

ANOMALY DETECTION & PREDICTION DECODED: 6 INDUSTRIES, COPIOUS CHALLENGES, EXTRAORDINARY IMPACT

eBOOK

 **Progress**[®]
DataRPM

The Popular Chronicle of Industry Downtime

Today, organizations across various industries are facing a serious dilemma.



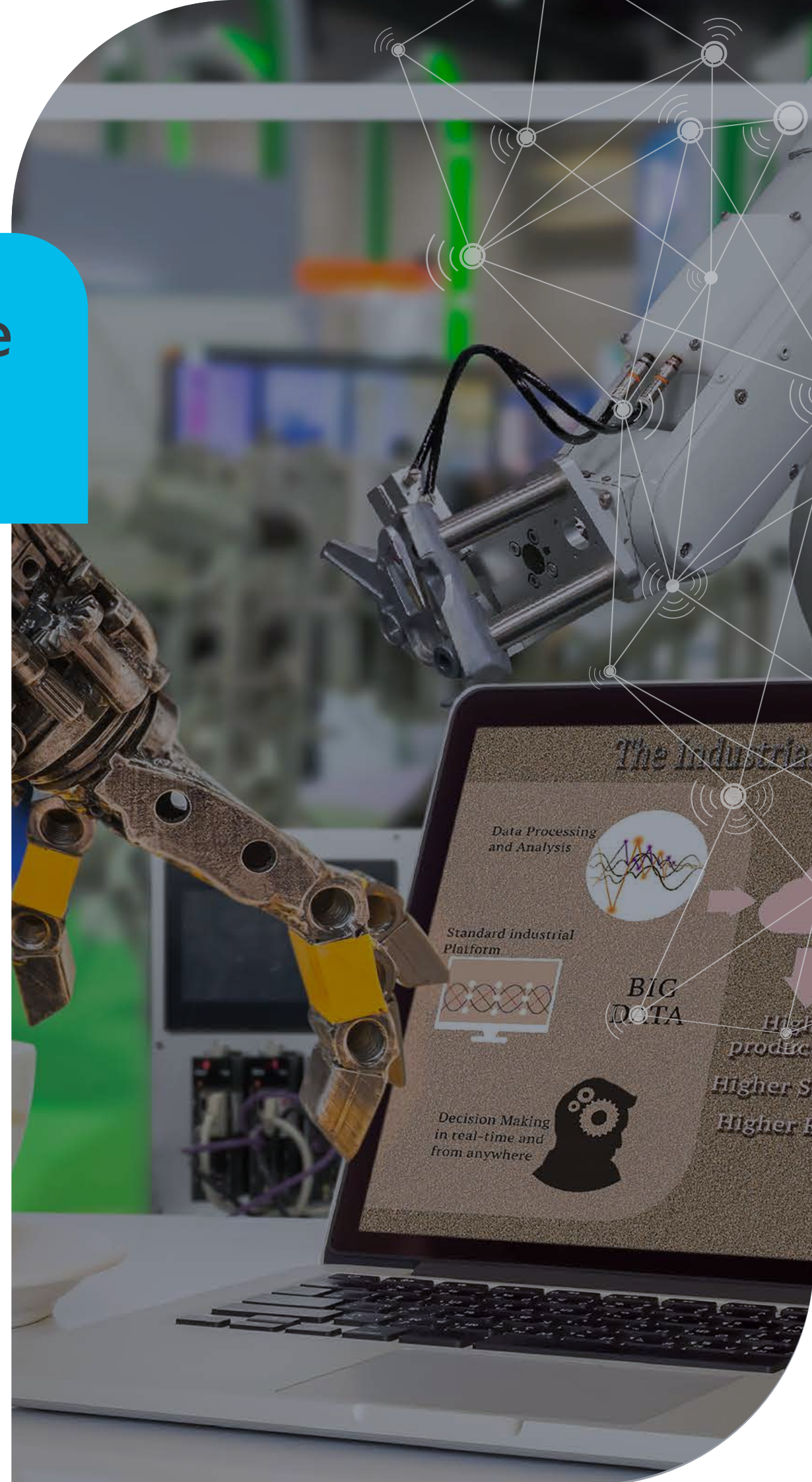
The Problem:

On one side, there's a set of machines or equipment that are able to record in-time values of data generated by sensors.

On the other side, an industrial company that wants to target unplanned downtime and improve productivity by using the data generated by its machines.

The Questions that Need to be Asked:

- ? Where is the abnormal behaviour and when will it occur?
- ? Where and when have failures happened?
- ? How can one predict unplanned failures before they occur?





The Plot Twist:

The sheer volume of industrial data is very large and extremely complex. Detecting and predicting anomalies is harder than searching for a needle in a haystack because you often don't know whether you're even looking for a needle in the first place. No one knows how to define this abnormality.



The Savior:

However, we know two things that give us a critical starting point:

- We know that we are looking for something unusual.
- We have the power of machine learning, which uses its magic lens to scout for these anomalies.

Anomaly detection continues to play a vital role in most industries across the globe. According to a report by [MarketsandMarkets](#), the size of the global anomaly detection market is estimated to grow from **\$ 2.08 billion** in **2017** to **\$ 4.45 billion** by **2022** at a compound annual growth rate of **16.4%**.



6 Capacious Industries Constrained by Countless Challenges

The Industrial Internet of Things (**IIoT**) is unlocking new possibilities for asset-intensive industries like manufacturing, aviation, oil and gas, automotive, transportation and logistics and energy and utilities.

Sadly, almost **85%** of these industries let this data sourced from trillions of data points go unused. Only the remaining **15%** possess the capabilities to derive insights from the limited data sourced from a select few sensors. This leads to building generalized models that encompass only a few assets, which are then extrapolated to the entire asset population.



The Result?

Only **20%** of the actual potential asset failures are detected and a massive **80%** are categorized as individual one-offs.

With the high degree of unpredictability surfacing across all industries, here is a quick look into each of these spaces and the myriad challenges they face.





Manufacturing: The Fulcrum of Growth and Innovation

Industry **4.0** is pushing digital transformation in the manufacturing sector and is driven by three sources of disruption: the astonishing rise in data volumes, increasing connectivity and the emergence of analytics.

All of this is directed towards achieving a common goal: ensuring maximum machine availability. This is one of the biggest battles fought by manufacturers-to keep the amount of materials consumed by maintenance and repairs to a minimum.

Industry Viewpoint

A **1%** improvement in productivity across the manufacturing industry can result in **\$ 500 million** in annual savings.

Predicting anomalies on time can result in savings of upto **12%** over scheduled repairs, maintenance cost reductions of up to **30%** and elimination of breakdowns by up to **70%**.

Challenges Faced by the Manufacturing Industry





Automotive: Shifting Gears towards a Digital Revolution

IIoT is driving massive transformation for the automotive industry, driven by shared mobility, connectivity services and feature upgrades. Auto manufacturers are gearing up to offer data-driven services that have the potential to create **\$ 1.5 trillion** in opportunity—this means a **30%** additional revenue potential in **2030**.

To achieve this, automotive manufacturers need to be able to detect and predict abnormalities in operations by leveraging machine learning, big data and machine-to-machine communications. This would enable automakers to assimilate data and analyze it in real time, while delivering actionable insights.

Industry Viewpoint

By **2020**, the auto sector will be investing **\$ 82 billion** into new technology to capitalize on digital transformation.

Research conducted by a leading business analytics company revealed amazing success numbers due to connected devices and predictive analytics: **65%** greater uptime versus unconnected fleets, **40%** lower average repair time, **54%** year-over-year service cost improvement, **10%** lower service cost for connected fleets, **10%** operating cost reduction, **14%** scrap reduction and **70%** reliability increase.

Challenges Faced by the Automotive Industry



Overly Cautious
Equipment
Maintenance



High
Maintenance
Costs



Unplanned
Maintenance
Schedules



Increase
Mean
Time-to-Repair



Technical
Equipment
Failure



Unmet
Delivery
Expectations



Oil & Gas: Pumping Productivity to face upstream Challenges

The rapid progress of IIoT-based technologies has helped the oil and gas industry tap into the power of big data, analytics and sensors. It provides this industry the chance to automate high-cost and dangerous tasks. Most oil and gas operators are starting to capture these opportunities to nip fatal anomalies on time and significantly improve their bottom line.

IIoT-based technologies offer many potential benefits in the upstream value chain of exploration, development and production. However, some of the biggest opportunities are in production operations, such as reducing unplanned downtime.

Industry Viewpoint

The International Energy Agency projects that total energy demand will rise by **32%** through **2040**, from about **\$ 13.6 billion** tons of oil equivalent to nearly **\$ 18 billion** tons, corresponding to a **1%** compound annual growth rate over the period.

An average mid-size LNG facility loses about **\$ 150 million** every year due to unplanned downtime.

It costs between **\$ 10** and **\$ 16 million** to surface a blowout preventer for maintenance. Accurate anomaly prediction can help save drilling companies millions in unplanned downtime and repairs.

Typical Challenges Faced by the Oil and Gas Industry



Complex +
Large Scale
Operations



Reduced
Asset
Tracking



Volatile
Oil
Prices



Sub-Optimum
Production
Efficiency



Poorly
Managed Asset
Maintenance



High
Capital
Costs



Transportation & Logistics: Seeking a Pathway to Drive Operational Efficiencies

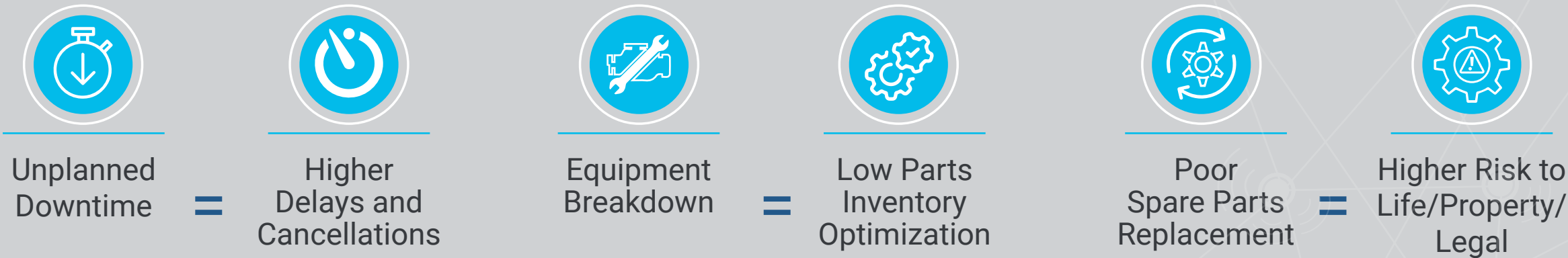
The transportation and logistics industry strives to achieve greater all-around performance and reliability of high-value assets. Eliminating the slightest of abnormalities from the operations cycle, can ensure smooth performance of core business functions.

Since any kind of asset downtime implies loss of revenue from that source, it is important to optimize the flow of goods, people and services to maximize value.

Industry Viewpoint

Union Pacific, a major USA railroad corporation with nearly **8,000** locomotives in operation, estimates that predictive maintenance saves it approximately **\$ 100 million** per year.

Typical Challenges Faced by the Travel and Transportation Industry





Aviation: A Turbulence-Free Flying Experience

The biggest reality of the aviation sector:
A grounded aircraft is as good as a dead machine.

According to an estimate by boeing, every aero-engine maker loses on average about **\$ 40 billion** per year in maintenance costs. Effective on-ground operations that are free of erratic abnormalities, can ensure millions of dollars are saved in detecting and fixing aircraft equipment failures. However, ground ops teams need a vast pool of resources, equipment and parts to be connected across multiple locations to do this.

Industry Viewpoint

When Virgin Blue suffered an **11-day** unplanned downtime in **2010**, it resulted in **50,000** disrupted passengers, **400** grounded flights and a loss of upto **\$ 20 million**.

When Southwest Airlines experienced a single router malfunction, it took over **12 hours** to fix and caused about **2,300** flight cancellations. The cost of cancelled flights and vouchers was about **\$ 25 million**.

Common Challenges Faced by the Aviation Industry



Assembly Asset
Configuration
Mismatch

=



Delay in
Aircraft
Schedules



Erratic
Unscheduled
Maintenance

=



Low
Airplane
Utilization



Poor Manual
Engine
Diagnostics

=



Higher Downtime,
which means Lost
Revenue



Energy & Utilities: A Power Grid for Intelligent Solutions

Did you know that there is a **100%** industrial internet potential impact on energy production and **44%** industrial internet potential impact on global energy consumption?

Since energy literally drives everything in the industrial world, the energy and utilities industry itself is under constant pressure. The space is facing pressure to tackle efficiency problems and performing **24/7** without disruptions. There is additional pressure to ward away the slightest of deviations from process flows. There is also pressure to find effective ways of utilizing sensor data to create ubiquitous power grids. This can finally help in siphoning just the right amounts of power to customers.

Industry Viewpoint

In the power sector, digitizing central generation could create upto **\$ 80 billion** of impact for new combined cycle gas turbine and wind turbine orders, with additional value for upgrades to existing assets.

Unexpected disruptions can cost **3% - 8%** of capacity, resulting in **\$ 10 billion** production cost lost annually.

40% of abnormal events can be attributed to operator error.

Challenges Faced by the Energy and Utilities Industry



Disruptions
in Power
Supply



Inability to meet
Global Energy
Demands



Unexpected
Operational
Anomalies



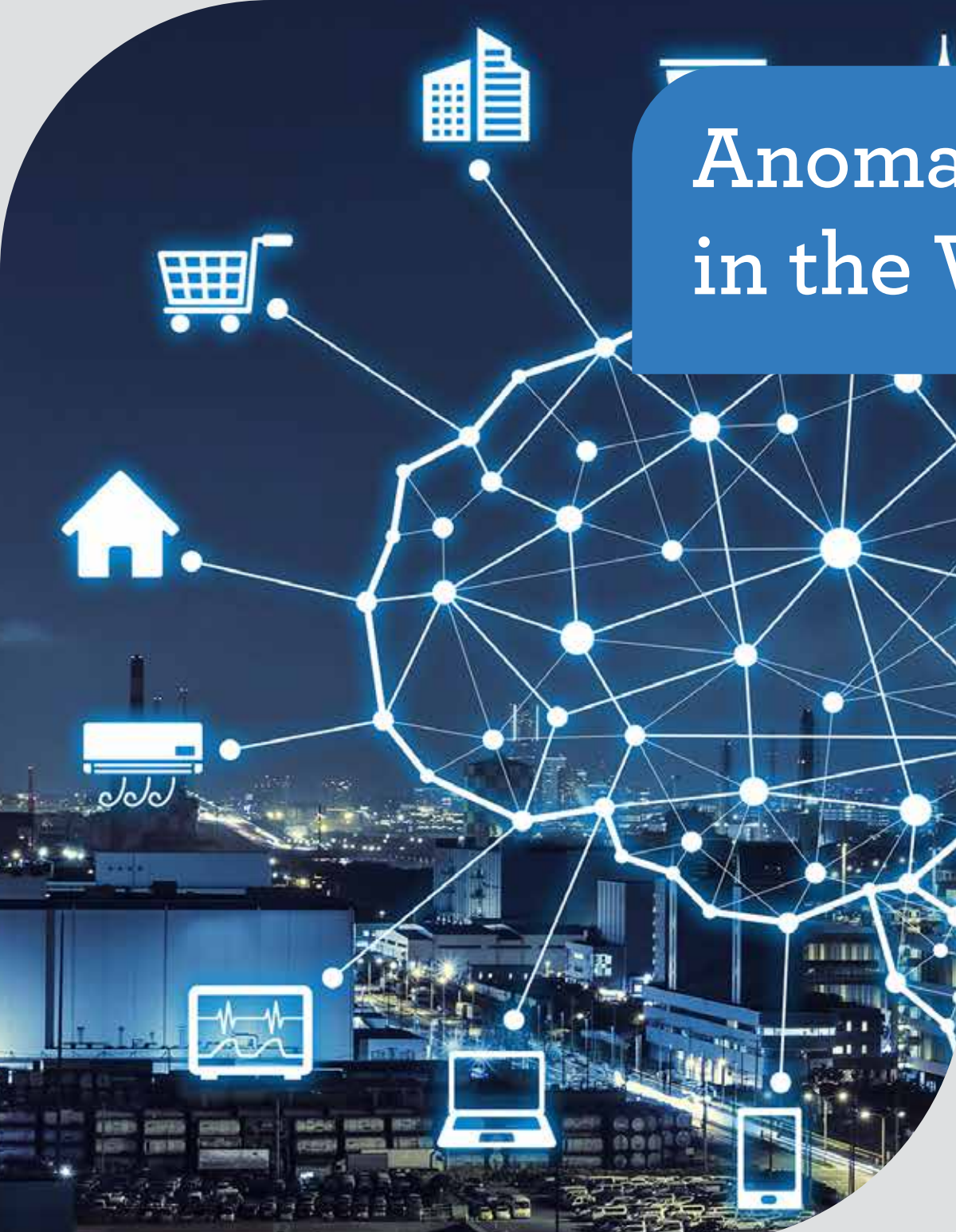
Forced
Power
Outages



Ambiguity in
Assessing
Plant Data



Reduced
Power Asset
Life



Anomaly Detection Playing Hero in the World of Industrial IoT

Gartner predicts that by **2020**, the number of connected IIoT devices will reach **\$ 20.8 billion**. McKinsey confirms this with a report that predicts the potential economic impact of IIoT being **\$ 4 trillion** to **\$ 11 trillion** a year by **2025**.

“It is clear that our industries’ future will involve billions of connected things, producing trillions of gigabytes of data—all of this in a market of trillions of dollars. This rapid explosion of data presents a challenge and an opportunity at the same time.

With accurate anomaly detection at the right time, this data explosion can be converted into a powerhouse of infinite value for all our industries.

These insights are first collected from sensor data and then channelled towards deriving actionable outcomes. These outcomes would then feed into an anomaly detection and prediction system and ensure the number of anomalies are reduced.

Sensors
Connected Assets,
Machines and
Industrial Equipment

Insights
Detecting and Predicting Anomalies
by Monitoring Machine Health and
Conducting Root Cause Analysis

Actions
Taking the necessary Actions
to ensure these Anomalies do
not Occur i n the Future

Data

Merging this Sensor
data with Business
Information

Impact

Enhanced Efficiencies,
Reduced errors and
Increased ROI



Applying Anomaly Detection and Prediction: Deep Seeding Potential Value Across Industries

Manufacturing Tracing Down Anomalies On The Factory Floor

Staying on top of the IIoT game is now a real possibility with data-driven insights that support informed decision making at all levels within the factory. Anomaly detection and prediction, if done right, can intelligently tap information from all connected sources to analyze and derive insights. This can significantly help businesses as they look to nail down productivity busters by predicting failures even before they occur.

Manufacturing Big Improvements



Slashing Unplanned downtime by **50%**



Reducing Scrap Production by **75%**



Improving overall Equipment Effectiveness by **25%**

Automotive Squashing Anomalies for a Smooth Ride

With analysts predicting a quarter of a billion connected vehicles on the roads by **2020**, connected automobiles will gush information like never before. For automakers, this presents an opportunity to tap into the trillion-dollar bonanza of sensor data. These insights can be intelligently applied to detect and predict anomalies in real-time.

Real-time anomaly prediction and detection can help the industry auto-predict unforeseen failures and shift overall productivity into overdrive. This also minimizes warranty claims and risks.

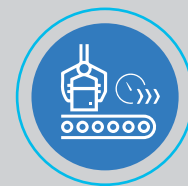
Value-Driven Benefits



Optimize Spare part Availability by **13%**



Diagnose Potential Malfunctions **75%** faster



Improve Assembly line uptime by **35%**



Oil & Gas

Drilling Out Abysmal Anomalies

In a highly volatile industry like oil and gas, improving production efficiency by even a slight margin can yield up to **\$ 220 – \$ 260 million** bottom-line impact on a single brownfield asset. However, improved production efficiency requires data-led decision-making to replace intuitive conclusions or guesswork.

With accurate anomaly detection, companies in the oil and gas space can derive meaningful insights from the several thousand sensors that they've invested in and can put that data to real use.

Pumping Out More Value Per Barrel



75% Reduction in Breakdown of Offshore



100% Reduction in errors due to Faulty Decision Making



56% Gain in Production Efficiency



Transportation & Logistics: **Clamping Down on Anomalies from your Fleets**

With the demand for transportation and logistics slated to double in the next two decades, service providers are faced with a massive challenge of improving reliability and assuring steady availability. By tracing and predicting anomalies at the right time, optimum fleet management solutions can be discovered.

This can help put a stop to behind schedule arrivals and enables transportation and logistics companies to stay on track with improved visibility.

Delivering Value On Time, Every Time.



Eliminate Unplanned
Downtime by Almost
100%



Improve Vehicle
on-road Performance
by **28.5%**



Enhance Fuel
Efficiency by
5-10%

Aviation

An Anomaly-Free Flying Experience

IATA's prediction of air travellers doubling in the next 20 years means more airplanes flying on newer routes. In the IIoT era, this translates into an incremental rise in the number of machine sensors and the generation of an unprecedented volume of data.

More data could possibly imply more frequent and a higher number of anomalies in airline operations. With an accurate anomaly detection mechanism in place, flight engineers can leverage this data to ensure a smooth, uninterrupted flying experience. After all, zero anomalies imply zero turbulence.

Reaching the Skies of Higher Profitability



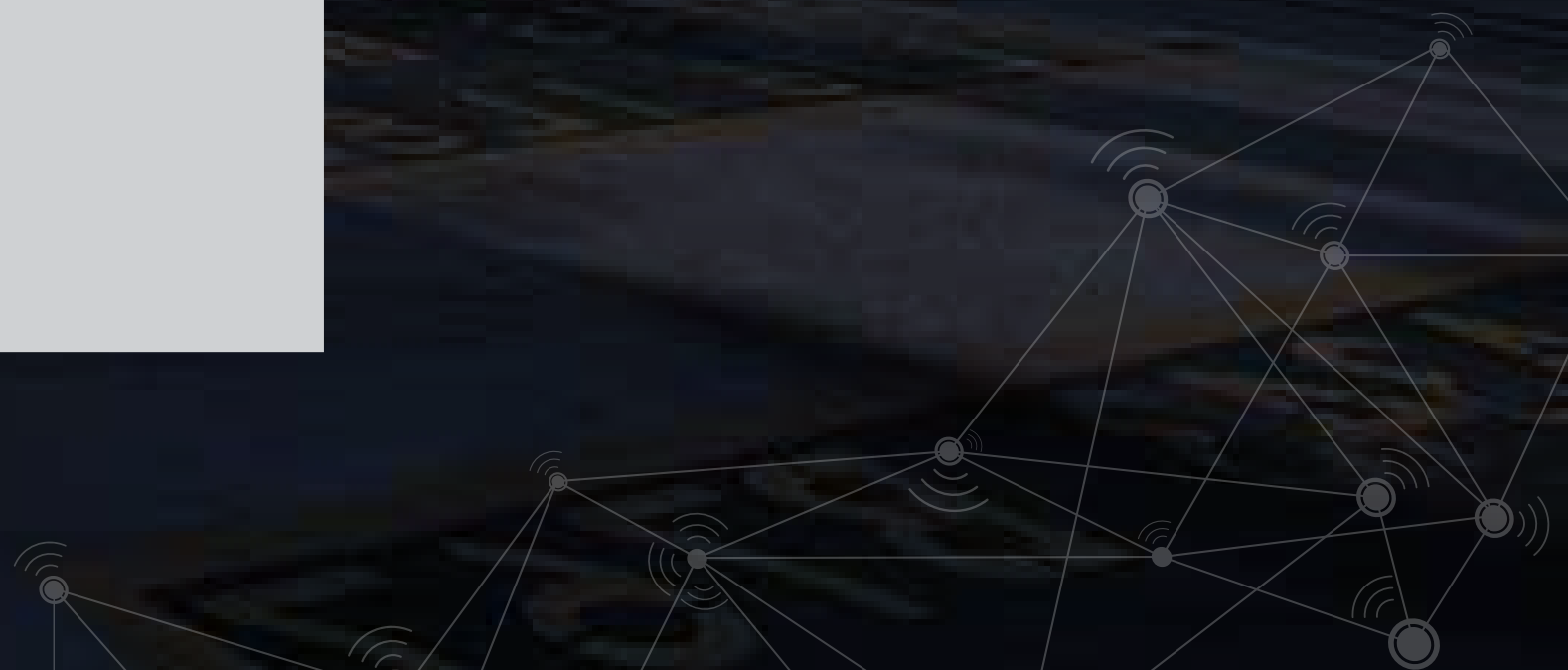
Achieving **35%** more control over Fuel Efficiency



Obtaining **10** times Greater **ROI**



Saving Costs **of \$ 10,000** per hour on Grounded Airplanes



Energy & Utilities

Generating Power Without Anomalies

The future of the energy and utilities sector is powered by a unique value chain that leverages digital technologies effectively. The industrial internet sparks off these technologies to deliver greater cost efficiencies and increase the sustainability of power generation systems.

However, enhanced technologies come with their own risk of potential breakdowns, which could cause irreparable damage. By targeting anomalies that exist in these process flows, energy and utility companies can prevent unplanned failures and achieve huge cost savings.

A Power Grid of Benefits



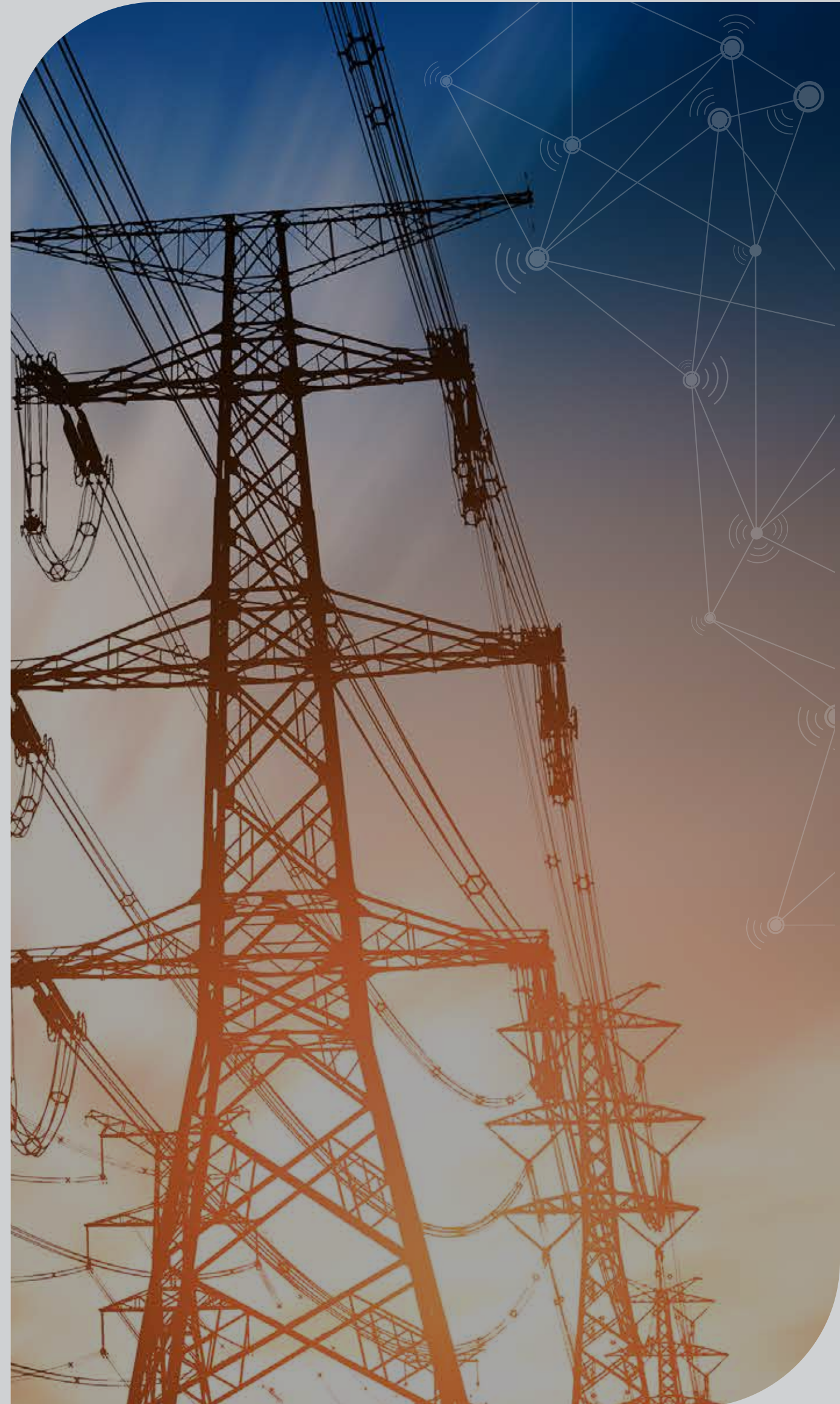
Eliminating Uncertainties in Asset Performance by **90%**



Enhancing Field Workers' Efficiency by **25%**



Making Accurate Decisions Five Times Faster than the Competition





Our Industries Continue to Fight the Eternal Downtime Battle - it's time to cease fire with Anomaly Detection

The Plague Of Unplanned Downtime



Airline Industry

Flight Delays,
Cancellations = \$ 45 Million
per Day



Oil and Gas Industry

Out-Of
Commission Wells = \$ 7 Million
per Week per Well



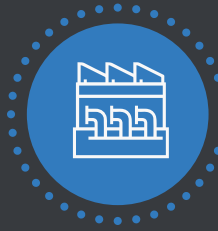
Transportation and Logistics Industry

Lost Locomotive
Availability = \$ 400 Million
per Year



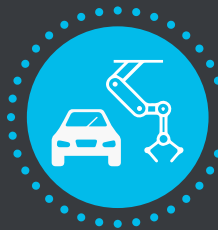
Energy and Utilities Industry

Lost
Production = \$ 45,000
per Day



Manufacturing Industry

Breakdown In
Production Line = \$ 50,000
per Hour



Automotive industry

Unplanned
Factory Downtime = \$ 20,000
per Minute

With a smart and secure anomaly detection and prediction system in place, original equipment manufacturers across these industries can:

- 1 | Spot unusual behaviour that differs significantly from what has been observed before or from what is expected
- 2 | Use data insights to take the necessary steps to predict, stop and abate anomalies from manufacturing processes
- 3 | Train machines to learn and recognize these unusual patterns, therefore intelligently automating the anomaly detection process

One such effective technique is deploying cognitive computing to predict anomalies before they occur.

Download this [infographic](#) to meet the cognitive anomaly detection and prediction superhero, who uses his superpowers to slay anomalies at their root. You will be amazed to see what he can do for you!

ABOUT PROGRESS DATARPM

DataRPM, a Progress company, is a pioneer in cognitive technology and is on a mission to transform the future of Industrial IoT through disruptive cognitive data science. It enables asset-intensive organizations to achieve a fail-proof environment, maximizing the yield of their mission-critical assets. Through a first-of-its-kind product, the Cognitive Anomaly Detection & Prediction (CADP), Progress DataRPM makes the process of voluminous data ingestion and analytics faster, scalable and devoid of manual error to find anomalies and patterns in data.

The meta-learning powered solution is credited with delivering > **80%** accuracy in asset failure prediction at 1/30th the time and resources, delivering **30%** in cost savings and revenue growth.

Since its inception in 2012, Progress DataRPM has serviced leading industrial conglomerates across the globe. It has made asset-related decision-making within organizations faster, credible and more quantifiable through data-driven insights and machine recommended solutions. In 2017, DataRPM was acquired by Progress.

To Know More

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 **Progress**
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