Optimizing Industry 4.0 Aftermarket Services

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Executive Summary

Machine, product, and vehicle downtime is never acceptable. The new generation of always-connected consumers expect increasingly superior digital experiences. While today's factories include wireless connectivity and sensors to visualize the entire production line, manufacturers still face serious challenges mining data to minimize or eliminate downtime at the first sign of trouble. As a result, while enterprises chase Digital Transformation, many Industry 4.0 initiatives are failing.

With Pega Intelligent Automation + AWS IoT, the core challenges of triggering and orchestrating aftermarket services such as warranty, maintenance, or parts return are addressed through pragmatic, end-to-end intelligent automation. These technologies make business transformation possible across the entire value chain of an industrial enterprise – from product development through the aftermarket phase of moving a product into obsolescence. Together, Pega's low-code platform and AWS IoT's out-of-the-box services help manufacturers turn digital insights on machine health into instant action.

With connected IoT devices, the aggregate economic impact of Industry 4.0 will be between $500 billion to $1.5 trillion in the next five years.[1] The aftermarket services of connected devices such as connected cars are particularly critical for manufacturers, especially for original equipment manufacturers (OEMs).

While automotive aftermarket journeys might remain an afterthought, the business impact is considerable:

- Aftersales generate 20% of revenue, and ~50% of profits for OEMs.[2]
- In 2017 alone, ~23 million vehicles were recalled in non-Takata airbag campaigns.[3]
- Warranty claims impact OEM revenues by ~3.3%.[4]
- 72% of vehicle owners would pay a flat monthly fee for "invisible" effortless service. This Includes convenience services like "vehicle pick-up from and return to home."[5]

Intelligent Automation + IoT, AI/ML, and blockchain target existing inefficiencies by optimizing the warranty lifecycle. Organizations gain the power to track a part with IoT solution constructs like a digital twin for the entire production lifecycle, from distribution to sales, service, and finally recovery. Such an automated warranty value chain is estimated to provide significant benefits, including 50%-70% reduction in document verification time, 40%-60% reduction in fraudulent claims, and a 60%-80% reduction in warranty information mismatch.

The road to IoT success runs through Intelligent Automation.[6]

[1] Capgemini, "Smart Manufacturing" (2018)
[2] Accenture, "Why Automotive Needs to Re-Haul Aftersales Now" (2018)
[3] Stout, "2018 Automotive Warranty & Recall Report" (2018)
[4] MSX International, "Benchmarker: Digital Transformation of Automotive Retail Networks" (2018)
[5] Accenture, "Why Automotive Needs to Re-Haul Aftersales Now" (2018)
[6] Khoshafian, S. "The Road to IoT Success runs through Digital Process Automation," www.linkedin.com/pulse/road-IoT-success-runs-through-DPA-setrag-khoshafian/

Example: Challenges of warranty value chains

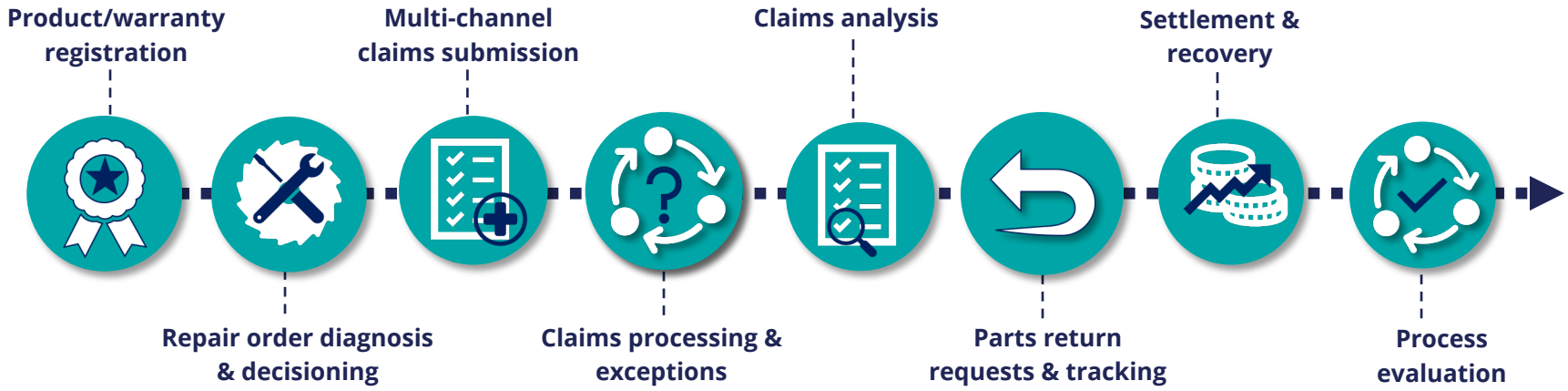
A typical manufacturer now spends 3%-4% of revenue on warranty management.[8]

In its current state, the warranty process is full of roadblocks

Warranty is both an interesting challenge and a differentiation opportunity for manufacturers, especially OEMs. Despite a reduction in the number of claims, costs have increased notably across the warranty value chain. Customers spend $2 trillion in warranted product sales on owned assets, while a typical manufacturer now spends 3%-4% of revenue on warranty management.[8]

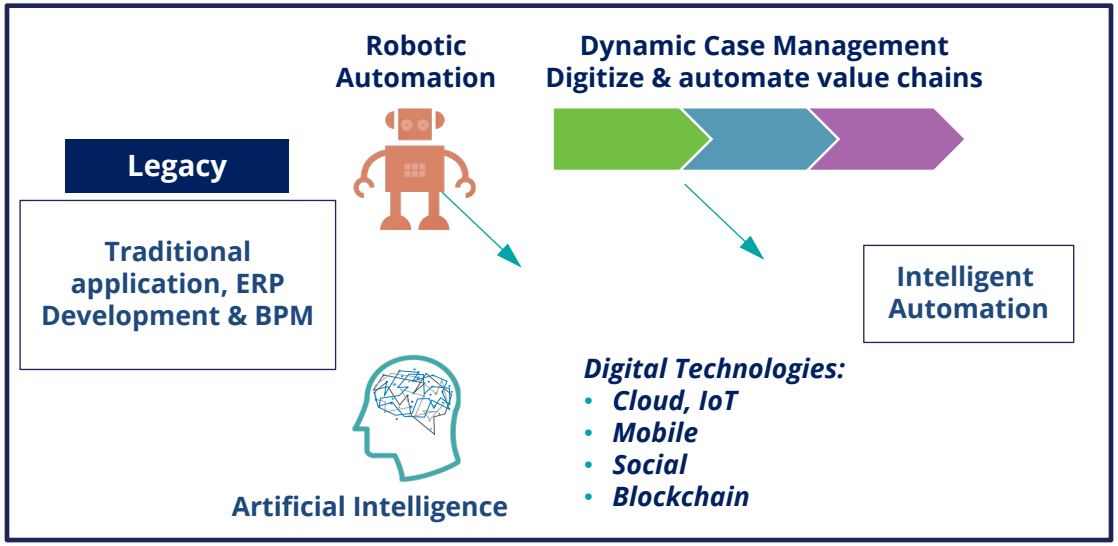
Therefore, warranty is one of a manufacturer's most significant expenses. Existing legacy systems are siloed, disparate, or standalone, requiring manual interventions and hand-offs, with zero immutability of records. Thus, the onus is transferred to the customer to prove ownership and warranty coverage via physical invoices. This contributes to decreased customer satisfaction, work duplication, and inability to handle counterfeiting and fraudulent claims.

The graphic below illustrates some of warranty management's many potential pain points. These challenges can be transformed into differentiating opportunities and addressed through two fundamental technologies: Intelligent Automation (IA) seamlessly integrated with the IoT platform on the Cloud with predictive analytics with AI/ML and immutability of records with Blockchain. In the following section we discuss the impact of these AWS technologies coupled with Pega Intelligent Automation.



[8] https://www.pega.com/system/files/resources/2020-01/pega-aftermarket-services-research-report.pdf
[9] https://news.thomasnet.com/companystory/downtime-costs-auto-industry-22k-minute-survey-481017

Intelligent Automation with IoT



Intelligent Automation is the prime enabler for Digital Transformation.

Intelligent Automation has evolved from traditional *Workflow* and *Business Process Management (BPM)*.

Digital technologies that influence BPM include Robotic Process Automation (RPA) and Artificial Intelligence as well as social, mobile, cloud, IoT, and Blockchain. Enterprises realize that the end-to-end chain-of-value work assigned to different business units and trading partners is only as strong as the weakest link.

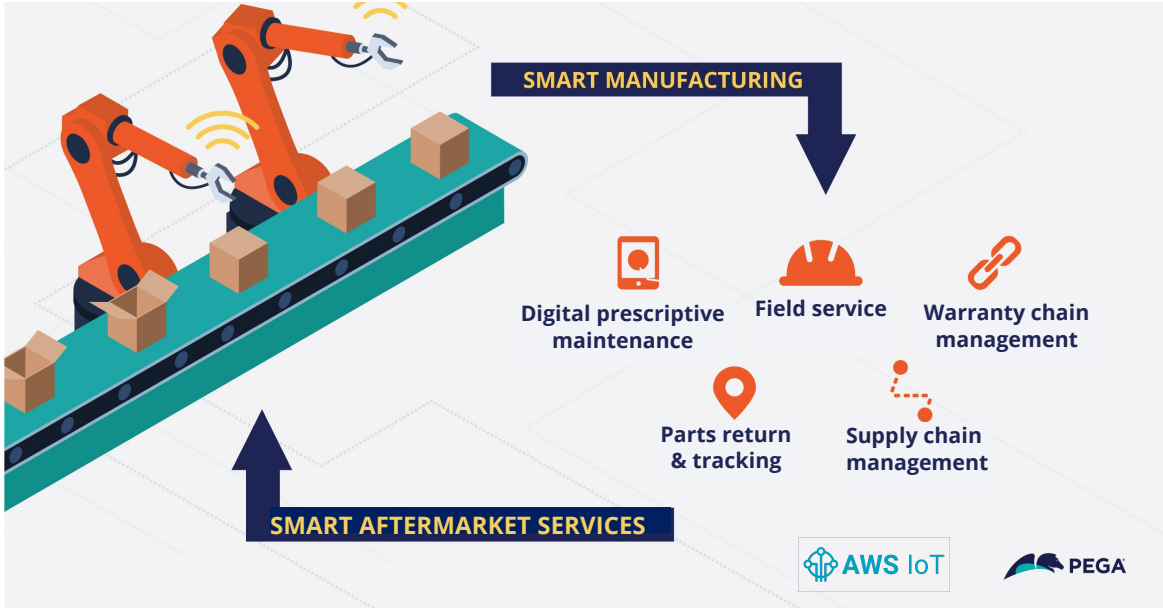
The process flow-chart and swim-lane paradigm is now superseded with Dynamic Case Management (DCM) capabilities that provide direct digitization to automate value chains. End-to-end automation is growing increasingly *Intelligent,* especially by operationalizing the insight mined from Big Data. Automating repetitive tasks and providing AI assistance to knowledge workers is the new norm.

DCM digitizes and automates the value chains that cross organizational silos. With Intelligent Automation, developing robust enterprise applications is also accelerated as model-driven low-code/no-code development now supports Citizen Developers and Data Scientists. This accelerates innovation by obliterating the traditional siloes between Business, IT, and OT.

Intelligent Automation is therefore the prime enabler for Digital Transformation: the catalyst for innovation for accelerated development and intelligent automation.

As a result, customer journey value chains are shifting from silos, manual tasks and legacies to digitally transformed operations.

What about IoT?



The Innovation IoT connectivity in Smart Manufacturing and aftermarket services such as recall, warranty, and digital prescriptive maintenance offer tremendous potential opportunities for innovation and operational optimization. For example, as automotive manufacturers gain a deeper understanding of a customer's driving habits and maintenance history, they can proactively map out the right services to grow the relationship.

IoT connectivity has changed the customer experience – helping optimize customer service by enabling access to remote devices as well as real-time data and analytics. IoT connectivity has changed the customer experience – helping optimize customer service by enabling access to remote devices as well as real-time data and analytics. Combining smart factory connectivity with connected devices' data using with machine learning and digital twins creates innovation opportunities, *through low-code / no-code, end-to-end digitized and automated processes*.

IoT connected devices participate in processes, activate processes, or both. Devices are most commonly leveraged in aftermarket services for the following four use cases:

- **Things as participants in digitized process and cases:** For example, check temperature, shut off, or deliver package. Things also include mobile devices and connected vehicles used by field service technicians.
- **Events activate dynamic case management to respond to the event:** For example, field service is initiated when a connected vehicle breaks down.
- **Stream of events to correlate and handle complex scenarios:** For example, different sensors detect high pollution levels within 5 minutes, initiating a case.
- **Detect patterns and act using big data and predictive analytics:** For example, vibration anomalies are detected in a connected vehicle and fixes are prescribed before an adverse event can occur.

Example: Digital Prescriptive Maintenance (DPM)

Unplanned downtime events can cost manufacturers as much as $22K per minute![9]

DPM is considered a "Killer Application" for IoT with Intelligent Automation.[7]

Digital Prescriptive Maintenance (DPM) is a compelling use case of Intelligent Automation with IoT. There are pragmatic business reasons for IoT with DPA for maintenance. Maintenance is a key component in a production system, and a key success factor of manufacturing organizations. Unplanned downtime events can cost as much as $22K per minute! Manufacturers are aware of these challenges, yet over 70% struggle to balance cost and reliability.[9] The illustration above shows the value chain of DPM.

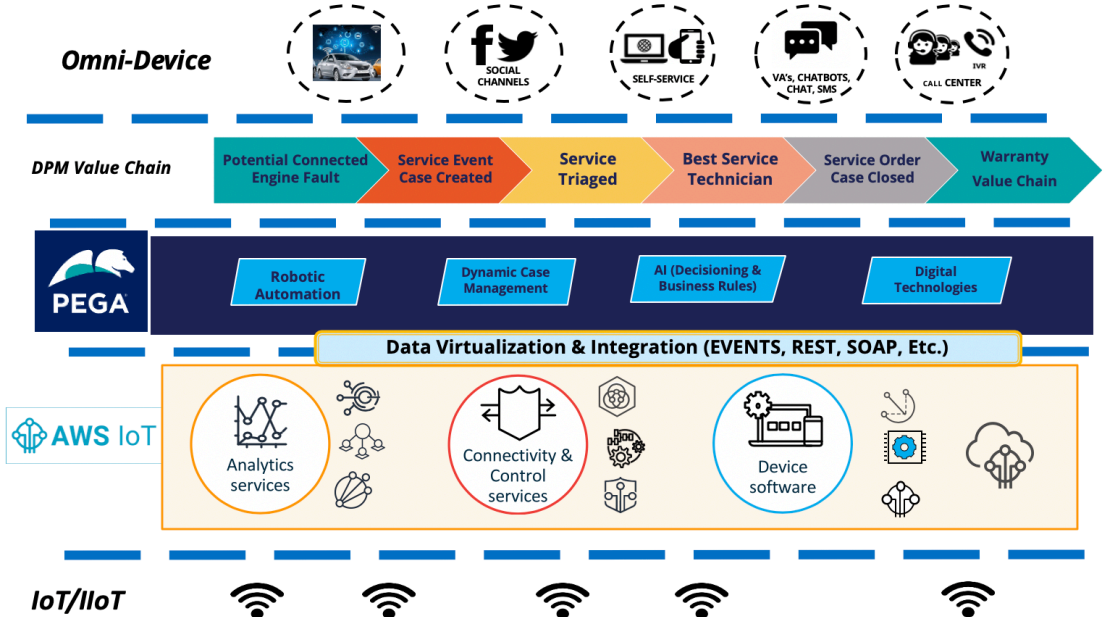
According to a recent survey, 40% of drivers said it was not easy to know how to resolve issues that they encountered while driving.[8] So what if you could predict issues before a driver sees their check engine light, then use that intelligence to ensure service teams have the required parts and skills? Not only would you save time and money, you would also make your customers happy.

This kind of real-time prescriptive maintenance isn't futuristic. It's here, as powerful combines sensor data, event streaming, in-memory databases, and real-time analytics, with decisioning and workflow orchestration. The connected device – a connected car in this example – can generate a maintenance case through an ML model forecasting the remaining useful life of a component or via sensor events.

After creating the case, triage from intelligent business logic can select the next-best-action. One option is sending the service technician closest to the dealer who services the car. After closing the service order, a warranty sub-chain is created to pay the dealer and return parts, if necessary. This value chain is as strong as the weakest link! Thus, a combined IoT + Intelligent Automation ensures that the issue is optimally completed and resolved.

[8] https://www.pega.com/system/files/resources/2020-01/pega-aftermarket-services-research-report.pdf
[9] https://news.thomasnet.com/companystory/downtime-costs-auto-industry-22k-minute-survey-481017

Pega Intelligent Automation and AWS IoT Reference Architecture



AWS offers the broadest, deepest IoT services, from edge to cloud. Pega is the world's leader in Intelligent Automation. The seamless combination of AWS with Pega provides manufacturers the most compelling digital transformation platform. This architecture can seamlessly achieve all four use cases as illustrated above.

Omni-channel and omni-device customer interaction layer: Manufacturing and technology companies realize the tremendous potential of smart-connected devices for homes, vehicles, and industrial applications. IoT devices are also channels for upsell and cross-sell. Sensors provide feedback and opportunities for Machine Learning: device health, usage, and consumer preferences. Continuous data intelligence transforms the relationship between manufacturer and consumer.

Value chain intelligent automation layer: At the top, the end-to-end value chain orchestrates and sequences tasks involving people, automated devices, and enterprise applications (known as *systems of record*) and trading partners. In aftermarket services such as DPM, recall or warranty, the participants include manufacturers, third parties such as dealers or field service technicians, suppliers and the customers.

Pega Automation + AWS IoT: The next two layers illustrate the Pega and AWS components. Pega's platform supports the no-code modeling, automation, and operational orchestration of value chains involving people, enterprise applications, trading partners, and, most importantly, connected devices. All IoT capabilities are realized through the AWS IoT data services, control services, and device software.

The Pega and AWS integration can leverage synchronous API calls or events. Solutions can be deployed on the cloud, on premise (for enterprise), or via hybrid-cloud models.

IoT/IIoT Connected Device layer: The IoT/IIoT connectivity layer is the lowest layer. Physical and increasingly connected devices are becoming part of the end-to-end value streams. AWS IoT edge computing provides an added advantage in filtering the IoT data and even pushing the execution of business logic to the edges. This means devices can potentially carry out autonomous or semi-autonomous actions. This is realized in conjunction with the AI and business logic executed within the end-to-end processes through Pega Intelligent Automation. The decision on when and why to push logic on the device layer vs. the intelligent automation layer is guided by best practices.

The benefits and business case

Owners prefer proactive engagement – *Sixty-five percent of drivers prefer to receive a reminder from the automaker or dealer when it's time for service.*[10]

With Pega Intelligent Automation + AWS IoT, the core challenges of Industry 4.0 and aftermarket services such as warranty, maintenance, or parts return are addressed through pragmatic end-to-end intelligent automation solutions. Pega's no-code platform and AWS IoT's out-of-the-box services can accelerate connected application development.

As noted, multiple players exist within a complex enterprise, with often siloed business units and inter-organizational partners, various connected devices, and consumers. They can now all become participants to optimize the manufacturer's cost reduction, revenue generation, and compliance challenges with complete visibility and control.

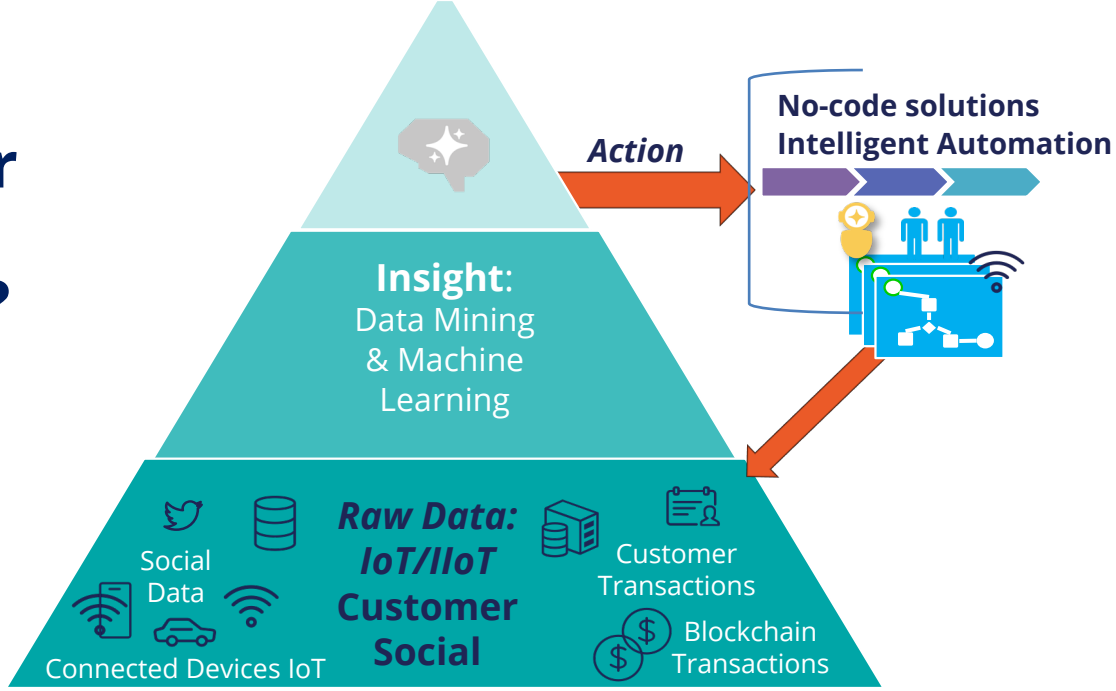
For warranty, the combined Pega + AWS services like IoT, AI/ML, and blockchain include capabilities like remote diagnostics, predictive analytics, and immutability of records. This provides a 360-degree view of asset performance in near real time, predictability of asset failure, immutability of documentation across the value chain, automated processes, and optimizes next-best-actions for warranty customers.

These capabilities transform aftermarket services from an afterthought into a process with significant built-in intelligence to help with the following business outcomes:

- **Aftersales Remote Diagnostics:** With this capability an end-to-end device directed warranty can achieve:
  - Automatic updates of on-board device software
  - Automatic sense and detect measures from edge device
  - Automatic control for maintenance
  - Quarantine and fix of vehicles in ship mode
- **IoT supply chain and parts return:** The edge device that needs to replace a defective device can be monitored from the supplier to the distributer or customer.
- **IoT repair or parts validation:** Once a repair or replacement is complete, the manufacturer can validate the fix, potentially leveraging the device's digital twin.
- **Warranty cost forecasting:** Use predictive analytics to better estimate warranty costs.
- **Increased customer satisfaction:** Increased visibility into product performance and predictive analytics improve customer satisfaction due to proactive claims management for parts in warranty.
- **IoT supply chain and parts return:** The edge device that needs to replace a defective device can be monitored from the supplier to the distributer or customer.

[10] https://www.pega.com/system/files/resources/2020-01/pega-aftermarket-services-research-report.pdf

So why Pega + AWS for Industry 4.0 Aftermarket Services?



Pega Intelligent Automation with AWS IoT provides a 360º actionable view of the customer, connected device, and all the participants of manufacturing processes.

The health of the connected device, device software updates, and validations can be monitored continuously through AWS IoT components. The data from connected devices, aftermarket services, and the customer as well as trading partner interactions are aggregated for Machine Learning insights.

Many layers and complex multi-tier architectures provide the infrastructure for this value-stream connectivity. Pega + AWS support these next generation multi-tier architectures.

The top layer of collaboration and process orchestration is critical for optimization. Insights are sometimes executed at the edges. However, the "action" of the ROI opportunities always involves automating processes. In fact, intelligent automation with participants that can be robots, trading partners, AI-assisted workers, enterprise applications, or connected devices.

So why Pega Intelligent Automation + AWS IoT for Industry 4.0 Aftermarket Services? Because the joint solution accelerates innovative application development through Pega no-code development and out-of-the-box AWS IoT components.

More importantly, a comprehensive spectrum of task or process automation avoids waste and accelerates aftermarket operations.

Finally, acting on the robust insights from Big Data (IoT, Customers, Enterprise Applications) creates real business value. The seamless combination of Pega Automation and AWS IoT architecture can seamlessly achieve all four use cases to provide manufacturers with the most compelling digital transformation platform. These core capabilities of the joint solution are exactly what is needed to optimize Industry 4.0 aftermarket services!

How can you get it right?

Leading manufacturers already embrace this approach, with dramatic results.

To learn more about how automotive, industrial, high-tech, and medical device leaders are delivering customer-focused aftermarket services, visit us at:

pega.com/manufacturing

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