MAANA®

7 Digital Knowledge Technology Use Cases for Accelerating Industrial Profitability

- Field Service
- Part Order Optimization
- Turbine Service Call Optimization
- Turbine Shutdown Prediction
- Logistics Optimization & Contingency Management
- Accounts Receivable Collections
- Cyber Security

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Create New Knowledge to Optimize Industrial Assets and Processes

According to a recent study conducted by Accenture and GE, a growing number of industrial companies are using analytics and the Internet of Things (IoT) to uncover new opportunities to increase operational efficiency and profitability. For instance, they are gathering vast volumes of machine-generated sensor data and combine it with maintenance logs, production history records, weather data, employee shift records and product data. These information assets can be analyzed to drive predictive maintenance, maximize equipment uptime and reduce production losses. Similar opportunities for operational improvement in other business areas include: field service, equipment failure prediction, finance and risk and compliance.

Even small operational improvements can yield big savings, as a 1% improvement in OPEX can result in hundreds of millions in savings. For example, GE is using the Industrial Internet to increase the fuel efficiency of a gas turbine fleet; just a 1% increase in fuel efficiency will save the company over $6 billion in fuel savings annually.[1] Similarly, in the oil and gas industry, a 1% improvement in oil recovery is estimated to result in 10 billion additional barrels per year; equivalent to billions in additional revenue. Furthermore, avoiding just one day of downtime in an offshore platform can prevent $7 to $10 million per day in lost production.

Given the potential for these types of impacts to accelerate profitability, it's no surprise that in a recent Accenture survey, nearly 90% of company executives indicated that analytics is either their top priority or among their top three.[1] And nearly 75% believe that analytics have the power to shift the competitive landscape for their industry in the next year.

Today's most progressive companies are transitioning away from data-centric technology – and driving innovation and optimization by embracing digital knowledge technologyTM. This next paradigm in technology goes beyond data analytics and is uniquely able to capture and model the complex relationships between how business processes, assets and organizations operate and interconnect.

Barriers to Optimization

Most companies struggle to harness their data to accelerate profitability. As noted in the Accenture study, companies need to mobilize data from across the enterprise, to deeply analyze it to realize its value, and govern it effectively. And as more data is generated, they need the ability to continuously collect, join and quickly analyze this data to make effective and timely decisions.

Big data analytics has been a big focus for many companies over the past few years. Fortune 500 companies have augmented their data warehouses by spending tens of millions of dollars to create data lakes and fund lengthy big data projects. Most of these analytic initiatives have been performed in departmental silos with limited business value, but have not had significant impact on increasing enterprise-wide profitability.

The approach to gather data from across the enterprise and consolidate it all in one place in hopes that data scientists can mine it later for insights and stumble upon the right answers has simply failed to deliver measurable ROI.

For industrial companies, 1% improvements in OPEX can result in hundreds of millions of dollars in savings.

1. www.accenture.com/us-en/insight-industrial-internet-competitive-landscape-industries.aspx

Take analysis of data related to field service management, for example. Most industrial firms are generating massive volumes of data from field service automation, work order and fleet management systems, equipment sensors and other solutions already deployed.[2] All of these data are stored in different departmental and system silos. One of the biggest challenges for field service organizations is bringing together and preparing for analysis all of this data—especially data related to service and maintenance including, HR and travel data, training records, text documents, sensor data and time series data.

Using Maana's Knowledge Platform to Accelerate Profitability

Maana pioneered "knowledge technology" for the enterprise. The Maana Knowledge Platform turns human expertise and data from across silos into digital knowledge for employees to make better and faster decisions. Digital knowledge is a network of models that provide continuous, actionable recommendations into key decision flows of the enterprise.

At the core of the platform is Maana's patented Knowledge Graph™, which combined with Maana's algorithms, expedite extracting knowledge directly from data silos and information sources to reveal their relationships in the context of optimizing assets or processes. Maana represents knowledge in the form of models and the Maana Knowledge Graph is the network of models that are developed to optimize specific assets and workflows.

Maana Knowledge Platform enables subject matter experts (SME) to quickly build models that answer complex questions and extract the information needed to understand the relationships and interdependencies of business processes and assets across their organization. These models represent concepts, entities, properties, and relationships that SME and data scientists can reason over together.

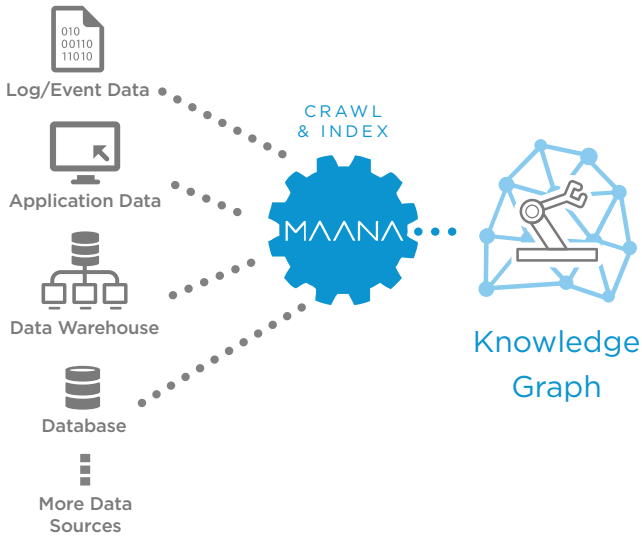


Figure 1: Maana provides a holistic view of assets and business processes for optimization

2. Big Data Can Make A Big Difference In Field Service." Field Technologies magazine. By Brian Albright. July 24, 2014. (http://www.fieldtechnologiesonline.com/doc/big-data-can-make-a-big-difference-in-field-service-0001)

Digital Knowledge Use Cases for Industrial Companies

Maana has been working with the largest industrial companies in the world to optimize their key assets and business processes. As shown in Table 1, this eBook explores seven use cases of Maana's Knowledge Platform for industrial firms.

Field Service	Equipment Failure	Finance	Logistics Optimization & Contingency Management	Risk and Compliance
• Fieldservice profitability • Part order • Equipment service calls	Turbine shut down prediction	Accounts receivable collections	Logistics Optimization	Cyber security

Table 1: Top use cases of digital knowledge technology for industrial companies

All of these use cases are based on actual customer experiences, with companies seeing impressive results such as a:

- 67% reduction in unused parts ordered for field service maintenance
- 65% improvement in accounts receivable collections
- 5% reduction in major asset downtime

Exploring Use Cases for Industrial Manufacturing

The following use cases—all based on real Maana customer experiences—illustrate some of the ways that industrial manufacturing companies are using our knowledge platform to optimize operations and business processes.

Field Service Management

Field Service Profitability

A Fortune 50 company that manufactures and maintains industrial equipment wanted to increase the effectiveness and profitability of its field service organization. Management sought to understand exactly what factors were impacting field service

Enterprises Using Maana Can:

- **Gain a holistic view** of assets and business processes from data across multiple silos
- **Operationalize insights** as recommendations into line-of-business applications for thousands of employees to make better and faster decisions
- **Optimize key enterprise assets and business processes** with insights from data in multiple silos—simultaneously

profitability and effectiveness and what changes they could make to reduce cost by $6-10 million per year. However, the data they needed to gain insights, plan jobs more effectively and assign resources optimally was housed in 10 disparate silos and applications. This made it nearly impossible to access and analyze all of this data together and gain necessary insights.

Analyzing Data Simultaneously Across Data Silos

To meet these needs, the company used Maana's Knowledge Platform, which enabled the field service team to analyze data from across silos simultaneously and generate insights needed to uncover opportunities to increase efficiency, optimize billable hours and reduce overall costs.

As illustrated in Figure 2, Maana's Knowledge Platform crawled 10 different data sources such as:

- SSAP ERP for revenue and invoicing data
- ServiceMax field service software
- Travel Hub for data on dates and costs of technician travel to customer sites
- Applied time reports for time per field engineer
- HR data, such as each technician's location, tenure and years of experience
- Training completed by field engineers
- Net Promoter Scores for measuring customer satisfaction
- Operations activity reports
- Customer data in Salesforce.com
- Weather data

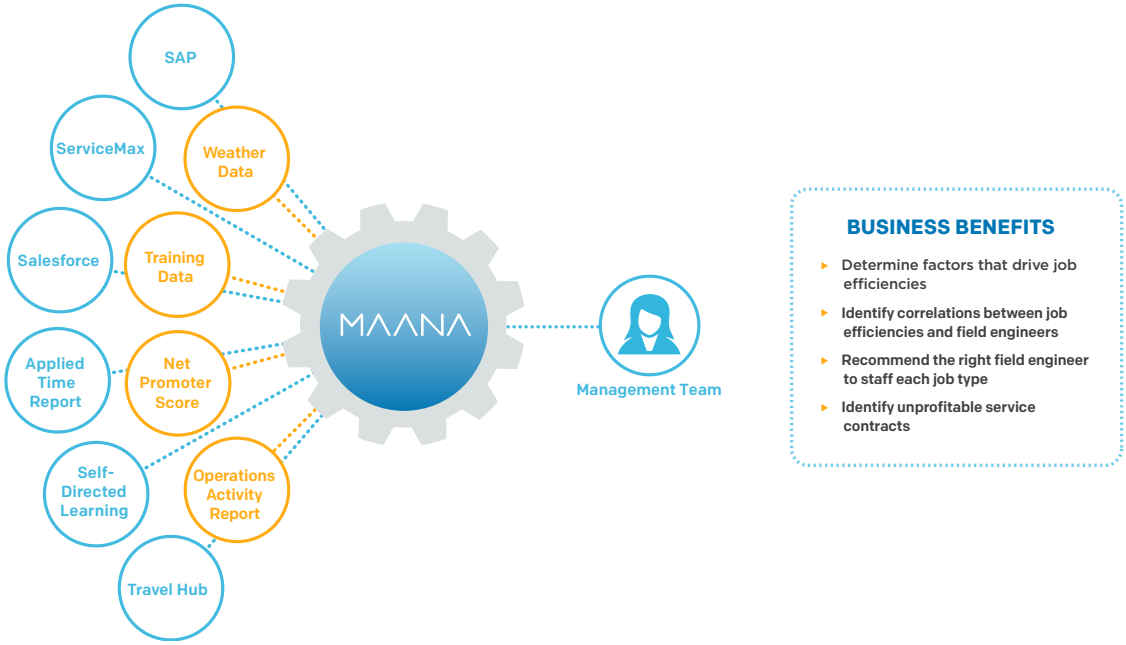


Figure 2: The Maana Knowledge Platform helped a Fortune 50 company understand what drives field service profitability, enabling management to systematically improve field service profitability.

Identifying Root Causes of Inefficiencies

Maana's Knowledge Platform analyzed multiple data sources simultaneously to identify hidden correlations and generate unexpected insights into the root causes of inefficiencies. The first phase of analysis focused on the relationships between data on field service engineers, the geographic location of customers (and their major equipment) and the efficiency of engineers when working on different product lines. Maana's analysis provided the company with a clear understanding of:

- The location of field service engineers employed by the company
- The skill sets, years of tenure and hours of training for each field engineer (by region and city)
- Correlations between field service efficiency and productivity by region relative to the amount of annual training and years of tenure each engineer has with the company

Using the Maana Knowledge Platform, the company analyzed all of this information simultaneously, generating new insights into job inefficiencies. For example, the platform identified many hours of unbillable travel time; this was due to the fact that the company lacked sufficient service engineers in some regions and paid for staff to travel to these locations to complete jobs. Based on these insights, management learned that by hiring new staff in underserved areas, they could eliminate most of these costs and service customers faster and more effectively.

In addition, Maana's Knowledge Platform was used to identify geographic areas where the company had invested heavily in the training of new technicians, but this investment had not translated into higher customer satisfaction. The analysis revealed that technician experience, not just training, was critical to engineer efficiency and effectiveness, and that the problematic regions had the lowest-tenured field engineers. By ensuring that the local staffing mix for all geographies included sufficient numbers of experienced field engineers, the company could substantially increase job efficiency and customer satisfaction.

The Maana Knowledge Platform is now being used to create a data-driven process for assigning technicians to each job. Maana analyzes what skills and experience levels have historically correlated with the fast, efficient completion of different types of jobs on each kind of product. The new matching process ensures the right field engineer is assigned to the right job, increasing efficiency, profitability and customer satisfaction.

Understanding Barriers to Profitability

Using Maana's Knowledge Platform, they also identified barriers to field engineer productivity and profitability by correlating service profitability with the type of service call and product type. This analysis revealed valuable knowledge, such as which product lines generated the most service problems and repeated service calls and why. For example, the company learned that:

Using insights from the Maana Platform, the company can:

- Determine factors that drive job efficiencies
- Identify correlations between job efficiencies and field engineers
- Recommend the right field engineer to staff each job type
- Operationalize Maana recommendations directly in their field service software
- Identify recurrent repairs made to the same equipment

- After a major software upgrade to a specific turbine model, the company experienced a spike in the number of alarms (due to downtime) and customer calls to the call center.
- Certain product lines were generating the majority of service tickets or repeated service calls.
- Profitability varied by type of field service agreements (for example, fixed rate service vs. hourly billed services).

The next phase of this project will translate key findings into targeted operational recommendations, which when implemented, are expected to increase field service profitability by $6-10 million per year.

Part Order Optimization

A multibillion dollar division of a Fortune 100 company that manufactures and operates medical and diagnostic equipment wanted to improve field service efficiency by optimizing parts ordered by field engineers. The company knew that 55% of parts being ordered were unnecessary—an inefficiency that was tying up nearly $30 million in cash per year. By identifying and addressing the root cause using Maana's Knowledge Platform, they could understand why this was happening, address the root cause and boost profitability and customer satisfaction.

Maana's Knowledge Platform was used to pull in data from XELUS (the company's service inventory management and demand planning software) and SAP ERP and analyze it to understand why so many unused parts were ordered. The analysis identified a subset of field engineers—just 5%—located in Asia PAC that had a 95% return rate on parts ordered for maintenance and repairs.

They then used Maana's Knowledge Platform to optimize the parts ordering process. Maana crawled multiple data silos, analyzing past service issues to identify the parts historically used to address them. These insights were used to make recommendations to field engineers regarding new service visits. Now field technicians can verify the correct parts to order for each job (including recommended, related parts), minimizing parts returns and enabling technicians to have what they need to resolve customer issues on the first visit.

As shown in Figure 3, these insights and recommendations have helped to reduce orders for parts that go unused from 33% to 11%. The company has also realized savings through reductions in customer service trips, part returns and inventory and shipping costs.

Maana enabled a multibillion dollar division of a Fortune 100 company to reduce unused parts ordered from 33% to 11%.

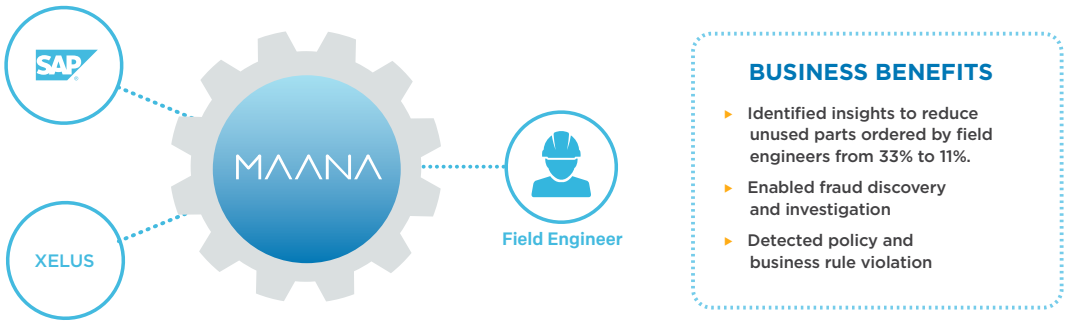


Figure 3: The Maana Knowledge Platform helped a Fortune 100 company reduce unused parts ordered from 33% to 11%.

Turbine Service Call Optimization

A Fortune 50 company sought to better understand the underlying reasons for customer service calls. To accomplish this, the company needed more insights from data stored across multiple, disparate data sources.

As summarized in Figure 4, Maana's Knowledge Platform was deployed to identify the issues that prompted customer service requests. The Maana Knowledge Platform crawled and indexed multiple data sources, such as global installed base data, turbine trip data, controller alarm data, parametric time series data and field service data from their ServiceNow system. The project involved over 600 million alarm values and approximately 1,200 trip events.

Natural language processing (NLP) was used to identify the reasons why people called customer support. Machine learning capabilities enabled subject-matter experts to gain a better understanding into the causes of turbine alarms. Specifically,

Maana's Knowledge Platform found and identified correlations between historical patterns in customer support calls and trip events. The correlations showed obvious but previously unverified relationships between trips and support calls for various generator models. Using these insights, the company can better understand the underlying triggers for customer service calls and determine which product lines and regions were incurring the most issues.

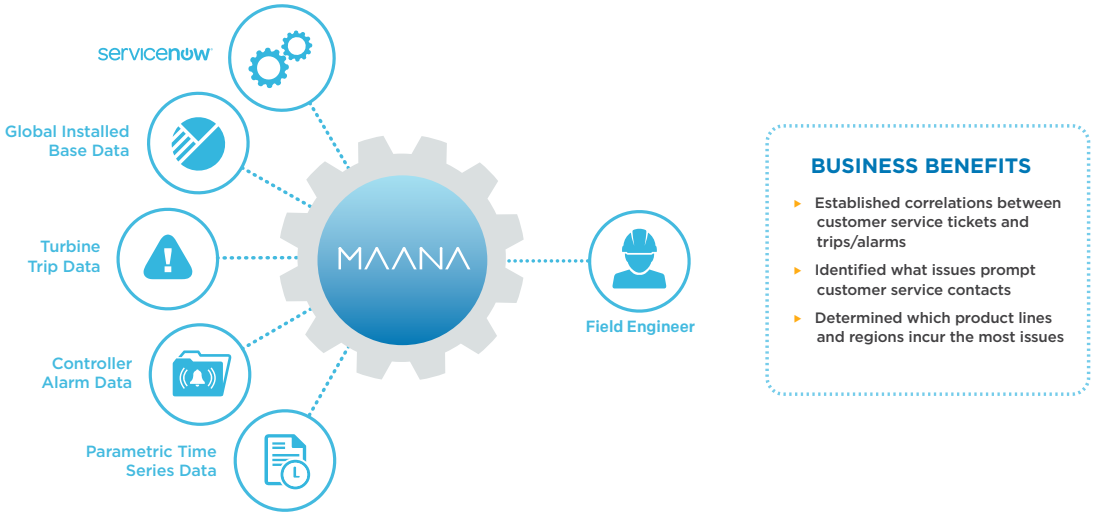


Figure 4: : The Maana Knowledge Platform crawled diverse data sets to identify triggers for customer service calls.

Equipment Failure Prediction

Turbine Shutdown Prediction

A major division of a Fortune 100 company operating hundreds of turbines around the world began experiencing an average of two unplanned shutdowns per day. They wanted to reduce unexpected interruptions and mitigate production loss by anticipating and avoiding potential shutdowns.

Using the Maana Knowledge Platform, the company navigated volumes of controller alarm data being created by 350 generators. As shown in Figure 5, this data was then combined with turbine specification data and turbine trip data to build a model that predicts imminent trips and alerts staff using alarms. The model draws correlations between historical patterns in support calls and trip events. Now the company can detect unwanted events that could lead to a potential turbine shutdown within 24 hours, gain insights into trip events and ultimately reduce the frequency of unexpected shutdowns.

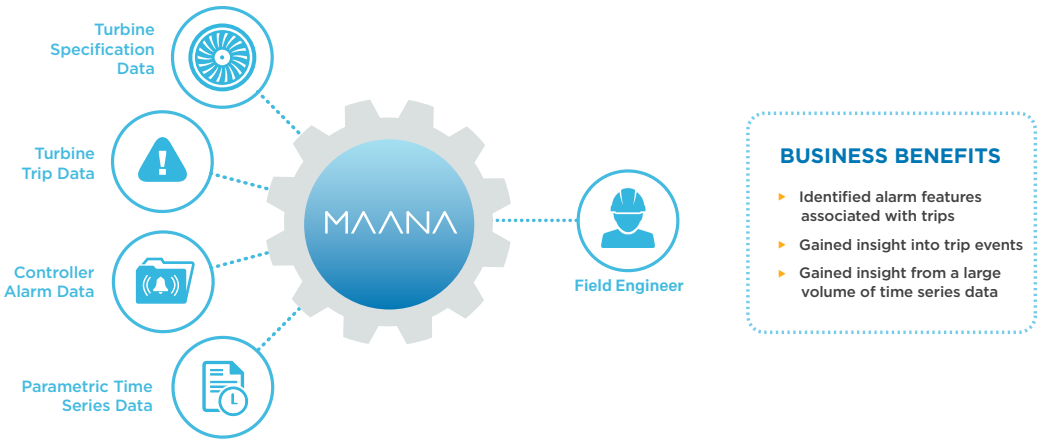


Figure 5: The Maana Knowledge Platform crawled diverse data sets to predict turbine shutdowns.

Logistics Optimization and Contingency Management

Logistics & Contingency Optimization

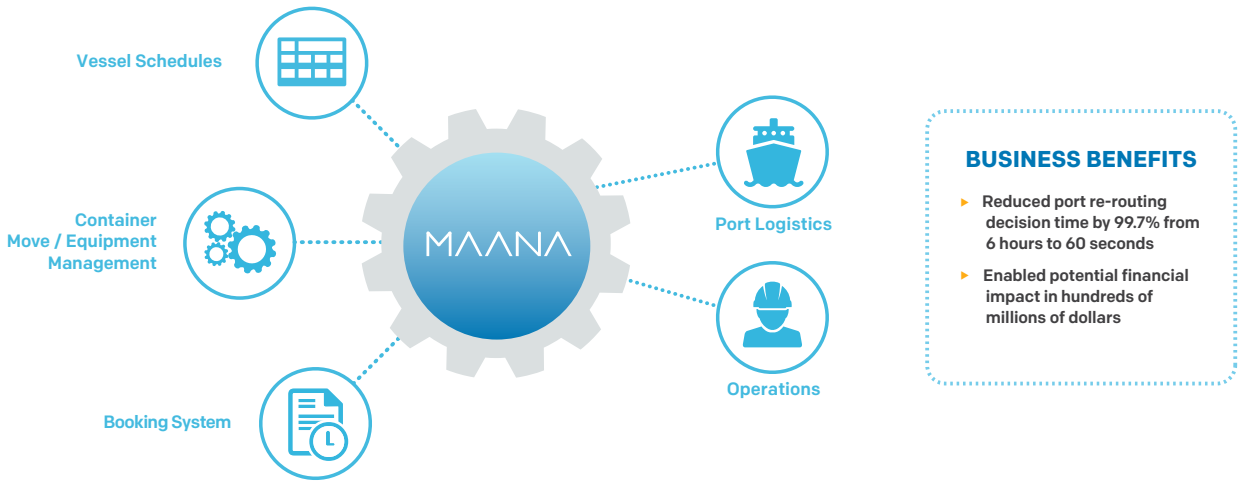
For a leading shipping company, each port omission decision can cost the company several hundreds of thousands of dollars. Given that the company has to make thousands of port omission decisions every year, the costs add up quickly. Using the company's prior systems and processes, it was taking people about six hours to make one port omission decision, as they had to manually take into consideration a wide range of variables such as the customer involved, cargo stowage, schedules, bunker, inland operations, and port and vessel information. Management wanted to reduce the time it took the operations and port logistics experts to make these decisions – and do so without compromising outcomes.

Using Maana's Knowledge Platform to Reduce Decision Time by 99.7%

Using Maana's Knowledge Platform to facilitate collaboration amongst the operations and port logistics experts, this major transportation company mapped the key decision points of port omission, using cost as the driver for decision heuristics. The Maana Knowledge Platform was used to create a simulation model of the port omission and re-routing decision process using data from key systems such as data on vessel schedules, container moves, equipment management, and bookings. This simulation model scores all possible re-routing options based on time and cost and generates recommendations based on the most optimized shipping re-route.

To enable this simulation model, the Maana Knowledge Platform:

- Crawled, extracted, parsed, and indexed core entities and data elements from key data systems (such as cargo, ship, vessel, port, and priority) for the port re-routing decision process
- Created a simulation model using variables with different weights, such as perishability of the cargo or cargo classification (for example, military or a premium customer)
- Illustrated the time and cost impact of each re-routing decision using the simulation model
- Listed all recommended contingency re-routing options within the simulation model
- Ranked contingency options by their business impact score
- Calculated the time and cost impact of each re-routing decision



In this way, the Maana Knowledge Platform provides a knowledge model that offers a unified view of multiple data sets and enables faster decision making. As more data inputs are added to the model, the Maana Knowledge Graph grows, learns and adapts, enabling it to support new simulations for cargo to be discharged – for example, so decision makers can determine the costs of different decisions given various constraints (such as commercial, regulatory, cargo, and other constraints). As a result, the company can trust that the Maana Knowledge Graph will always recommend the best alternatives – which has been defined as what will have the least impact on overall cost and transit time.

Most importantly, the company was able to realize its goal of reducing port re-routing decision time from 6 hours to 60 seconds – a 99.7% time savings– while optimizing decisions and outcomes. The potential financial impact of this time savings is expected to be in the hundreds of millions of dollars.

Finance

Accounts Receivable Collections

A division of an industrial Fortune 50 company wanted to improve its working capital and reduce outstanding invoices, which totaled over $800 million. The company's finance team used the Maana Knowledge Platform to analyze over five years of invoices to uncover hidden patterns and correlations, as well as identify specific recommendations that would reduce days sales outstanding.

As shown in the figure below, the Maana Knowledge Platform crawled and mined data related to over one million invoices across a wide range of business silos, including historical data (such as open, closed and disputed invoices; collector logs and customer loyalty information) and external data (such as customer credit ratings, the price of oil and interest rates). Maana also used the time value of money as part of its analysis.

After creating and evaluating several data models using the Maana Knowledge Platform, the company was able to accurately predict the likelihood of late payments before invoices were actually due, as well as identify the root causes of late payments, which included:

- **Weekend due dates:** The analysis showed that any invoices with due dates of Saturday and Sunday were always late.
- **Lack of familiarity with invoices for first-time customers:** The majority of first-time invoices were usually late by 90 days because the customer did not understand their invoice.
- **Customer satisfaction:** Many late invoices were attributed to service issues that had not been addressed and required customer service follow-up, not a collection call.

Using the insights gained through the Maana Knowledge Platform regarding the root causes of late payments, the company created a customized call list for each collection agent; this call list was incorporated into the organization's AvantGard GETPAID collection system.

As the Maana Knowledge Graph learns and adapts over time, it provides ongoing, data-driven recommendations regarding which customers should be called and when. For example, at one point, it recommended that accounts payable call all new customers ten days prior to their invoice due dates to ensure they understand their invoice and get questions answered.

After just 30 days of operationalizing recommendations like this one into GETPAID, the Maana Knowledge Graph and machine learning algorithm continues to learn, adjust and fine-tune insights and recommendations based on daily data input on open and closed invoices, collector actions and stock market changes. For example, the platform recently identified four groups of customers as consistently late payers, as well as specific strategies that the company can take to mitigate future late payments:

A division of a Fortune 50 company used Maana to accelerate A/R collections by 65% over the prior year. By expanding use of Maana to all A/R agents in that division, A/R collections will accelerate by $600,000 per day.

- **First-time customers:** The Maana Knowledge Platform recommended that finance make a courtesy call to these customers to ensure they understand their invoice and can ask questions at least 10 days prior to invoice due dates.
- **Customers with unresolved service issues:** The Maana Knowledge Platform recommended that the finance department call customer service to ensure open cases are resolved, as most customers with unresolved issues will not pay.
- **Institutional Customers:** These customers had contracts with longer net payment terms, so accelerating collections would require re-negotiating the contract terms.
- **Other:** Accounts receivable clerks should call all other customers with late payments for other reasons.

By operationalizing all of these recommendations, the company improved A/R collections by 65% over the prior year, which increased working capital by $520M per year.

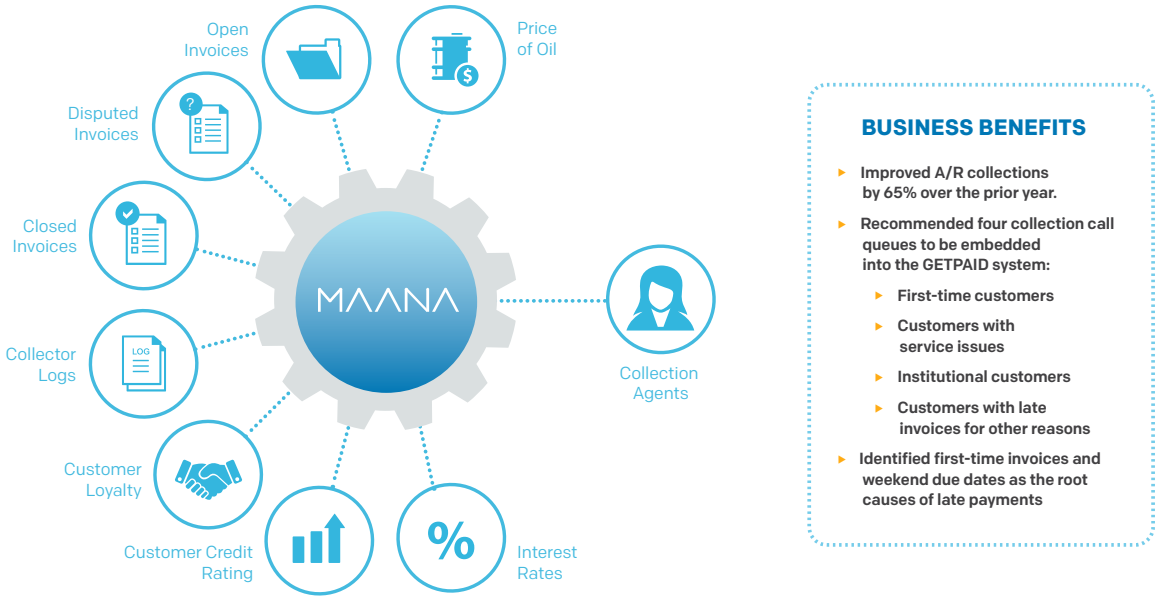


Figure 6: The Maana Knowledge Platform accelerated accounts receivable collections by 65%.

Risk and Compliance

Cyber Security Phishing Detection

Cyber security breaches are a major threat to oil and gas companies, as they can lead to theft of intellectual property and consumer data, as well as orchestrated equipment and infrastructure failures. While network intrusion detection solutions have been on the market for quite some time, most have focused on a specific problem and are unable to work across heterogeneous data sources or large data volumes. In addition, while they may be able to detect known threats, they are generally unable to detect new and emerging threats.

To overcome these issues, companies are using the Maana Knowledge Platform to enhance their cyber security detection capabilities. For example, a Fortune 100 wanted to give their cyber security analysts the ability to test their hypotheses about "exploratory" phishing attempts. They suspected, for instance, that phishing attempts were typically sent from throw-away email addresses, targeted at small groups of employees and involved the use of different subject lines for each email to avoid spam detection. If they could confirm these types of hypotheses using Digital Knowledge Technology, cyber security analysts could configure infrastructure to detect patterns, filter email traffic and quickly funnel suspicious emails to investigative resources.

A proxy device was already logging basic metadata on every mail message passing through the corporate network. But this data was essentially unstructured, and with up to 40 events logged per email message and stored without order, it was impossible to analyze this data in its raw form. Using the Maana Knowledge Platform's natural language processing capabilities, the company successfully identified hidden structural elements in this data; these elements included the unique ID number assigned to each mail message and aggregate unique log events for each email (such as date, time, domain address, sender and subject line).

Using this aggregated log data, subject-matter experts can now assemble the concept of a unique mail message and represent the data in a form that can be analyzed. Business analysts then use the platform to research, analyze, investigate and prove their hypotheses and ultimately define the conditions under which email should be considered a phishing attempt.

Going forward, cyber security analysts can quickly identify phishing attempts and dramatically accelerate the time it takes to investigate and contain potential threats. The company plans to integrate the platform with the company's IT infrastructure so that new threat detection rules can be rolled out quickly across the enterprise.

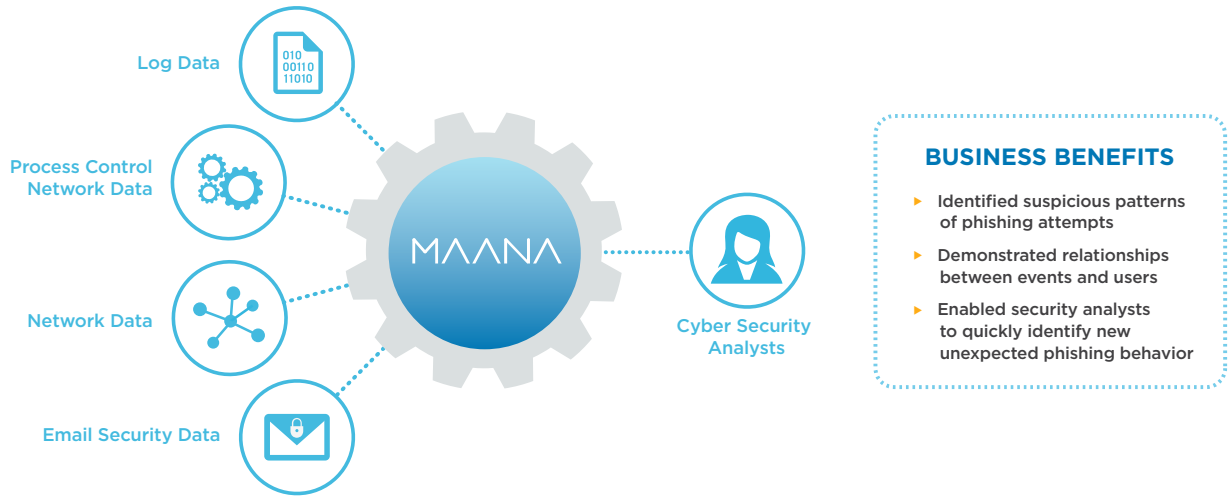


Figure 7: The Maana Knowledge Platform enabled cyber security analysts to quickly identify phishing attempts and investigate potential threats faster.

Learn More

To learn more about Maana, please visit:
http://www.maana.io/industrial/ or email
us at **sales@maana.io** to request a live demo.

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