Artificial intelligence will fuel the next wave of growth for industrial equipment companies
This report is based on recent in-depth analysis from Accenture Research. It combined a number of different elements to build up a detailed picture of the global industrial equipment sector, the challenges it faces and the ways in which artificial intelligence can be adopted and deployed to overcome these challenges, support innovation and drive future growth. Summarized below, these different research elements provide a unique, detailed and fresh picture of an industry on the cusp of massive change and reinvention:

- Desktop/Secondary research – spanning Factiva, Gartner, IDC, Forrester, IE companies’ annual reports and websites, competitor publications and other press research
- Expert interviews via 10EQS
- Internal interviews with Accenture industry/technology subject matter experts
- Industrial Equipment Technology Vision 2017 research, drawing on a survey of 560+ industry executives
- Face-to-face interviews at the Hannover Messe Fair April 2017
- Text analytics, leveraging QUID, an innovative tool that draws connections between different news articles and creates networks of stories
THE INNOVATION IMPERATIVE AND THE POWER OF INTELLIGENCE

As the global industrial equipment (IE) sector continues to be bombarded by a host of disruptive forces, manufacturers are under ever greater pressure to innovate and find new sources of growth. And now that artificial intelligence technologies are coming of age, they’re demonstrating they can provide a much-needed productivity boost, as well as help in reducing operating costs and transform customer experiences.
**DISRUPTION AHEAD**

Life for industrial equipment manufacturers has never been more challenging. Globally, the sector is being impacted by multiple forces and trends. Not only must they deal with macroeconomic and political volatility, they must also adapt to an ever-changing cohort of disruptive digital technologies – predictive analytics, additive manufacturing, and the Industrial Internet of Things to name a few. What’s more, they must constantly reimagine how they function in the digital era, from creating a connected workforce to enabling predictive maintenance.

And they must do all this amid the rise of industrial consumerism – where consumer-style expectations permeate every part of their value chains.

It all adds up to an intense pressure to innovate. And Accenture’s latest research shows just how widespread the impact is (see **Figure 1**). More than three-quarters of industrial equipment executives think the industry is facing at least moderate disruption. More than a fifth say that disruption is all-encompassing. And as many as approx. 85 percent agree they have to innovate ever faster just to keep a competitive edge.

**FIGURE 1: THE PRESSURE TO INNOVATE HAS NEVER BEEN SO HIGH**

**Q.** What degree of disruption is your industry currently facing?

<table>
<thead>
<tr>
<th>Degree of Disruption</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Disruption</td>
<td>5%</td>
</tr>
<tr>
<td>Moderate Disruption</td>
<td>21%</td>
</tr>
<tr>
<td>Slight Disruption</td>
<td>19%</td>
</tr>
<tr>
<td>No Change</td>
<td>55%</td>
</tr>
</tbody>
</table>

**Q.** Please indicate your agreement with the following statement: My organization must innovate at an increasingly rapid pace just to keep a competitive edge.

<table>
<thead>
<tr>
<th>Agreement Level</th>
<th>Percentage</th>
<th>Industry Equipment</th>
<th>Cross-Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>41%</td>
<td>41%</td>
<td>42%</td>
</tr>
<tr>
<td>Agree</td>
<td>44%</td>
<td>44%</td>
<td>44%</td>
</tr>
<tr>
<td>Neither agree nor disagree</td>
<td>14%</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Disagree</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Source: Accenture Tech Vision 2017
ARTIFICIAL INTELLIGENCE: THE NEW FUEL FOR GROWTH

The rapid evolution of artificial intelligence (AI) is thus coming at an ideal time for the sector. It has the potential to help industry players operate at unprecedented speed and scale, as well as facilitate the reduction in costs — and transform customer experiences for the better.

The technology — in reality, a collection of different technologies like machine and deep learning, analytics, computer vision, all working and evolving together — enables machines to simulate human intelligence. It lets them sense the world around them, comprehend it, and then act accordingly — all without much human intervention.

By replacing labor activities with faster and more accurate intelligent automation, augmenting workers as they perform higher-value tasks, and making capital stock more productive, AI will undoubtedly bring new growth to the industry. And that’s before the spill-over and network effects are even accounted for. Indeed, Accenture’s research suggests AI will add approximately US$3.7 trillion to the manufacturing sector by 2035.2

Industrial equipment companies agree that AI will have a huge impact. Accenture’s research shows (see Figure 2) that a large number believe AI will bring significant changes to both their organization (approx. 71 percent) and the industry as a whole (approx. 78 percent).

FIGURE 2: THE INDUSTRY THINKS AI WILL HAVE A TRANSFORMATIONAL IMPACT3

Q. To what extent do you believe AI will transform your organization/industry over the next 3 years?

Source: Accenture Tech Vision 2017
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Industrial equipment companies agree that AI will have a huge impact. Accenture’s research shows (see Figure 2) that a large number believe AI will bring significant changes to both their organization (approx. 71 percent) and the industry as a whole (approx. 78 percent). What’s more, about a quarter believe those changes will represent a complete transformation of how the sector operates. Although industrial equipment companies say that they plan to invest heavily in the technology over the next three years, up to now they’ve lagged behind companies in other industries like financial services, retail, media, and healthcare (see Figure 3). Observing successful AI initiatives in other industries, they’re now starting to invest themselves.

It’s been a reactive approach that means they’re now playing catch-up in a hugely competitive field. That represents a significant risk. The global, cross-industry race to snap up AI patents, AI talent and AI start-ups is already well underway. It can be seen in General Electric’s acquisition of Wise.io, a machine learning service that helps businesses find patterns and trends in their vast data stores. And it can be seen in Samsung’s acquisition of Viv, which has developed an open AI platform giving third-party developers the ability to use and build conversational assistants and integrate natural language-based interfaces into its applications and services. These are just two examples of the race to accelerate innovation. Those that fail to move quickly risk being left behind.

**FIGURE 3: OTHER SECTORS ARE AHEAD IN THE AI RACE**

But the IE sector has still a long way to go in leveraging AI - whereas Financial Services, Retail, IT and Healthcare are already far ahead in this race.
Some industrial equipment trailblazers are showing the rest of the sector what AI can bring. In areas like electrical equipment, heavy equipment, automotive suppliers and consumer durables, initiatives to apply AI technologies like deep learning, computer vision and analytics are underway. Indeed, AI applications can already be found right across the value chain, from research and development, through manufacturing to marketing, sales and after-sales.

But AI is by no means limited to internal operations. One of its most important applications is in customer interactions (see Figure 4). More than three-quarters of industry executives think the technology will revolutionize the way they interact with, and get information from, their customers. A similar proportion think AI will be the primary interface for those interactions within three years. And a large majority believe centralized platforms and intelligent assistants will be a very important part of their future success.

What’s more, the leading industrial equipment players recognize that AI’s true disruptive potential can only be appreciated when seen within the wider technology landscape. The combinatorial effect of vast amounts of sensor data generated by the Industrial Internet of Things, together with the power of AI, has enormous potential for manufacturers.
FIGURE 4: THE INDUSTRY REALIZES THE IMPORTANCE OF CENTRALIZED PLATFORMS AND ASSISTANTS

Q. To what extent is your organization using Intelligent Virtual Assistants as AI-powered interfaces to create better customer interactions?

<table>
<thead>
<tr>
<th></th>
<th>Industrial Equipment</th>
<th>Cross-Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently using on large scale projects or broadly across the organization</td>
<td>29%</td>
<td>31%</td>
</tr>
<tr>
<td>Using in select business areas</td>
<td>39%</td>
<td>36%</td>
</tr>
<tr>
<td>Piloting/Experimenting</td>
<td>24%</td>
<td>24%</td>
</tr>
<tr>
<td>Not using</td>
<td>7%</td>
<td>8%</td>
</tr>
</tbody>
</table>

Q. How important will it be to the future success of your organization to offer your products/services through centralized platforms or assistants (i.e., Google Now, Apple’s Siri, or Amazon Echo) or messaging bots (Viv, Facebook Messenger, WeChat, Kakao, etc.)?

<table>
<thead>
<tr>
<th></th>
<th>Industrial Equipment</th>
<th>Cross-Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely important</td>
<td>22%</td>
<td>24%</td>
</tr>
<tr>
<td>Very important</td>
<td>59%</td>
<td>59%</td>
</tr>
<tr>
<td>Moderately important</td>
<td>15%</td>
<td>14%</td>
</tr>
<tr>
<td>Slightly important</td>
<td>2.5%</td>
<td>2%</td>
</tr>
<tr>
<td>Not important</td>
<td>0.9%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Source: Accenture Tech Vision 2017
A collaboration between Fanuc, a leading industrial robotics manufacturer and General Motors, the global automotive manufacturer, represents the most successful large-scale implementation of AI in the industrial equipment sector to date. The project connected sensors in thousands of assembly line robots, together with other external devices, to a cloud network set up by a third party. Vast amounts of data about temperature, operation cycles, human operator activities and other metrics are processed by an analytics engine, leveraging an open deep learning framework from another supplier, to capture out-of-range exceptions and predict maintenance needs. A cloud app alerts engineers from both companies when a piece of machinery needs to be serviced. What’s more, any replacement parts needed are automatically shipped in time for the next scheduled maintenance. The goal is nearly zero equipment downtime – and for a global manufacturer for whom every minute of unplanned downtime costs thousands of dollars, that represents a potential saving of up to US$40 million.

This potential is already being realized. For example, Komatsu Ltd, a multinational construction equipment manufacturer based in Japan, now provides its customers with drones to monitor construction sites. The data these drones collect is processed by the company’s AI algorithms to create three-dimensional maps and extract construction blueprints. The benefits? With a 20-minute flight and a few hours’ cloud processing, customers receive a globally geo-referenced map where every point is accurate to within 5cm. Instead of it taking hundreds of hours a month to survey a construction site, it can now be handled to a far higher degree of exactitude in just a few minutes.
CASE STUDY: DIGITAL TWINS AND AI CREATE MULTIPLIER EFFECT

General Electric is building an army of AI-enabled digital twins in order to make significant operational savings. The digital twins are digital replicas of the company’s physical assets, each capable of showing the real-time status of its physical twin based on data collected from sensors in the equipment. By integrating an AI-powered virtual assistant, employees can interact with the digital twin in a completely natural way, as if they were talking to a colleague. So, questions like “Which parts of this machine are the most damaged?” will be answered, in voice or by text, with an answer like “the turbine sub-system might fail if not reviewed”. The effect? A huge potential cost saving, not just in integrating technology, but also in streamlining the training given to employees.

CASE STUDY: A GLOBAL NETWORK OF AI-ENABLED ROBOTS

KUKA, a European manufacturer of industrial robots, has partnered with Huawei, the China-based communications company, to develop a global network of AI-powered manufacturing robots. The proposed smart manufacturing platform is built on the Industrial Internet of Things and will connect robots in numerous factories around the world and then embed integrated AI and deep learning into the network. The collaboration will explore the use of imitative deep learning in advanced manufacturing environments. The two companies will also work together in fields like cloud computing, big data, and mobile technology to help their customers embrace smart manufacturing.
In all the AI breakthroughs seen in the industrial equipment sector to date, one thing is abundantly clear. Success has not – and could not have – come by one company working in isolation. Instead, collaboration with the wider ecosystem is the key. Rather than attempting to build the supporting technology themselves – at great cost – industry leaders are making well-planned collaborations within their ecosystems, where each participant brings its unique experience and value to bear on an AI solution (see Figure 5).

This applies not only to the data integration and hardware connectivity support that are essential in industrial equipment AI applications, but also to the development of the core algorithms behind machine learning and deep learning applications.

So, whether it’s the companies focused on particular AI technologies, the industrial AI start-ups offering specialist services, the hardware companies providing the infrastructure, the connectivity providers connecting the end customers, the universities performing cutting-edge research, the consulting firms providing essential expertise and guidance, or the system integrators gluing everything together, it’s essential to understand what every participant brings to the equation.

Start-ups are a particularly valuable source of innovation. For example, Augury is a New York based start-up using vibration and ultrasonic sensors in conjunction with machine learning to analyze equipment performance in the finest detail. Sight Machine’s analytics platform uses artificial intelligence, machine learning, and advanced analytics to improve quality and productivity on the plant floor. And Microscan applies computer vision technology to item tracking, defect detection, and automated guidance and monitoring operations.
Provider of hardware systems such as sensors, laptops, robots, machines etc.

Acts as the connecting tissue to build computing systems by combining hardware and software products from multiple vendors

Sets the protocol for “Responsible AI”

Setting best practices and examples

Telematics; end-customer connectivity

Acts as the connecting tissue to build computing systems by combining hardware and software products from multiple vendors

Universities or institutions conducting academic research on AI and bringing some groundbreaking innovations

AI companies with dedicated focus on technologies such as computer vision, natural language processing, virtual assistants, machine/deep learning etc.

Start-ups working at the intersection of AI and IE (highly specialized and targeted solutions)

Helps in AI transformation journey

Source: Accenture Research Analysis; Insights from Expert Interviews
THE WAY FORWARD

The benefits of using AI in the industrial equipment sector are clear. Whether they lie in digitally focused innovation, enhancing user experience, bringing new levels of operational efficiency, or a completely new competitive edge, the technology holds huge potential for companies willing to make the jump to intelligent operations. There’s certainly no shortage of innovative examples to inspire them. From the breakthrough advances being achieved by heavy equipment companies to inspiring use cases from the electrical equipment sector leveraging analytics and deep learning to drive predictive maintenance, amongst other capabilities.

RECOGNIZING THE CHALLENGES

But the risks and challenges ahead should not be underestimated. Not least, reassuring an uneasy public about the implications of using AI. Accenture Research, using the QUID advanced analytics tool, analyzed key themes in hundreds of news articles to reveal the most pressing concerns (see Figure 6).

The findings show that the uppermost concern is AI’s impact on employees’ jobs – and not just in entry-level positions. Concerns about security threats, data privacy and maintaining compliance with an evolving regulatory environment also feature highly.
Executives within the industrial equipment sector also cite a series of specific challenges. These relate to issues arising from the larger, more complex ecosystem in which companies that adopt AI will be operating. Shown in Figure 7, they range from ensuring compatibility between AI and existing infrastructure and concerns about the maturity of AI technology, to a lack of expertise within the industry, insufficient data quality and getting users to share their data.

Of course, concerns about job losses cannot be dismissed. AI will inevitably be used to handle some of the repetitive tasks, in manufacturing, as well as in back-office and customer-facing operations. However, these concerns, we believe, will be outweighed by the opportunities AI will create for new roles within the workforce. Data-driven processes need human workers who can act rapidly on the opportunities that machines discover in real time, whether a sales lead, maintenance alert or an opportunity to cut costs. They also require people to assess them continuously and input improvements to safety, fairness and auditability. These are just two of the many ways in which humans and machines will work together in an AI-enabled future: new categories of jobs will be created (such as chatbot engineers and drone handlers) in which humans help machines and machines help humans, requiring companies to redesign jobs and training.

**FIGURE 6: THE PRINCIPAL CONCERNS SURROUNDING AI TECHNOLOGY**

- **DATA PRIVACY (19%)**
  - Artificial intelligence poses data privacy challenges
- **JOB LOSS RISKS (38%)**
  - Will artificial intelligence take over your job soon?
  - Artificial intelligence may put many entry-level jobs at risk, the study says
- **SECURITY ISSUES (24%)**
  - Will AI technology usher in a wave of security threats?
- **LEGAL COMPLIANCE AND LAWS (17%)**
  - In a world filling with artificial intelligence, how will our laws and society adapt?

Source: Accenture Research using QUID advanced analytics tool
FIGURE 7: CHALLENGES FROM A LARGER ECOSYSTEM

Even industry participants surveyed suggest that a larger ecosystem will bring multiple challenges. The integration/compatibility issue will be the top concern for embedding AI.

Q. Which of the following are challenges for your organization in embedding artificial intelligence into user interfaces?

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Industrial Equipment</th>
<th>Cross-Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration/compatibility issues between AI and current IT infrastructure</td>
<td>36%</td>
<td>34%</td>
</tr>
<tr>
<td>Users prefer interactions with humans</td>
<td>34%</td>
<td>34%</td>
</tr>
<tr>
<td>Technology not mature enough</td>
<td>34%</td>
<td>33%</td>
</tr>
<tr>
<td>Lack of expertise to use the technologies</td>
<td>34%</td>
<td>32%</td>
</tr>
<tr>
<td>Cost is prohibitive</td>
<td>32%</td>
<td>33%</td>
</tr>
<tr>
<td>Data quality</td>
<td>32%</td>
<td>36%</td>
</tr>
<tr>
<td>Concerns or fears over use of AI technologies</td>
<td>30%</td>
<td>31%</td>
</tr>
<tr>
<td>Privacy issues</td>
<td>29%</td>
<td>33%</td>
</tr>
<tr>
<td>Getting users to share their data</td>
<td>27%</td>
<td>30%</td>
</tr>
<tr>
<td>Insufficient useable data</td>
<td>25%</td>
<td>26%</td>
</tr>
<tr>
<td>Lack of C-level commitment</td>
<td>24%</td>
<td>21%</td>
</tr>
<tr>
<td>Data exist in silos</td>
<td>20%</td>
<td>22%</td>
</tr>
</tbody>
</table>

Source: Accenture Tech Vision 2017
OVERCOMING THE CHALLENGES AND MOVING AHEAD WITH AI

To overcome these challenges, industrial equipment companies will need to develop a completely new set of operating capabilities (see Figure 8). These will span the value chain, from Procurement and Talent to After-Sales Service:

**FIGURE 8: NEW OPERATING CAPABILITIES ACROSS THE VALUE CHAIN**

**PROCUREMENT AND TALENT**
Supplier strategies will have to be redefined to become more technology vendor-centric. New sets of suppliers will have to be identified, outside traditional supplier clusters. These will include providers of telematics, onboard software, wireless connectivity and analytics. And in addition to their focus on production engineers, companies will need to hire more digital specialists and data engineers – a significant challenge with these skilled resources in short supply.

**DESIGN AND MANUFACTURING**
Developing the core algorithms behind machine learning/deep learning and developing AI-embedded products will be a big ask for IE players. More generally, complex design processes with more sophisticated prototypes will need to be developed. And data captured from AI-enabled products will have to be fed back to R&D to further improve the product development process through a continuous feedback loop. As a range of AI-enabled robots and machines revolutionize industrial operations, the manufacturing workforce will need to be reskilled to work alongside them, while legacy machines/equipment will require “retrofit” solutions to give them a “second life”.

**SALES AND MARKETING**
Companies will have to move to a more consultative selling approach, moving beyond the mindset of selling products to working with AI-driven intelligent sales solutions. New approaches for identifying and training dealers will have to be developed, and there will be a greater emphasis on technology upskilling for the sales and marketing workforce. Overall, marketing messages will focus more on smart digital/AI-enabled features and less on traditional areas like engineering and safety.

**AFTER-SALES SERVICE**
Dealers and after-sales service shops will need to have technology engineers readily available to solve maintenance problems in embedded systems.
Successfully developing these capabilities will hinge, in most cases, on data. Industrial equipment companies must be ready to capture information in numerous formats from numerous sources – assets, employees, customers, weather conditions, traffic, and, importantly, suppliers (see Figure 9). They must have the data management systems and processes in place, as well as the algorithms that will generate the insights they need. And they must be ready to digitally engage with their customers, dealers and employees via new AI-powered workflows, apps and dealer interfaces.

**FIGURE 9: EFFECTIVE AI IMPLEMENTATIONS ARE BUILT ON DATA**

IE companies need to consider end-to-end digital enablement for effective AI implementation.

All this undoubtedly brings complexities. Data security becomes ever more paramount. The use of customer and partner data must be made transparent. A balance must be struck between using human employees and AI-enabled machines, including a full consideration of the ethics of AI development. And companies must be ready to work with their suppliers and dealers to share the data that drives AI applications.

Source: Accenture Research Analysis; Insights from Expert Interviews
The industrial equipment companies that take the lead in overcoming the challenges, and collaborate wisely with their wider ecosystems, are set to be the leaders of tomorrow. So far, the world has only seen a fraction of what AI has to offer. Industrial equipment companies have barely scratched the surface of the potential and possibilities of Artificial Intelligence. That needs to change. It’s time to make the leap to intelligent industrial manufacturing.
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