indicates companies that are more aggressively pursuing a smart operations strategy are taking a more comprehensive value chain view of their operations.

Figure 8 — Connectivity of the Sell-Side Value Chain

Q. Which statement best describes the sell-side operations for your organization?

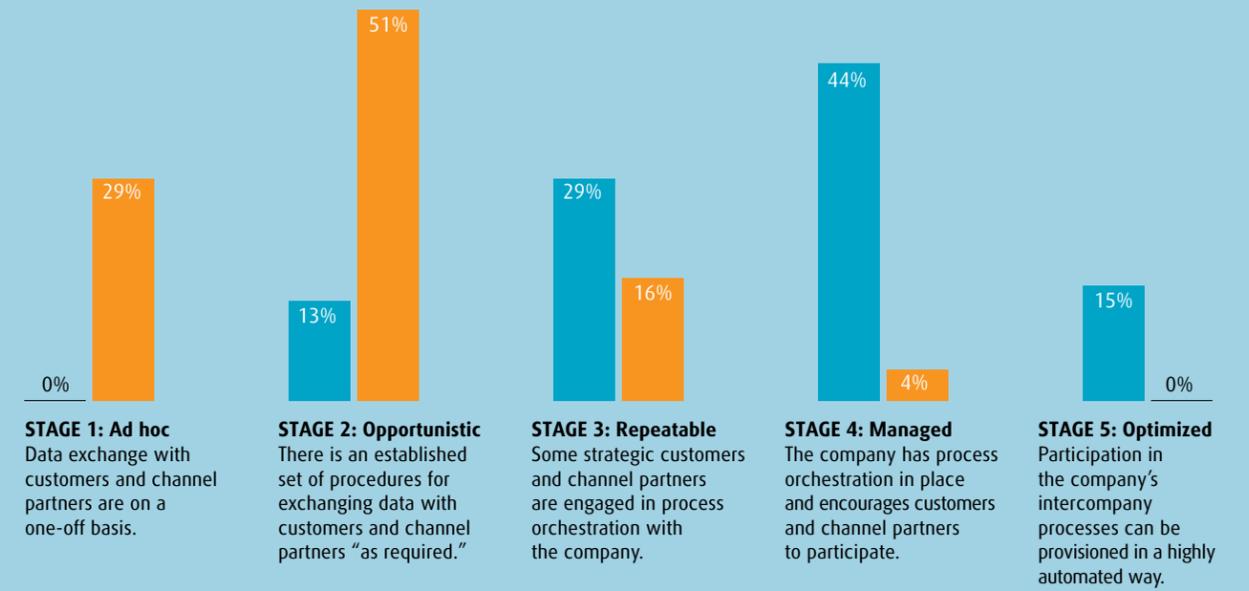
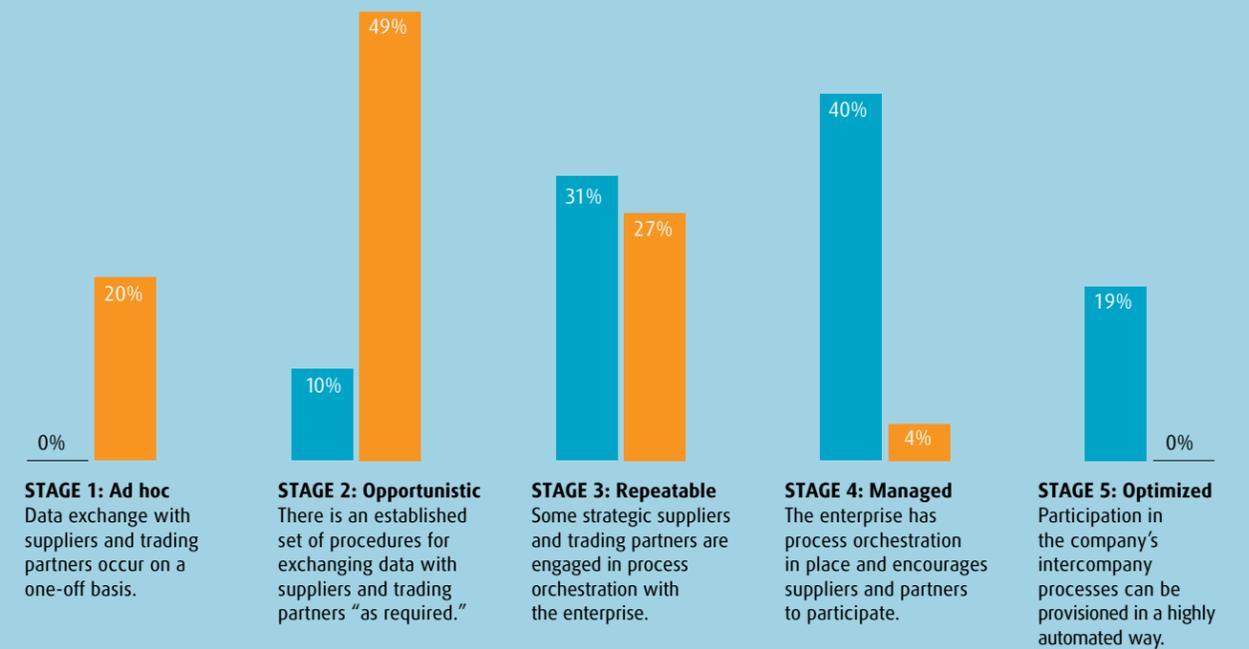


Figure 9 — Connectivity of the Buy-Side Value Chain

Q. Which statement best describes the buy-side operations for your organization?



n = 48 for thrivers, n = 55 for survivors
Source: UPS Smart Manufacturing Survey, IDC, January, 2016



Companies further along in the journey to smart operations are **investing aggressively in technology.**

For all the factors in our maturity model, the cluster of companies we classified as thrivers showed substantially higher levels of maturity in all dimensions of smart operations manufacturing capabilities. These companies are much better prepared to make the transition to the next generation of Lean and achieve the next level of operational excellence. This transition will better position these companies to transform their operating models and achieve profitable growth in a digital economy.

What Makes Thrivers Thrive?

The survey data shows that thrivers have higher levels of maturity than survivors in every dimension of the smart operations maturity model. It is instructive to examine the specific approaches these companies are taking to technology, cross-functional collaboration and the use of third-party services. These activities are central to advancing overall maturity and delivering higher levels of operational excellence.

Technology Provides Resiliency

The results from the research conducted, in both the survey and the focus group conversations, show that companies further along in the journey to smart operations are investing aggressively in technology. These efforts are what puts the “smart” in smart operations. Technology is what helps companies overcome the brittleness of Lean.

Thrivers see smart operations as a business strategy that is essential to delivering on the new customer experiences that are required for future success. As such, thrivers view technology investment as central to creating the necessary capabilities to achieve smart operations and are moving forward more quickly. Survivors look at more contained investments and struggle with articulating the investment return within the narrow scope. Survivors are also challenged by the changing nature of the technology and the subsequent security implications.

Thrivers see more risk in investing in technology because their ability to achieve a higher level of operational excellence and compete effectively is dependent on the instrumentation and intelligence of an integrated, end-to-end value chain. Our focus group validated this premise in our discussions.

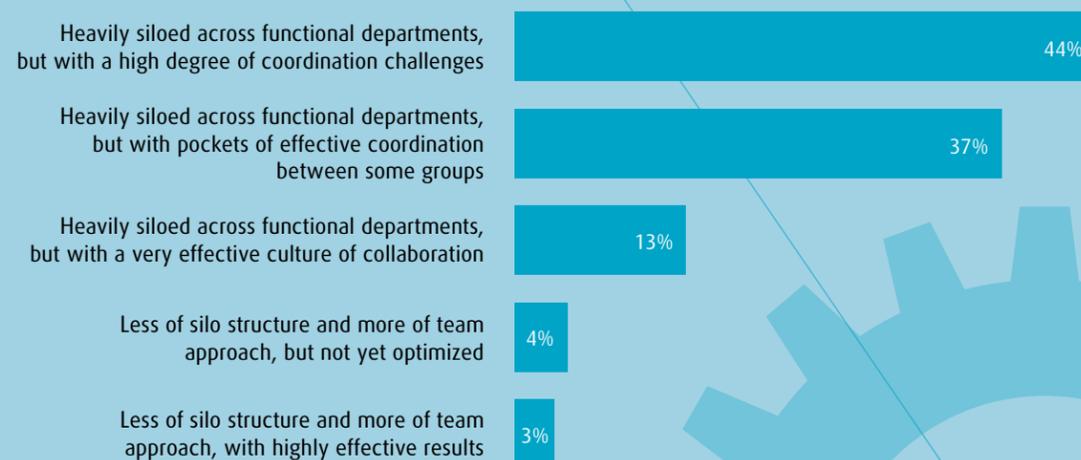


Establishing higher levels of cooperation

with external parties will be difficult if the company hasn't established a culture of collaboration within its own organization.

Figure 10 — Level of Internal Collaboration

Q. How would you characterize your operations organization?

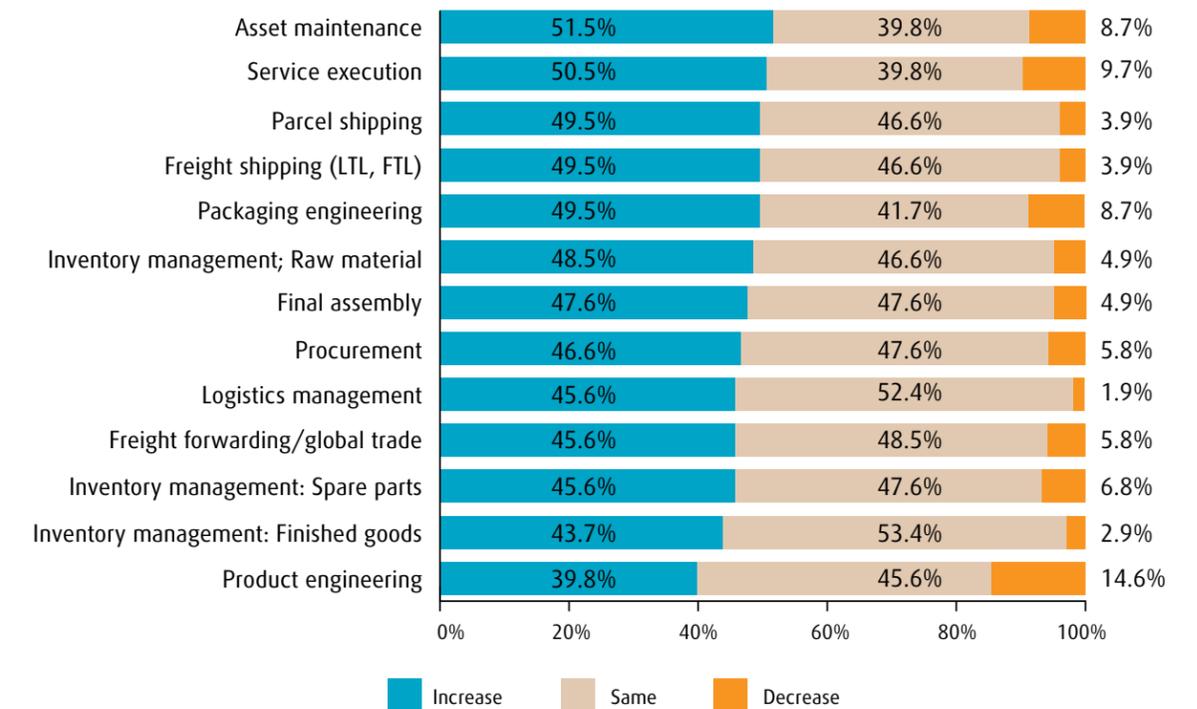


n = 103

Source: UPS Smart Manufacturing Survey, IDC, January, 2016

Figure 11 — Use of Third-Party Service Providers

Q. Please indicate whether the following will increase, decrease or stay the same over the next three years.



n = 103

Source: UPS Smart Manufacturing Survey, IDC, January, 2016

We wanted to explore the use of both sensors and mobile devices to enhance data acquisition as well as using advanced analytics to understand that data. The focus group was mixed on the broad use of sensors but shared that they were increasing usage and had a number of initiatives that included mobile applications. The area where there was most enthusiasm was around reporting and analytics. To better adjust responses to market situations, participants discussed using more analytic models, but many of them admitted being stuck doing more review of past performance and wanted to establish better real-time control and predictive capabilities.

Collaboration Creates a Smart Ecosystem

We found that nearly 60% of thrivers had advanced process orchestration with both the buy-side and the sell-side of the value chain. This activity delivers many advantages because it allows a company to utilize the skills of the personnel at these partners to overcome

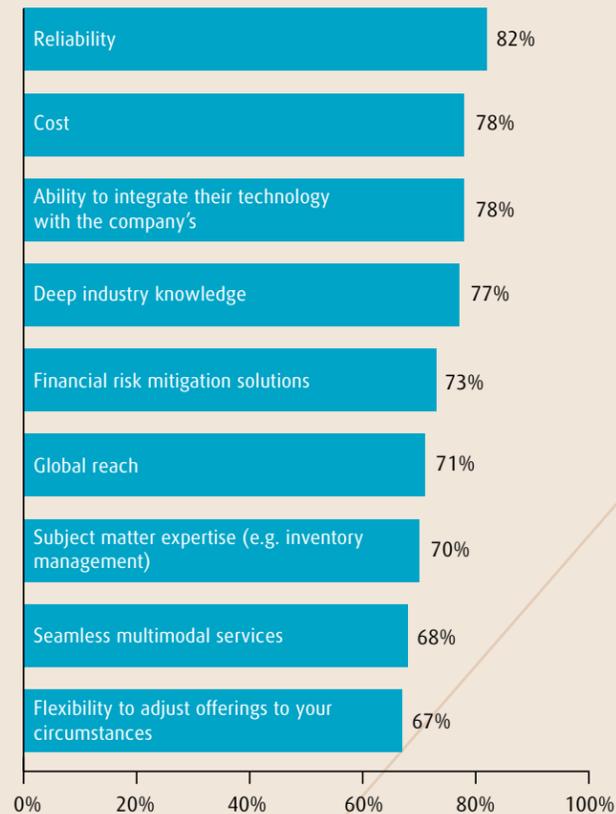
talent shortages. Also, key service providers, such as logistics companies, bring process scale and are often very advanced in their own technology investments. However, operations executives express a desire to further deepen the activity by expanding collaboration. From our survey data, we find that collaboration must begin at home (see Figure 10).

The results indicate that companies are still struggling with high levels of functional silos. Establishing higher levels of cooperation with external parties will be difficult if the company hasn't established a culture of collaboration within its own organization.

Establishing the culture of collaboration is even more crucial when one considers companies' intent to increase the use of partners to support critical processes. Our survey showed that for all of the processes we asked about, at least 40% of companies anticipated increased usage of partners (see Figure 11).

Figure 12 — Key Selection Criteria for Logistics Providers

Q. In terms of what is important in selecting a logistics partner, please rate each of the following capabilities on a scale of 1–5, where 1 = not important and 5 = critically important.



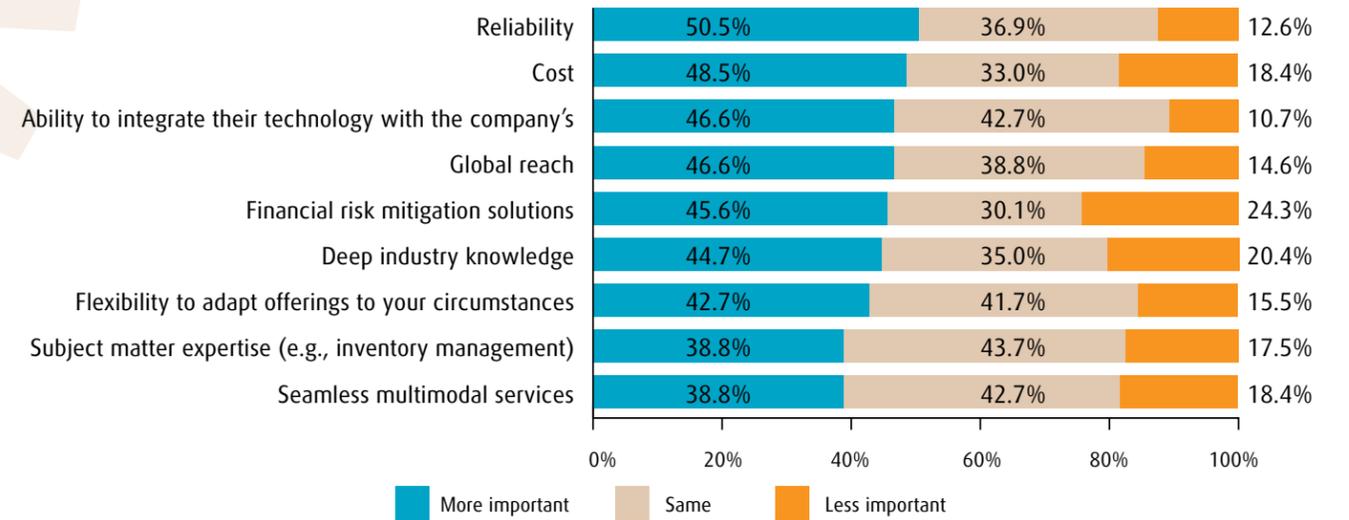
n = 103

Source: UPS Smart Manufacturing Survey, IDC, January, 2016

There may not be a more **critical relationship** than the one with logistics providers when trying to advance smart operations.

Figure 13 — Importance of Criteria in the Future

Q. Please indicate whether you think the following capability will be more, less or of the same importance in three years.



n = 103

Source: UPS Smart Manufacturing Survey, IDC, January, 2016

The increased use of external parties to support processes is likely due to the challenges related to talent shortages. These companies bring a level of scale to the process and have made significant investments in operational technology. For survivors, these external parties can provide valuable input into how to use technology. For thrivers, integrating their technology investments with those of the providers can magnify the value received. The ecosystem is a critical factor in achieving smart operations, and our survey participants recognize this in their intention to increase usage of external parties across all process domains.

There may not be a more critical relationship than the one with logistics providers when trying to advance smart operations. A global provider gives a manufacturer operational scale and geographic reach. Also, the better suppliers have made investments in sophisticated technology that can be integrated with the company's systems and accelerate the establishment of the advanced capabilities needed for smart operations. The survey results indicate value remains the critical factor in selecting a logistics partner (see Figure 12 on previous page).

Value is a simple equation — the reliability of the service received divided by the service cost. The survey results

show that these two factors remain the most critical when it comes to external providers. What may be more interesting are the next two factors. The first is the "ability to integrate their technology with the company's," which demonstrates how important it will be to leverage information systems to achieve smart operations. The next most popular factor, with nearly as many responses as cost, is "deep industry knowledge," which demonstrates the need for closer partnerships. Also high on the list is "financial risk mitigation solutions," which brings the partnership to a financial level. The results speak to a new level of cooperation including people (industry knowledge), technology (integration) and money (risk mitigation).

When we asked about the importance of the same criteria in the future (see Figure 13), all of the choices drew significant interest, ranging from 38% ("subject matter expertise") to over 50% ("reliability"). These strong response rates point to the growing role of logistics providers in serving as a strategic partner in a company's desire to achieve world-class operational capabilities. This conclusion is also supported by the fact that more respondents chose "reliability" than "cost," indicating that service levels will increasingly define the relationship, not the price.



Manufacturing firms investing in technology will enjoy
**superior revenue growth
and higher margins**
in the emerging digital economy.

Conclusion and Next Steps

Manufacturers must combine their Lean Sigma discipline with modern technology capabilities to effect smart operations at their organizations. This effort will raise the level of operational excellence and allow companies to serve ever-demanding customers with limited human resources and at greater speed. The manufacturing firms that do this will enjoy superior revenue growth and higher margins in the emerging digital economy.

Equally important is a focus on higher levels of collaboration. This begins within the organization where existing functional silos must be converged to create a more fluid and responsive operational capability. Reinvigorating a continuous improvement discipline and creating a culture of collaboration will require a tremendous focus. Manufacturers, by their own admission in this survey, will become increasingly dependent on external providers to support their efforts, and new types of relationships will have to be forged. In turn, the providers themselves must demonstrate scale to help manufacturers gain efficiencies and reach global markets effectively and consistently.

Reaching operational excellence requires a sustained and deliberate effort over several years. However, a manufacturing company can take action now to get started.

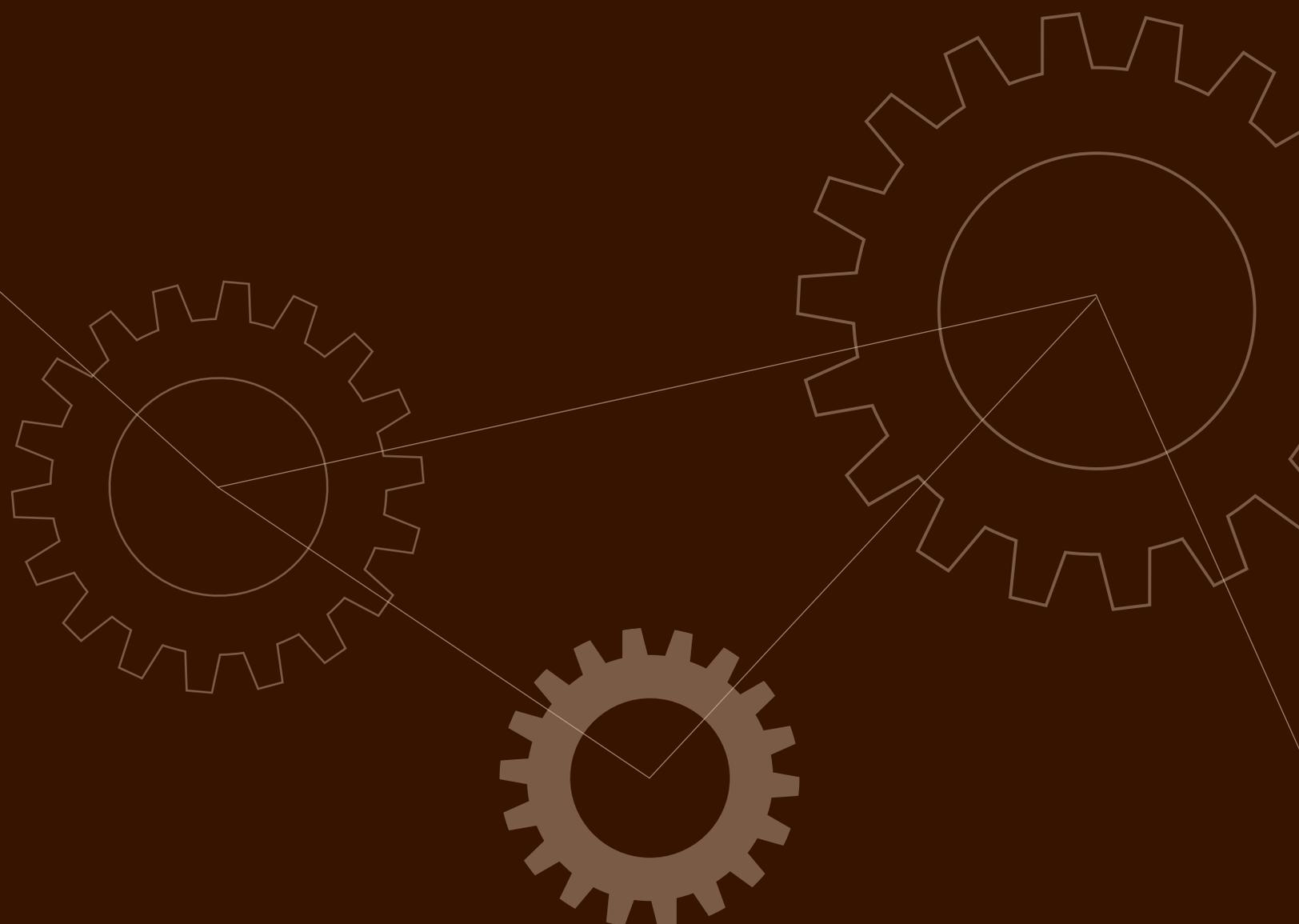
- **Assess the relative maturity of your company's efforts to transform its operating model to support new smart operations strategies.** If you are at the early stages, you are in a similar position as most of the companies.
- **Look at your activity relative to your peers.** Are you investing more aggressively in the five activities — connected products, connected assets, supply chain decision making and buy-side/sell-side value chain integration? Are you a “thrivers” or a “survivors?”
- **Articulate a strategy for your transformation regardless of your status relative to industry peers.** Too many companies — especially survivors — are stuck with an uncoordinated set of activities and will find it difficult to optimize the business benefit.
- **Examine supply chain decision making.** How does the decision-making process have to change to achieve new levels of excellence? Identifying the key decision points will highlight the most important sources of data, the most strategic value chain participants, and the scope of the role of third-party service providers.

• **Set priorities for connecting products in the field and the assets in the value chain.** Understanding the most important sources of data will assist with this effort. The whole value chain doesn't have to be instrumented all at once; by focusing on the most critical areas, a company will get the highest returns and will also gain valuable insight as to how to best deploy the technology. These efforts should be in parallel to investment in advanced analytic tools so that the data can be aggregated and put into the right context for operations decision makers.

• **Identify strategic suppliers and sales channel partners for higher levels of process integration.** Also, higher levels of ad hoc collaboration should be enabled. As the survey data indicates, most companies must be able to tear down barriers to internal collaboration first.

• **Work with your logistics provider.** Third-party service providers can bring scale, process expertise and advanced technology knowledge to the transformation. If your company is a “survivor,” look particularly to the technology knowledge to make up ground quickly. If you are a “thrivers,” integrate your technology investments with the provider, but especially look to take advantage of the scale and expertise to accelerate the benefits of what you have already set in motion. Your logistics provider is a great place to start because these companies will have the most direct impact on operational activities.

You don't have to do everything at once, but there is urgency. With more than half of all manufacturing companies expected to reach stage four or stage five in their maturity in three years, they are actively making investments today. Smart operations will be critical to future success, allowing companies to serve increasingly demanding customers with limited resources and with more speed.



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