Why the Most Innovative Fortune 500 companies are Using Maana’s Knowledge Platform to Accelerate Digital Transformation

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The Unfulfilled Promise of Data Lakes

Big data analytics has been the rage for the past 5 years. Fortune 500 companies augmented their data warehouses by spending tens of millions of dollars to create data lakes and fund lengthy big data projects. Most of these data lake driven analytics initiatives occurred within departmental silos. And because they delivered limited business value, they have not significantly impacted overall enterprise profitability. Companies learned the hard way that simply gathering data from across the enterprise and consolidating it in data lakes – in hopes that data scientists can mine it for insights and stumble upon the right answers – fails to deliver expected ROI.

What’s clear is that the approach of gathering data from across the enterprise, consolidating it all in one place, and having data scientists mine it for insights – hoping they stumble upon the right answers – isn’t working. Many of the world’s industry-leading companies aren’t seeing a significant, positive impact on enterprise-wide profitability. They still struggle to derive knowledge from their data to understand the root causes of problems, optimize operations to improve profitability, and identify and mitigate risks.

That’s why today’s most innovative companies are transitioning away from data lakes and data-centric technologies – and choosing instead to drive optimization across the entire enterprise by embracing Enterprise Knowledge Technology. This new breed of technology is uniquely able to capture and model the complex relationships between how business processes, assets and organizations operate and interconnect.

Enterprise Knowledge Technology is Being Adopted by the Most Innovative Fortune 500 Companies

Consider GE, Maersk and Shell – all well-known in their industries as leaders in revenue and profitability. These industrial giants have always been at the forefront of innovation and set the trends for their respective industries. And they are driving digital transformation throughout their enterprise with a relentless commitment to optimizing every asset and process throughout every aspect of operations.

To realize their goals, these companies are using Maana’s Knowledge Platform™ – the first enterprise knowledge technology in the industry, which takes a fundamentally different approach than big data analytics solutions. Using Maana’s Knowledge Platform™, these Fortune 500 companies are optimizing assets and processes three to ten times faster than with any other technology, dramatically increasing profitability. They are using this platform to solve their toughest optimization challenges and answering questions they couldn’t begin to answer before.

“With Maana we are able to solve some of Shell’s toughest asset optimization challenges three times faster than we have in the past.”

—Johan Krebbers, IT CTO at Shell
And they are not alone. Companies across all industries are embracing Maana’s platform and seeing impressive results. As shown in Figure 1, customers have reported results such as:

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

Figure 1: Maana delivers significant, quantifiable business results that ultimately increase profitability.

What Is Enterprise Knowledge Technology?

Enterprise knowledge technology enables business experts in an organization to easily find the most relevant data from across silos and information inputs and understand their relationships in the context of optimizing an asset or business process. This knowledge-centric technology enables companies to better understand the interdependencies of assets and processes across the entire enterprise so they can accelerate optimizing assets and processes, resulting in increased profitability.

Engaging Subject Matter Experts in the Knowledge Creation Process

Enterprise knowledge technology eliminates the barriers between technical experts (such as data scientists), subject-matter experts (SMEs), and business analysts across the enterprise.

For example, it enables the early inclusion of subject matter experts (SMEs), such as the insurance underwriter or the drilling engineer, in the problem solving process. This departure from traditional big data analytics makes perfect sense because these employees have a deep, contextual understanding of the process or asset that needs to be optimized. Consider, for instance, that only an asset

“With Maana’s Knowledge Platform, we are continuously creating and enhancing a layer of enterprise knowledge on top of our information technology and operations technology data silos.”

“Through this knowledge, Maana’s platform will accelerate our time to value significantly by giving us the ability to develop hundreds of models, driving asset, operations & business optimization.”

—Ibrahim Gokcen
Head of Data Science & Analytics at Maersk
maintenance expert – someone responsible for turbine maintenance – understands the physics of how a turbine operates, the physical properties of the materials these assets are made of, and the current processes and resources used to maintain them. This knowledge is incredibly valuable in helping companies ask the right, narrowly focused business questions; gather knowledge inputs from a wide range of sources; and turn these knowledge inputs into reliable answers.

The right technology platform – one that accelerates the collection of knowledge inputs and supports deep collaboration between domain experts and data scientists and other technical experts – helps everyone involved work through these steps.

Maana Has Developed the First Enterprise Knowledge Platform

Maana pioneered knowledge technology for the enterprise and created the first Enterprise Knowledge Platform®, which dramatically accelerates knowledge discovery to increase profitability. Fortune 500 companies are using Maana's Knowledge Platform to optimize their assets and processes three to ten times faster than any technology used in the past.

Let’s explore how Maana’s platform makes this possible.

Driving Enterprise-wide Optimization of Assets and Processes

Maana’s Knowledge Platform sits between enterprise data silos and line-of-business applications. As shown in Figure 2, the platform extracts data and information from a myriad of siloed data sources and knowledge inputs, eliminating the need for data lakes.

*Figure 2: Maana created the first and most comprehensive knowledge platform.*
Knowledge, in the context of Maana’s platform, is represented in the form of models. Models, in turn, are created to capture all relevant mathematical relations. These relations are extremely important because by understanding them, people can answer precise questions and extract the most relevant information from silos.

All created models are actively indexed and stored in a Knowledge Graph™. A Knowledge Graph™ is Maana’s patented technology that enables enterprises to understand the relationships and interdependencies of business processes and assets across all organizations.

The First Step: Defining the Right Business Questions

Maana’s enterprise knowledge discovery process helps SMEs and analysts define the right questions to ask – precise, pressing questions in common business language such as, “Given an invoice and historical payment information, when is a customer likely to pay?” or “Given an engine, its operational and maintenance history, and the planned job schedule, what are the most likely failures?” Most importantly, these questions interrogate a relationship between common business concepts – for example, invoices, engines, maintenance histories, and so on. The answers to these questions drive decisions that accelerate profitability.

These problem-questions are represented in Maana’s platform in the form of knowledge models, which will be discussed in more detail. These models allow business leaders, subject matter experts, data scientists and business analysts to understand a business problem in the proper business context and in terms everyone understands.

Representing Knowledge Using Models Everyone Understands

Maana’s Knowledge Platform represents knowledge using models. Once a precise question has been defined, users can leverage Maana’s rich, graphical UI to model relevant business concepts and represent their interrelations as a knowledge model. Knowledge models are declarative in nature, in that they do not explain how to answer the question, but rather reveal the relationships and interdependencies of data and processes in the context of what needs to be optimized. This understanding focuses everyone’s attention on what needs to be answered next, and it helps them define questions even further – without getting too deep on the algorithms and data.

For example, as shown in Figure 3, the knowledge model for the question, “For any service within a vendor category, what is the average cost per day?” would look like this:
By itself, this is not enough information to make progress on answering the question defined above. But for subject matter experts in this area, it leads them to ask more questions such as, “Which categories are relevant?” and “What factors influence average cost per day?” These questions, in turn, can be modeled into various types of models, based on the type of business question being asked. Examples of commonly used models include:

- Domain models
- Physical models
- Data models
- Simulation models
- Predictive models
- Prescriptive models
- Computational models

Using Easy-to-Use Artificial Intelligence to Do the Heavy Lifting

To help users create, maintain and enrich these models, Maana has created Knowledge Assistants. Knowledge Assistants use artificial intelligence, machine learning, and many other techniques to augment people as they extract, explore, discover, and model new forms of knowledge describing some aspect of the business domain. We refer to this as our user-guided, machine-assisted approach, which optimizes the interactions between people and machines to maximize overall productivity and effectiveness.

Knowledge Assistants save both domain experts and technical experts a great deal of time by doing the heavy lifting for them, accelerating the creation of models. For example:

- **JoinAssist™**
  Guides users in finding non-obvious relations, even when the user does not fully understand their data relationships. Often, users have a good understanding of the available data, but the effort to manually connect it all to create large data models is difficult and time consuming. Maana’s user-guided, machine-assisted mechanism provides a visual interface to automatically build the relevant joins – and with little manual intervention.
**Similarity Assist™**
Empowers users to identify instances, cases, events or records similar to the one they would like to investigate. For example, when looking for unprofitable insurance contracts, companies aren’t limited to searching for fixed attributes like high claims. With Similarity Assist, they can pinpoint contracts that are most similar to a sample unprofitable contract. The tool’s guiding algorithms search across several dimensions (such as performance, economic, and competitive) to identify similarities given the context of what the user is trying to solve.

**DocAssist™**
Enables extraction of targeted knowledge – in the relevant context – from unstructured documents. For example, a large amount of data is usually stored in tables or hidden in unstructured documents like PDFs or Word files. Maana’s Knowledge Platform uses machine learning to extract structure from these documents, as well as domain-specific terminology that can be labeled for further training of the machine learning model.

**SourceAssist™**
Data are often spread over multiple files, parts or sources, making it both difficult and time consuming to get to more engaging phases of solution development. With SourceAssist, now you can interactively discover and securely acquire relevant data for use within Maana. SourceAssist also helps with the challenge of constantly changing, growing data by letting you configure how Maana deals with repeated or periodic acquisition of the same content.

**SearchAssist™**
Building models at speed requires quick and easy access to available components. SearchAssist allows you to browse all data indexed in Maana and easily create or modify models by dragging and dropping results into a workspace. An intuitive search experience ensures that as you type, results continuously update to match what is being typed. Results are displayed in order based on a MaanaRank™, which ensures results with a higher ranking are displayed first.

**KnowledgeModelAssist™**
Visually build knowledge models – the fundamental building blocks for Knowledge Applications – from pertinent “problem” questions such as, “Given a vessel, omitted port, and date, what are the set of alternative port options ranked by score?” With KnowledgeModelAssist, you can search concepts, bring them into the workspace, define relationships between them and apply appropriate functions in order to digitize your subject-matter expertise.

**KnowledgeGraphAssist™**
As you build out your Knowledge Application, you can use KnowledgeGraphAssist visualize all knowledge graph elements in your workspace and explore all connected elements, including data sources. This not only helps you get an overview of how the different models are fitting together to form the desired solution, but it also provides the level of transparency required to explain how the models are working to answer specific questions.

**PresentationAssist™**
As you build knowledge models, you must be able to view the actual data represented by them. PresentationAssist gives you the ability to view information as tables. You can also change visualization types, edit the presented data, and provide inputs to get the answer (i.e., the output) to a specific question (e.g., which units had the most spare parts replacement last quarter).
Maana is continuously developing more Knowledge Assistants to provide users with a wealth of advanced algorithms that turn raw data into usable knowledge. While technical in nature, many Knowledge Assistants are useful to business oriented subject-matter experts as well (for example, those providing intuitive, self-service functionality).

**Connecting Models Using Maana’s Patented Knowledge Graph**

Once built, all models are connected to form an intelligent, relationship-driven, easily searchable and scalable semantic Knowledge Graph, which is at the core of the Maana platform. This patented technology enables knowledge representation and reasoning for asset and process optimization. This breakthrough invention extracts knowledge directly from data silos and information sources – eliminating the need for data lakes – and represents concepts, entities, properties, and relationships as models that SMEs and data scientists can reason over together.

Over time, a company’s Knowledge Graph can grow and adapt to include a vast network of models, which taken together, provide a holistic view of assets and business processes to be optimized. This network of models allows users to easily see all of the interdependencies between them, provide insights and thus enable them to optimize assets and processes across the entire enterprise.

The insights gained are then operationalized as recommendations into line-of-business applications, enabling thousands of employees to make better, day-to-day decisions that drive enterprise-wide profitability.

**Building on Past Knowledge for Faster Optimization of Assets and Processes**

The benefits of Maana’s Knowledge Graph don’t end once the initial Knowledge Graph is created within a business. The models contained in it can be reused as is or modified and re-applied to another problem – for example, to help an industrial company achieve field service optimization. If users have already figured out when industrial equipment is likely to fail and the likely potential root cause of the failure (as part of a predictive maintenance schedule initiative, for example), they can re-use that existing knowledge to determine which service engineers are available to maintain assets and which are best suited for each task, thus improving service response rate.

Similarly, other problems outside the organization (for example, parts inventory management) can be solved much faster because users can reuse models in the Knowledge Graph rather than start from scratch. Having already figured out how certain equipment is likely to fail and which engineers might be deployed to service them, they can now identify which replacement parts should be released and stocked to ensure timely maintenance. Figure 4 illustrates how the overall time to business value falls as enterprises keep adding to their library of reusable knowledge models.
Figure 4: With Maana, overall time to business value falls as enterprises keep adding to their library of reusable knowledge models.

Because Knowledge Graphs are uniquely able to help users build new knowledge on prior knowledge, the addition of new models across an organization results in a cumulative reduction in the time to value. Shell IT CTO, Johan Krebbers, summarized it best when he said, “With Maana we are able to solve some of Shell’s toughest asset optimization challenges 3 times faster than we have in the past.”

As the adoption of the Maana Knowledge Platform continues to grow within an organization, companies can solve optimization challenges 10 times faster than in the past.

Enabling Faster, More Effective Reasoning to Arrive at the Best Answers

Users can represent and consolidate knowledge in the Knowledge Platform. But without human reasoning as well, this knowledge is not very useful. Reasoning is the ability to generate conclusions – or answers – from available knowledge using inference. Straightforward types of reasoning would include tasks such as calculating a sales tax or customer discount. But with the help of Maana’s Knowledge Platform, they can make logical inferences needed to answer far more complex questions such as how to best identify fraudulent bitcoin transactions, or how to optimize global shipping ports to accelerate loading and unloading.

Let’s take a closer look at how Maana’s Knowledge Platform supports reasoning.

Facilitating a Search-and-Explore, Intuitive User Experience

If an oil company wants to know which pumps are failing, for instance, Maana users can simply type the question in the search bar, and the software’s natural language algorithms will respond by providing a list of relevant responses. Want to see only the electronic pumps? Users can guide the platform by selecting the right result. If they drill down further by asking about sensors, the platform
will know that they don’t want to know about all sensors – only those related to their last search regarding electronic pumps. The platform’s rich user experience ensures that subsequent questions (such as a drill-downs on sensors) are automatically considered in context, making interacting with the platform much like talking with a person and brainstorming about a problem.

This entire experience is powered by Maana’s patented semantic search, which enables users to find the most relevant data and knowledge inputs once they have been indexed into the Knowledge Graph. As mentioned earlier, the semantic search also suggests and auto-completes user queries using domain-specific knowledge retrieved from the Knowledge Graph. Once the user provides guidance on the relevancy of the suggestions, results are presented using rich, interactive visualizations for subsequent refinement and action.

Delivering Time-Saving Knowledge Applications

Another way Maana’s platform helps users draw inferences from existing knowledge faster is through the software’s built-in Knowledge Applications. Unlike Knowledge Assistants (discussed previously), Knowledge Applications are tailored for business users and provide prebuilt analytic functionality for predictive maintenance, supply chain optimization, accounts receivable optimization, and more. Users can also build new Knowledge Applications or extend existing ones to meet custom requirements specific to different needs.

Each Knowledge Application is essentially a solution template (for example, to implement predictive maintenance) that includes data models, computational models, and a dedicated user interface – all of which can be connected to the relevant knowledge inputs (for instance, invoices, sensor data, and maintenance logs).

Knowledge Applications can accelerate the implementation of a diverse range of sophisticated business solutions. For example, Maana recently worked with a global leader in the shipping industry that wanted to reduce the time it takes to make highly complex decisions about port omissions. One port omission decision costs them hundreds of thousands of dollars. They have to make thousands of such port omission decisions every year. The cost adds up very quickly because on average, it takes them six hours to make each port omission decision. In this case, the business question that needed to be answered was, “Given a port omission event, what are the contingency plans, and how can we get to them in the shortest possible time?”

![Figure 5: Overview of the ports omission use case in the Shipping & Transportation industry.](image)
To answer such a complex question, diverse variables (such as the customer, cargo sewage, schedule, bunker, land-line shipping, port, and vessel information) must be considered (see Figure 5). Collaborating with the subject-matter experts at the shipping company and using the Maana Knowledge Platform, we created a simulation model of the port omission and re-routing decision process using data from key operational systems. This simulation model scores all possible re-routing options based on time and cost and provides a ranked list of recommendations for consideration by decision makers.

The team responsible for optimizing cargo delivery schedules used a Knowledge Application to create a unified view of multiple data sets. As shown in Figure 6, this view lists all available options, sorted by a suitability score so that people can make optimal decisions at a glance. In the end, the company reduced decision making time by 99%.

The simulation models can also be adjusted to accommodate various constraints such as commercial and regulatory requirements, cargo types, and so on. The Knowledge Platform will find the new, best alternatives among the possibilities that have the lowest impact on overall cost and transit time. These kinds of adjustments can be made using internal resources rather than experts from Maana, as the platform was designed to be open, rather than a “black box.”

**Operationalizing Knowledge**

Maana enables companies to translate extracted knowledge and answers and turn them into actionable recommendations. These recommendations can be implemented using existing, line-of-business applications used by thousands of employees, thus enabling them to make smarter, day-to-day decisions.
As an example, a major division of an industrial Fortune 50 company wanted to increase its working capital and reduce outstanding invoices totaling over $800 million. The finance team used the Maana Knowledge Platform to analyze over five years of invoices to uncover hidden patterns and correlations and identify specific recommendations that would reduce days’ sales outstanding.

The 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) 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 models, the platform was able to accurately predict the likelihood of late payments before the invoice due date, 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 the invoice.
- **Customer satisfaction:** Many late invoices were attributed to service issues that had not been addressed and required customer service follow-up as opposed to a collection call.

As shown in Figure 7, using insights from the platform on the root causes of late payments, the company created a customized call list for each collection agent, which was incorporated into the organization’s AvantGard GETPAID collection system.
As the Maana Knowledge Graph learns and adapts, it provides ongoing, data-driven recommendations regarding which customers should be called and when. For example, it recommended that accounts payable call all new customers ten days prior to their invoice due dates to ensure they understand their invoice and can ask clarifying questions.

Most notably, the platform identified four groups of customers as consistently late payers, as well as specific strategies that the company can take to mitigate future late payments:

- **First-time customers**: 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 in advance.
- **Customers with unresolved service issues**: Maana Knowledge Platform recommended that finance contact 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 and accelerating collections would require re-negotiating the contract terms.
- **Other**: All other customers with late payments that accounts receivable clerks should call.

By operationalizing all of these recommendations, the company improved A/R collections by 65% over the prior year. Management estimates that by expanding the use of the Maana Knowledge Platform to all A/R agents in that division, cash collections will accelerate by $600,000 per day.

### An Open Platform for Extending Existing IT Investments

Maana’s platform integrates with existing technology investments in ecosystem tools and custom solutions. To facilitate this, Maana continues to invest in support for the Hadoop family of technologies, while also providing ODBC, OData, REST/JSON, and other standard integration protocols; this enables support for 3rd party ETL, data wrangling, visual analytics, dashboards, and more. IT organizations can use Maana’s integration capabilities and extensibility to expand, extend, and adapt to their current technologies.

Maana recognizes that knowledge exists in many forms. That’s why we provide a universal platform that supports any backend system, such as Google’s TensorFlow, gridMathematica, or even a proprietary system through a pluggable interface. This allows Maana to support the right tool for each job. Whether users have is a Python-based optimization package or a complex, deep learning network, Maana supports fluid integration and composition.

### Key Takeaways

The world’s most innovative Fortune 500 companies, such as GE, Maersk, Chevron and Shell, have already moved beyond data lakes to embrace enterprise knowledge technology innovated by Maana. Why? Because it’s the only solution on the market that helps them optimize every aspect of their business and operations, enterprise-wide, and drive digital transformation. And they can do it three to ten times faster than with any other solution.

Are you ready to accelerate optimization of assets and processes across your business – and dramatically increase profitability? Learn more at www.maana.io.