THE RIGHT INFORMATION AT THE RIGHT TIME

ENGINEERING INTELLIGENCE REVIEW

WINTER/SPRING 2019

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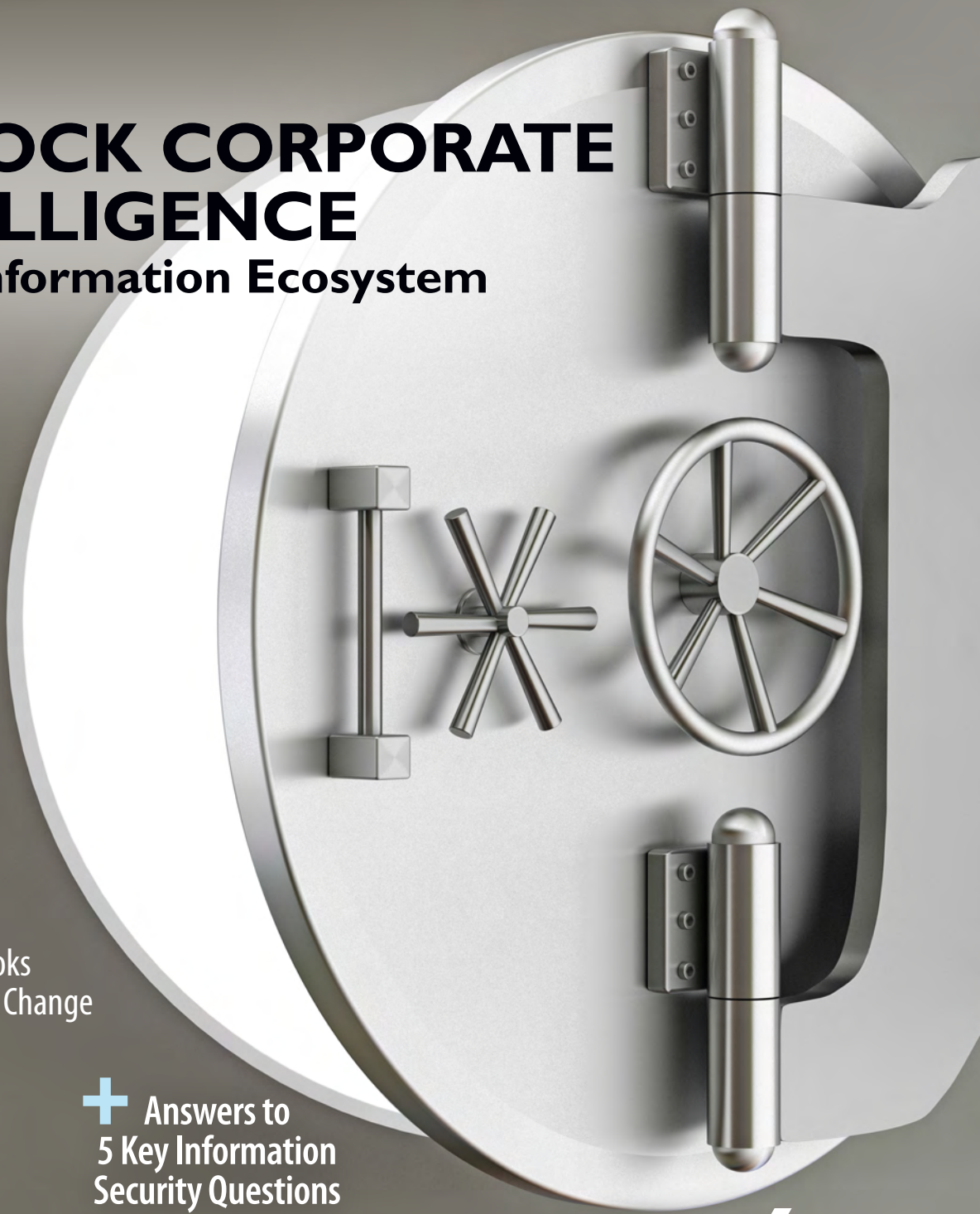

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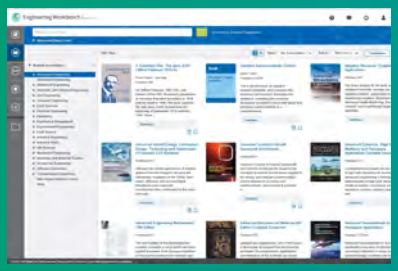

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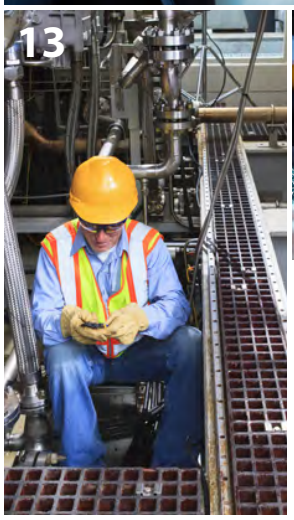

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EXECUTIVE MEMO

By John R. Yuva, Editor
jyuva@ACBusinessMedia.com

THE POWER OF INFORMATION

What is the value of information? That often depends on the context. Access to the right information at the optimal time can save hundreds of thousands of dollars for engineering teams during the product development phase. Conversely, an abundance of data can grind an engineer's project to a halt as can information stored away in disparate systems without a key to unlock it.

UNDERSTANDING INFORMATION IS ONE HALF OF THE DATA EQUATION, THE OTHER HALF IS ACCESSING IT.

When one considers all the factors with the potential to disrupt product development and other engineering endeavors, it's surprising things come to fruition at all. However, despite insurmountable odds, engineers find the solutions to problems.

In the latest edition of *Engineering Intelligence Review*, information is a critical component within every article. In his piece "The Right Information at the Right Time," Chad Jackson, analyst, researcher and blogger, asks the question: What is the most crucial factor in successful designs?

Jackson writes, "Today's schedules are getting tighter. Requirements are getting more complex. Budgets are shrinking. To meet the demands of modern product development, engineering needs to truly understand exactly what is on, and off, the critical path to designing great products. This one [the question] deserves some mind share."

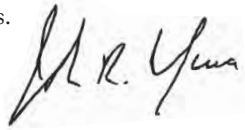
Learn why information is imperative to the design process, how it impacts productivity and ultimately what determines its value.

Understanding information is one half of the data equation, the other half is accessing it. Regardless of size, many companies have information residing in disparate systems. According to Gartner, it predicts that the volume of data generated will grow by 800 percent over the next four years, with 80 percent of that information categorized as unstructured data. This poses significant challenges to R&D teams who are under tight deadlines and cost pressure.

In their article, "Using Advanced Technologies to Enhance Knowledge Management," Adam Gromko and Geoff Sieron explain how advanced technologies such as artificial intelligence, machine learning, natural language processing and digital threading serve as critical tools for organizing and analyzing volumes of data for greater knowledge management efficiencies. These technologies close the gap between the engineer and the information most relevant for problem-solving.

As a leading source for engineering trends, strategies and insights, *Engineering Intelligence Review* seeks your feedback and encourages you to reach out with any questions.

Happy reading!



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By Chad Jackson

THE RIGHT INFORMATION AT THE RIGHT TIME

It's the most underestimated factor in successful designs

What is the most crucial factor in successful designs? I know. This is a pretty abstract question. For engineering, this is probably as existential as you can get. However, it is one worth asking. Today's schedules are getting tighter. Requirements are getting more complex. Budgets are shrinking. To meet the demands of modern product development, engineering needs to truly understand exactly what is on, and off, the critical path to designing great products. This one deserves some mind share.

One viable answer is process. Many companies deem their processes, identifying *who does what when*, as a core differentiator. And there is likely some truth in that statement. The execution of a process can materially affect the quality of design.

Another valid answer is people. Finding and training the right people for the right job is crucial. Without the correct skills, individuals will be woefully unequipped to design and engineer new products. Most executives recognize this reality and correspondingly invest in their people.

Yet another reasonable answer is information. Engineers need the right information at the right time to make good decisions. Without good accurate information, the wrong decisions result in poor designs that wreak havoc downstream.

One could argue that any one of these three factors are the most important to a successful design. Of these three, however, gaining access to the right information at the right time is likely the most *underestimated* factor. Let's take a closer look at that.

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THE NEED FOR THE RIGHT INFORMATION

Information is a key part of any decision an engineer makes. It all

ABOUT THE AUTHOR

CHAD JACKSON is an analyst, researcher and blogger providing insights on technologies used to enable engineers. He is a frequent publisher, speaker and researcher on critical topics that empower executives to reap more value from technology-led engineering initiatives in less time, with more surety, and less disruption. Learn more at www.lifecycleinsights.com.

starts with requirements. They come in a wide variety of forms. There are customer requirements that the overall product must satisfy. Those are frequently broken down into smaller requirements addressed by different aspects of the design. There are formal processes to govern when and how such requirements are created and changed.

While new requirements play a key part in development, not all of them are newly created as part of the development process. There is a burgeoning number of regulatory requirements that vary from country to country. There are also industry standards that apply. All of this information might be locked away in requirements management, product lifecycle management (PLM), or application lifecycle management (ALM) systems.

But the existing requirements are just as likely to be documented in PDF files, desktop spreadsheets, online databases and an array of other locations.

A different category of information necessary for good design includes a range of information on past designs. Engineers will often revisit past designs in order to develop new ones. When applicable, they can search documents that have been formally and digitally archived in enterprise systems like product lifecycle management (PLM) systems and enterprise resource planning (ERP). Yet, more information in the company is relevant. That includes results from prototyping and testing that might be a PDF. It covers older engineering artifacts such as scanned drawings and specifications.

30%

of total R&D spend is wasted duplicating research and work previously performed

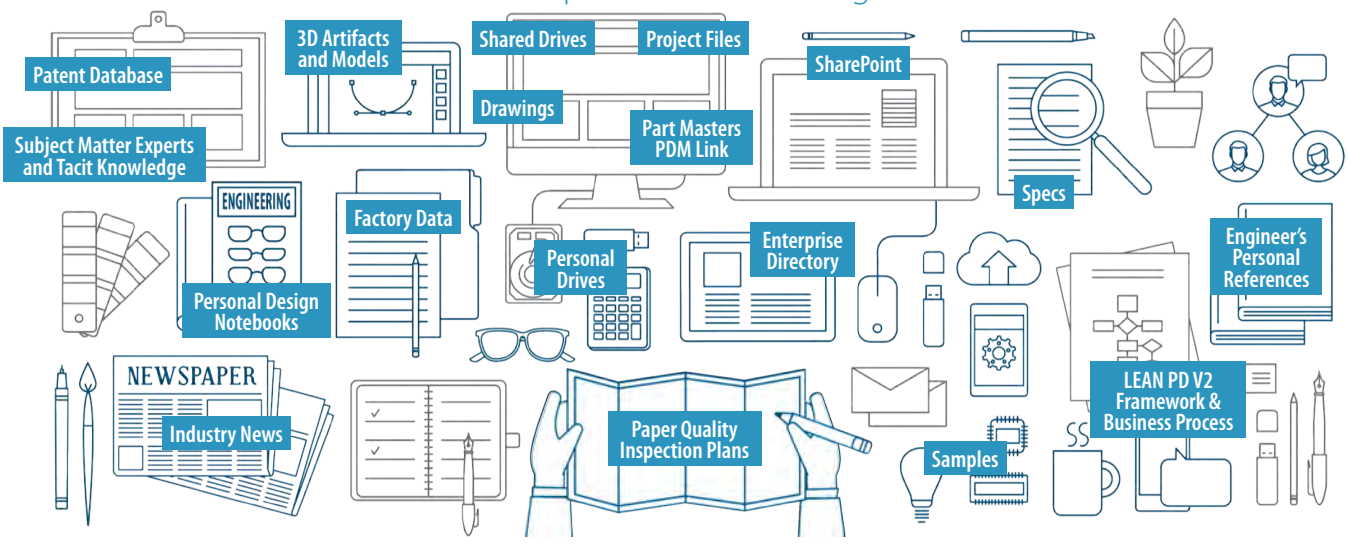
SOURCE: European Commission (DG Research) and the European Patent Office

Lastly, a critical source of information for good design is completely outside engineering. Modern design requires decisions that take broad considerations into account. Selecting a component might directly depend on if it is sourced by one supplier or more broadly available. It could depend on the current inventory level of a functional equivalent in the warehouse. The decision might be based on material composition. Yet more factors might include manufacturability, serviceability, quoting information and more.

Overall, engineers make some design decisions based on information that is not only accessible, but under their control. However, it is just as likely that key information exists in some form in another part of the company. In

The Engineer's Desk Today

a dispersion of knowledge



many circumstances, the engineer can't make a decision until they have that information. This reality has spawned a host of approaches to getting the right information to the engineer at the right time.

ACCESSING THE RIGHT INFORMATION

One low-tech way of getting the right information to the engineer at the right time is the use of a "gofer." This term refers to an entry-level role that essentially goes from place to place manually collecting things for someone. They "go for" this or "go for" that. This role originally involved tracking down information physically by talking to different stakeholders in different departments of a company. However, it has evolved into a modern-day version. That role now emails a variety of people in those different departments, collecting the information they need. If that information exists in an enterprise system, they are given credentials to login and retrieve it.

Beyond the manual effort involved, there are a number of flaws associated with this approach. The first problem is that some of the information is likely to change. The second problem is that there is no real-time notification of the change and update to the information. Together, those shortcomings make a deadly combination: decisions made from out-of-date information. Those using this approach try to minimize the amount of time that an engineer could have the wrong data in their hands. So they either increase the frequency at which the "gofer" role goes to get updates or they wait for the rate of change to that information to slow. None of this is an ideal approach.

Emerging technologies offer an alternative approach that addresses many of the shortcomings of the "gofer" approach. Companies such as IHS Markit offer solutions that 'connect' sources of information including enterprise systems like PLM, ERP, ALM and more. They index other sources of data like shared drives and desktops for documents, spreadsheets, and PDFs. Furthermore, they connect to online sources of knowledge that are outside of the organization's firewall such as industry standards, codes, component databases, patent databases, eBooks, periodicals and more. Powerful search functionality allows engineers to stay connected to the live data as it changes in real-time. Ultimately, engineers have access to information, even as it changes, so there is a dramatically reduced chance that decisions are made based on out-of-date data.

30-50%
of an engineer's time is spent searching for information

PRODUCTIVITY-BASED JUSTIFICATIONS

So what is the value of providing the right information to engineers at the right time? Traditionally, the focus has been on productivity. A variety of research studies have shown that modern engineers spend a significant amount of time searching for the right information. That represents a productivity loss where the engineer is not adding value to the development process. Many view it as a time sink.

All that is true. However, that argument fails to convince executives to take action or sign purchase requisitions. Engineers are salaried employees that will work for some minimum amount of time per week. If they save some time here or there, the operational costs of the organization do not go down. They stay flat. But furthermore, if projects are behind, engineers don't just stop working when they hit 40 hours for the week. They will often work nights and weekends to catch up. Justifications based on saving engineers' time has, and always will, fall short to executives. It is simply too soft.

Yes, new approaches to get the right information to engineers at the right time will increase the organization's productivity. However, that justification won't get approval from executives.

JUSTIFICATIONS WITH HARD BENEFITS

Instead, executives need hard benefits to approve changes. This typically will come in one of three forms: 1) the reduction of operational expenditures, 2) the reduction of capital expenditures or 3) increase in revenue. Each takes on a different form.

Operational expenditures, or OpEx, covers the ongoing expenses related to development and manufacturing products. Development OpEx includes funds for things like prototyping and testing. Interestingly enough, engineering executives are motivated to fully spend their development budgets. If they don't, higher level executives

One low-tech way of getting the right information to the engineer at the right time is the use of a "gofer." This term refers to an entry-level role that essentially goes from place to place manually collecting things for someone. They "go for" this or "go for" that.

There is motivation to spend all of their budgets, but not go beyond that. In the context of justification, engineering executives' ears perk up when they realize they can do more with the same budget.

think engineering can get by with smaller funding. So there is motivation to spend all of their budgets, but not go beyond that. In the context of justification, engineering executives' ears perk up when they realize they can do more with the same budget. This doesn't include frivolous extra rounds of prototyping and testing. But it might include more thorough correlation to simulation and analysis.

On the other hand, OpEx related to product costs is a real opportunity to improve profitability. With product prices or contract quotes often fixed well ahead of time, engineers control the ability to hit, or even undercut, cost targets for products. This is a dramatic win for the company as they can hold their original price and remove additional costs from the product.

Capital expenditures, or CapEx, covers the initial costs involved in ramping up the production of products, such as tooling. Reducing this cost directly affects the bottom line, improving the company's profitability. Engineering executives often have no stake in the game when it comes to CapEx costs. Acting as the source of cost reduction is a win. In fact, costs reduced here can instead be used to acquire new software solutions.

Revenue growth is one of the most appealing means to justify change, but also one of the most difficult to prove. Improving in this area directly affects the profit equation. But it also comes with additional benefits. Engineering can deliver revenue growth by delivering impactful, innovative and high differentiated features. However, validating such a causal relationship is difficult.

DECISION-BASED JUSTIFICATIONS

Productivity infrequently is the basis of a justification. Yet, cost control and revenue growth act as powerful ones. How can getting the right information to engineers at the right time affect costs or revenue?

Decisions.

Obviously, any engineer's responsibility is to save their employer money and increase their revenues. Their ability to do that, however, is directly related to the accuracy and freshness of the information at hand.

An engineer with real-time access to inventory and procurement categorization might find a functionally equivalent in-stock part for their design that saves the company a significant amount of money.

An engineer with an instant connection to a recently updated standard or federal regulation might catch a new documentation requirement that allows the company to avoid a fine during an audit.

An engineer with real-time access to a research company that publishes their findings online uncovers a newly released plastic, allowing them to avoid the use of a casted component that reduces cost-of-goods by half.

WHAT'S THE VALUE OF THE RIGHT INFORMATION TO YOU?

Getting the right information to engineers at the right time is a critical factor to successful designs. The question most organizations face is this: how do you enable that? Especially when there are so many relevant sources of information.

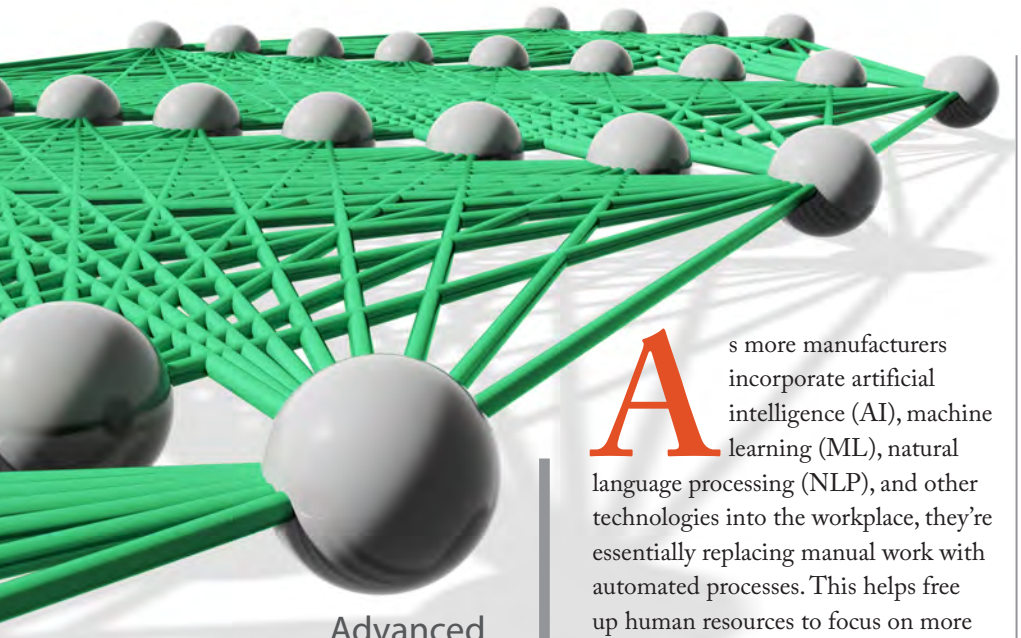
For years, many employed a "gofer" to manually collect information for engineers. However, that information was often outdated quickly. A new class of technology, included in IHS Markit's Engineering Workbench and Goldfire, offers a means to connect engineers to a wide variety of information sources in real-time, addressing the shortcomings of the "gofer" approach.

As many companies mull a change to this approach, the question becomes how to realize value from such solutions. Improving engineering productivity is appealing, but lacks the hard benefits most executives need. Decision-based justifications offer the means to reduce costs and improve revenues. This justification has many opportunities, but will often be company specific. EI

To learn more about new technologies that connect engineers to the right information at the right time, visit **ihsmarkit.com/ewb** (standards, eBooks and more) and **ihsmarkit.com/knowledge-discovery** (enterprise knowledge).

By Adam Gromko and Geoff Sieron

Use Advanced Technologies to ENHANCE KNOWLEDGE MANAGEMENT



Advanced technologies can help to free up human resources to focus on more important tasks while also enhancing operational efficiency, productivity, and significant cost savings across the organization.

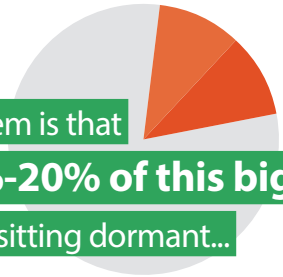
As more manufacturers incorporate artificial intelligence (AI), machine learning (ML), natural language processing (NLP), and other technologies into the workplace, they're essentially replacing manual work with automated processes. This helps free up human resources to focus on more important things while also enhancing operational efficiency and productivity across the organization.

For engineers, advanced technologies like AI, ML, NLP, and digital threading can help to vastly improve the knowledge management process, much of which is still handled either manually or by using disparate data systems that don't "link up" to one another. With organizations wasting up to 30 percent or more of their engineering and R&D resources duplicating work or repeating past mistakes, finding and accessing information stored in those repositories—often scattered across an organization—presents unique challenges.

In an increasingly complex manufacturing environment, where information from past projects is often buried in decades-old, non-integrated enterprise systems, engineers can spend 40 percent or more of their time searching for information. The scenario is only growing in complexity for firms: Gartner predicts that the volume of data being generated will grow by 800 percent over the next four years, with 80 percent of that information being categorized as unstructured data.

Gartner predicts that the volume of data being generated will grow by 800% over the next four years, with 80% of that information being categorized as unstructured data.

In this article, we explore the manufacturing environment and show how advanced technologies like AI, ML, and NLP are helping companies work smarter, better and faster without having to add human labor or make significant changes to their current R&D processes. We'll look at what's driving adoption of these technologies by engineers, scientists, and other knowledge workers, and provide a few starting points for companies that want to get started with AI, ML, NLP and digital threading.



The problem is that

we only use about 10%-20% of this big data,

and the rest is just sitting dormant...

WHAT ARE THESE ADVANCED TECHNOLOGIES?

As with any new innovation or concept, the definitions of AI, ML, NLP and digital threading change depending on whom you're talking to. Here's how we define them at IHS Markit:

Artificial Intelligence

One definition of intelligence is the ability to process information and then apply the knowledge and learn from that information. Going a step further, AI or computer intelligence is the ultimate ability of a computer to process information—be it data, visual information, auditory information, written information—and then use it to solve problems in the world today.

Machine Learning

Focused on how a computer takes information in and parses it to discover patterns of interest, ML is important because a computer is only as "intelligent" as the data set that it's given. Put simply, you have to train a computer to know what the Mona Lisa is if you're writing an algorithm that's meant to identify this famous subject in a child's drawing. You can collect a lot of drawings of the Mona Lisa created by children around the world and then expose those to a ML algorithm (which would then take those examples and learn to produce a program to best depict the Mona Lisa for the program).

Natural Language Processing

A particular type of artificial intelligence, NLP focuses on teaching a computer to understand the written word—or basically, training the computer how to read and understand what we write today. This is especially relevant for engineers who have to sift through large volumes of unstructured data to get the answers that they need. Whether it's research, design or manufacturing, every single aspect of product development today involves the written word. A technician working on a product on the floor needs to perform a certain operation in manufacturing, but does he or she have time to read a 100-page document to understand how to do that operation correctly? Probably not. That's where NLP comes in and makes the culling down of that information very streamlined, automated and easy.

Digital Threading

The digital threading concept utilizes all of these technologies to significantly raise the stakes on sifting through big data to connect critical information. Consider a physical asset: a person, a product, a part number. The goal of digital threading is to create a connected flow of information about the asset, and all data related to the asset throughout its life cycle. Taking the example of the asset being an automobile, the idea is to connect all design, manufacturing and performance data throughout the automobile's life cycle. Traditional enterprise software systems can identify explicitly linked information, such as a document number written and referenced in another document. But the real power comes in uncovering implicit links; creating navigable relationships that don't currently exist outside of an engineer's mind. A simple example of an implicit link would be connecting an expert in subject matter to a very specific written requirement. Establishing implicit links requires really powerful AI. Now, imagine the power of having this information in an enterprise 5,000 engineers strong. We are talking about delivering the right information at the right time in an astoundingly complicated environment.

THE DEVIL IS IN THE DATA

Ever since the invention of the computer in the 1930s, engineers and scientists have been using computers to solve problems like humans did in product development, product life cycle and manufacturing. As a whole, society has done an astounding job of using computers and applying computer calculations to solving problems in automation and digitization of product research, design and manufacturing.

Along the way, we've created a ton of big data—a proliferation that's only been multiplied in the cloud computing era. The problem is that we only use about 10 percent to 20 percent of this big data, and the rest is just sitting dormant in disparate, siloed repositories. The question is, how can we use advanced technologies like AI, ML and NLP to teach computers how to learn from this information and process it at a much faster rate than the human brain can?

Manufacturers are particularly well positioned to take advantage of these advanced technologies. Consider the product lifecycle for a mobile phone. From R&D to manufacturing to ongoing support for that product, the data that's being generated is literally stored all over the place. It's also in different formats, be it structured, unstructured, numerical, text and so forth.

For most product companies, tracking all of the data and then transforming it into useful intelligence is 100 percent human-reliant. Engineers struggle under the pressure of having to locate that information, process it, learn from it, and then apply it to ensure a good product outcome. The struggle is pretty much an accepted nature of the business, and it's why AI and other technologies are becoming more and more attractive for manufacturers right now.

But while the AI buzzword is everywhere, we're seeing a major disconnect between projected AI market size and the actual organizational implementations (less than 20 percent, by our accounts).

The fact is, people have a feeling that computer intelligence can be used to process data and learn from it, but we're still struggling with the basics of actually implementing AI, ML, NLP and other technologies in product development.

ASKING THE TOUGH QUESTIONS

Making technical products today requires millions of different parts, all of which are needed to build out the final products. That means engineers and scientists around the world are creating bills of materials and then reverting to those lists to locate single part numbers (e.g., in order to find the item's design specifications). As part of this process, the following questions probably come up:

- Is this part number included in other product designs and bill of materials?
- What's the performance data of this part?
- How do I know what suppliers I can order it from?
- What are those suppliers' written specifications?
- Is this product mentioned in the Lessons Learned reports?
- Have we ever had problems in product use with this specific part number?
- Are there any alternates to this part number?

It's not a matter of "if" you'll miss that information, but rather, just how much information will be missed.

Using digital threading, engineers can close those gaps...

If you're an engineer who is looking for answers to all of these questions, you're going to spend hundreds (if not thousands) of hours finding that data and answering those queries. You can research and read and make connections across the data you're gathering, but you'll also miss key pieces of information along the way. It's not a matter of "if" you'll miss that information, but rather, just how much information will be missed.

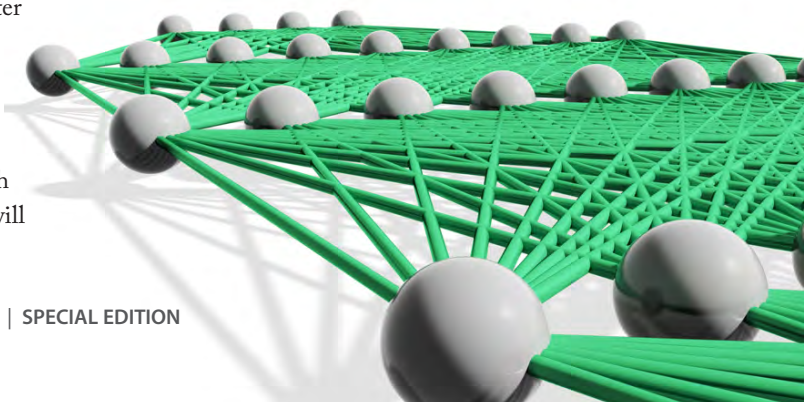
Using digital threading, engineers can close those gaps and then leverage AI, ML and NLP to read the documents for them and establish implicit links. With the concepts threaded together, the tribal knowledge collected, and the research process automated, engineers can move forward instantaneously with risk of error removed at all steps of the product development process. You simply can't ignore the power of AI in this scenario.

THE KEY: FOCUS

With AI, ML and NLP gaining ground in the manufacturing world, now is the time to start exploring just how these advanced technologies can help your organization make better use of its knowledge workers while also eking more value out of the data that it generates on a daily basis.

The key to success is to focus. If you try to start big, and if you try to implement AI across the organization without understanding your use cases, you'll only be setting yourself up for failure.

Think of how a human is trained; we don't jump to our Ph.D. thesis when we're young. We start small. It's the same with AI and other technologies. Know your use cases and then start with a focused AI-enabled solution and the technology that will solve your acute problems and really provide measurable results. EI



By Paul Hamilton

Accelerate Problem Solving —AND— Push Innovation to New Levels

Today's market leaders are solving repair and maintenance problems, improving their project proposal strategies and taking innovation to new heights.

In a world where engineers, scientists and other knowledge workers spend about 40 percent of their time searching for the information that they need to solve problems and develop solutions, solving problems and driving innovation become a delicate balance between time and resources. Drilling down even deeper, the same knowledge workers consult 13 or more unique data sources on any given project, and usually wind up spending anywhere from 30-40 minutes locating a single document.

Compound these challenges across an enterprise—where hundreds or thousands of engineers must locate information scattered across business units, geographies, directories and systems—and the inefficiencies start to add up pretty quickly. For companies in the manufacturing and design space, for example, whose value is rooted in their ability to "create stuff," the costs associated with rework, waste and repeating past mistakes can be substantial.

In this article, we'll explore three particularly challenging areas for manufacturers and show how companies are successfully conquering these issues, accelerating innovation and optimizing their service efficiency in unprecedented ways.

IMPROVING THE REPAIR, MAINTENANCE AND SERVICE PROCESS

Service organizations struggle to achieve targeted customer satisfaction rates or key performance indicators (KPIs). They are challenged to increase operational efficiency with existing resources, continue delivering service levels in light of reduced resources, or even drive service business and revenue growth. In fact, studies show that 70 percent to 90 percent of the total lifetime cost of heavy equipment is spent in maintenance and repair.

In the U.S. alone, companies lose over $53 billion annually on unnecessary repeat visits from field service technicians, resulting in significant downtime. One major

by the numbers

40%
Time spent searching for information needed to solve problems & develop solutions

Unique data sources consulted on any given project
13

Time spent locating a single document
30-40 min.

airline learned this the hard way recently when it realized that it was experiencing repeated rework because maintenance engineers couldn't find information quickly, nor could they align "fixes" across teams. And because knowledge workers couldn't find the information they needed quickly enough, the airline was reporting up to 75 hours of downtime in certain instances.

The problem is that a plane sitting on the tarmac or in the hangar—waiting to be repaired—costs airlines a lot of money. For them, repair, maintenance and service are mission-critical needs that can't be left to chance. To address this issue, most airlines collect hundreds of different service manuals, operational documents and other materials from airplane manufacturers like Boeing or Airbus.

Then, the airlines have to keep that equipment operational, or risk racking up steep "downtime" costs. In this particular instance, for example, a plane sitting at the gate for over an hour equated to up to and beyond $100,000 in lost revenues. And, if the plane has to be pushed out of service, that bill rises to several hundred thousand dollars. Put simply, ground time is a bad thing. To avoid these six-figure losses, the airline has to be able to turn around a piece of equipment quickly and keep it in-flight for as many hours as possible.

That goal can only be achieved when engineers and technicians have the right information in the right place and at the right time. The same rules apply for any company that's operating equipment—be it an oil rig, a highway construction firm, or a similar business—and that needs to keep equipment uptime at a maximum level. Engineers must be able to find answers to problems quickly, and then they need to log those answers in a system that allows them—and their colleagues across the globe—to reuse that knowledge over and over again (versus starting from scratch every time).

"We know we already solved this problem, but we can't seem to find the solution," was a familiar complaint we were hearing from the large airline that we worked with. Fast-forward to today and that same company has centralized its service and maintenance functions to the point where engineers have the information that they need right at their fingertips, and where 75-hour airplane downtimes are no longer an issue.

ENGINEERS MUST BE ABLE TO FIND ANSWERS TO PROBLEMS QUICKLY, AND THEN THEY NEED TO LOG THOSE ANSWERS IN A SYSTEM THAT ALLOWS THEM —AND THEIR COLLEAGUES ACROSS THE GLOBE— TO REUSE THAT KNOWLEDGE OVER AND OVER AGAIN (versus starting from scratch every time).

INNOVATING AND VALIDATING

A recent Accenture study found that 93 percent of executives believe their company's long-term success is tied to its ability to innovate and out-perform the competition, yet a full 82 percent of executives do not believe that their company's innovation efforts are delivering on their promises. That's likely because those efforts lack clear structure, definitions and goals—all of which work together to support any organization's innovation efforts. Ignore these realities and it won't be long before your organization starts spending too much money on late-stage product changes and losing dollars in missed market opportunities and canceled projects.

With over 1,000 new product development engineers, one innovation medical solutions provider knew it could no longer afford to "shoot from the hip" when it came to innovation and validation. That's because increases in productivity have a tangible impact on the bottom and top line for the company's cardiovascular division.

By consolidating its volumes of internal and external information, including industry standards, patents and journals—plus corporate knowledge scattered across shared drives and enterprise systems—on a single, accessible platform, the company has increased its R&D team's productivity by 30 percent. And, within one year, the same platform helped to generate 15 percent of all of the patents filed by one specific division.

In another example, a global snack food powerhouse strengthened its competitive advantage and grew its market share in emerging markets by enhancing global collaboration, expediting decision-making, and increasing operational efficiencies across its R&D team. Today, 1,100 scientists using the knowledge platform have reduced routine patent searching down from two weeks to just

Executives that believe their company's long-term success to be tied to its ability to innovate and out-perform the competition.

93%

82%

Executives do not believe that their company's innovation efforts are delivering on their promises.

one-half of a day. The organization indexed over 230 globally distributed knowledge bases in five languages within the first six months of using the platform. "We're starting to see faster innovation and intelligent decision-making," one scientist noted, "thus reducing our time to market."

These are just two examples of how innovation and validation can be supported by a knowledge platform where all critical information can be aggregated, shared and disseminated on demand. As companies strive to get their products to market faster than ever while also getting a leg up on their competitors, they need to know that they're bringing the right products to market. This is the name of the game across most industries, where companies literally live and die on their ability to innovate.

WINNING MORE BUSINESS

Every year, companies spend thousands of man-hours responding to complex requests for proposals (RFPs). It's a resource-intensive, manual and repetitive undertaking that can translate into high-dollar mistakes when not approached properly. Across industries, companies have a significant and urgent need to improve this workflow as it impacts many key business objectives.

For most firms, winning new business is certainly an obvious outcome related to the ability to respond quickly, effectively and completely to an RFP. However, creating well-crafted proposals is equally as important, and can lead to low-risk projects or programs. Put simply, effective proposals are the very basis of projects and programs that can meet requirements, while maintaining schedule, budget and scope.

The problem is that an improperly developed proposal can cost companies millions of dollars and result in hefty penalties and damage to a company's reputation in the marketplace. Using a knowledge platform, companies can effectively leverage past data to drive more effective proposals and avoid reinventing the wheel. This, in turn, helps them gain advantages when it's time to tackle new RFPs and projects.

One international construction firm that wanted to expand its business into new areas knew that its existing strategies for winning new business just weren't cutting it anymore. The company also wanted to strengthen its project driving power, make more effective use of past experience and documents, and accelerate its use of advanced technologies like the Internet of Things (IoT).

AS COMPANIES STRIVE TO GET THEIR PRODUCTS TO MARKET FASTER THAN EVER WHILE ALSO GETTING A LEG UP ON THEIR COMPETITORS, THEY NEED TO KNOW THAT THEY'RE BRINGING THE RIGHT PRODUCTS TO MARKET.

Currently in phase one deployment of its new knowledge platform, the company manages three or four multibillion-dollar construction projects per year for clients like Shell and Chevron. As such, it has to be able to respond to RFPs in order to win business. Just one project that goes off scope or off budget can wind up eating into the construction firm's profit margins.

The problem is that when you submit a bid, you're promising your customer that you're going to run the project a certain way, within a certain time frame, and in exchange for a specific budget. If the bid isn't written accurately, and if it isn't based on current, accurate information, then things can get risky pretty quickly for this large construction firm.

Using a centralized platform and "one version of the truth," the contractor can now review past projects, hear from subject matter experts, ferret out the lessons learned, and tap into the kind of tribal knowledge that was either stored in disparate systems or in its employees' heads. This has helped the company gain extreme efficiencies across many different facets of its business while also enabling a more confident bid response process.

Now, I visit a lot of companies during the course of a year, and not many of them aren't facing extreme knowledge management problems. Whether they are remedying an operational failure or machine malfunction or strategizing the next generation of products for new markets, the process of effective decision-making should begin with a thorough definition and analysis of the current situation or problem-space. And, it should be supported by a robust technology platform that offers a vehicle for ideation and creative problem solving; brings focus and clarity to problem definition and analysis; stimulates idea generation; and helps evaluate, validate, and prioritize solutions.

By Greg Wood

DISCOVER INTELLIGENCE in Your Electronic Component Data

A "perfect storm" is rocking supply chain operations across the globe.

From trade wars to environmental regulations to component shortages, manufacturers and distributors are facing a "perfect storm" of supply chain hurdles right now. New intelligence can help smart companies effectively ride out the storm and come out ahead of the pack.

Unpredictable supply, international tariffs, changing environmental legislation, and age-old challenges like component obsolescence are impacting the way manufacturers do business in increasingly complicated ways. New tariffs can increase component costs up to 25 percent while environmental regulations like REACH—an EU regulation addressing the production, import and use of chemical substances—recently added lead (Pb) to its candidate list of "Substances of Very High Concern, SVHC's." The move added another 18.8 million different part numbers into the required reporting mix. Although when initially released, REACH was not viewed as having significant impact to the electronic component industry; now there are almost 58.2 million parts requiring REACH reporting.

In an environment where simply staying ahead of component obsolescence is a full-time job, companies' information needs are expanding and gaining in complexity. To offset these challenges, firms are demanding reliable engineering/technical data, testing and simulation data, and information that supports accurate reporting, monitoring and tracking.

In this article, we explore the major challenges that both manufacturers and distributors are grappling with right now; show how these obstacles are impacting their profitability and sustainability in the industry; and reveal the best practices that companies can follow in order to successfully navigate increasingly complex, worldwide supply chains.

THE CHALLENGES CONTINUE TO MOUNT

New tariff, reporting and compliance challenges are piling up and making it more and more difficult for companies to navigate a tumultuous business environment. The RoHS legislation

New tariffs can increase component costs up to 25%

in the EU and China, for example, restricts the use of hazardous substances in electrical and electronic equipment (EEE) and promotes the collection and recycling of such equipment. In the U.S., Cal Prop 65 requires businesses to inform Californians about exposures to certain chemicals.

These and a handful of other regulations are putting new constraints on the component supply chain, whose challenges don't end here. In fact, there's a "perfect storm" in the air right now and it's being fed by surging global demand (which is outpacing manufacturing capacity for some device types), dwindling inventory quantities, and extended order lead times. This surge in demand has resulted in parts going on allocation or orders being limited to fixed quantities per month.

For OEMs, these realities translate into major procurement challenges as buyers work to secure the component supply chain. Further, widely reported short- and long-term supply chain disruptions have, in turn, created production delays. Ultimately, this perfect storm of procurement challenges is constraining sales (compared to last year's sales volumes).

NO END IN SIGHT FOR TARIFFS

Because supply chain expenses are one of the biggest costs for businesses, anything that varies can impact margins and profitability while throwing off the delicate balance that a procurement professional has taken the pains to establish and cultivate. Slap a 25 percent tariff on top of a company's existing costs, for example, and the entire supply chain gets thrown out of whack. The current United States' administration has already imposed three rounds of tariffs on more than 800 electronic products and more than 6,000 tariff product types—this does not bode well for the organization that's already grappling with other supply chain challenges.

"Lead times remain elevated across a number of components, including capacitors, resistors, memory, and certain discretes, according to our analysis of distribution data."
— STIFEL

For OEMs, understanding and absorbing these cost increases have become extremely difficult. To fully grasp their impact on a specific organization and its end-to-end supply chain means knowing specific Harmonized Tariff Schedule (HTS) codes, countries of origin, sources of alternate parts and other key data points. In the absence of this intelligence, companies simply can't make the best possible sourcing decisions.

Distributors are facing their own set of tariff-related obstacles right now with the main question being, "Exactly which components are impacted by tariffs and are, as a result, 10 percent to 25 percent more expensive than their counterparts?" Again, without the accurate HTS codes, countries of origin and component packaging labels, distributors are forced to play a guessing game in a business environment characterized by razor-thin margins and increasingly-demanding customers.

NAVIGATING THE PERFECT STORM

Unfortunately, the worldwide component shortage isn't going away anytime soon. According to *EPS News*, electronic component supplies got even tighter during the fourth quarter of the year, with demand remaining at or above normal levels in the automotive, IoT and industrial markets. "Capacity ramp-up may not bear fruit until the end of the year or 2019," the publication reports, "and tariffs are likely to unravel an already-stressed supply chain."

Investment firms say that the ongoing electronic component shortage is only worsening. "Lead times remain elevated across a number of components, including capacitors, resistors, memory, and certain discretes, according to our analysis of distribution data," Stifel reported. "We continue to see signs of double ordering as customers scramble for parts. The multi-layer ceramic capacitor (MLCC) shortage is the most severe, with

Meeting those customer demands while maintaining profitability requires internal company systems that can be quickly referenced, exchanged, shared and updated.

many parts seeing order-rescheduling requests from customers waiting on MLCCs or other parts."

Digging down deeper, BOM Intelligence by IHS Markit singled out capacitors (MLCCs and special capacitors), resistors (fixed and network), transistors (bipolar transistors and power FETs), diodes (Zener and Rectifier), and RF relays as just a handful of the components that are experiencing long lead times right now. Distributors are observing average lead times extending beyond 52 weeks. For example:

Part Type	Part Category / Description	Part Number	Manufacturer	Average Lead Time (Weeks)
Capacitors	Multilayer Ceramic Chip Capacitors	HSZ101KAQBRAKR	Vishay	78
Capacitors	Multilayer Ceramic Chip Capacitors	C0805C470J5GACAUTO	Kemet	47
Diodes	Rectifier Diodes	SS15-M3/5AT	Vishay	49
Diodes	Transient Suppressors	wTPC20CAHM3/I	Vishay	64
Inductors	Fixed Inductor	IMC1210ER470J	Vishay	70
Inductors	Automotive Inductor	B82450A1084C000	TDK	53
Interface ICs	Line Transceiver	ST3485EIDT	ST Micro	64
Resistors	Thin Film Resistors	MCU08050D2501BP500	Vishay	82
Transistors	Small Signal Bipolar Transistors	QSX2TR	Rohm	56

Source: BOM Intelligence by IHS Markit

IT'S IN THE DATA

Combined, the obstacles outlined above come together to create a "perfect storm" of disruptions for any firm that depends on a global supply chain to get its products from design to manufacture to market. From the manufacturing/planning standpoint, for instance, simply being able to get basic components on time and ready to go into final products has become a crapshoot—bad news in a world where customers are placing more orders and demanding faster delivery times.

Meeting those customer demands while maintaining profitability requires internal company systems that can be quickly referenced, exchanged, shared and updated—all in the name of being able to ramp up quickly to meet demand. Armed with a reliable and comprehensive source of component information for extensive and current parts information, firms can effectively integrate their related internal content and then leverage that content across all of their internal systems. This not only helps to eliminate information silos, but it also equips all stakeholders with the trusted internal and component information that they need to make the best possible decisions in a turbulent sourcing environment.

In return, companies can rest assured that the parts that they're buying are environmentally-compliant, their reporting is accurate, and any pending component obsolescence is squarely on their radar screens. Then, organizations can take the steps necessary to ward off any issues that could interfere with the smooth running of their own supply chains. EI

To learn more about how BOM Intelligence connects internal component knowledge with reliable and comprehensive information on more than 550 million electronic components, visit

https://ihsmarkit.com/bomintelligence.

By Greg Dance

ANSWERS TO 5 KEY INFORMATION SECURITY QUESTIONS

When Selecting an Enterprise Knowledge Discovery Solution

To solve the toughest problems and develop optimal solutions, your engineers and other technical professionals must locate information scattered across business units, geographies, directories and systems. To effectively enable knowledge discovery across the enterprise, you must be able to answer this fundamental question: "How do we enforce proper security for one content source and yet allow discovery in another content source?"

- The product data management archive contains secure content, including some restrictions backed by legal agreements. How can we ensure that existing security protocols and permissions are maintained within our new knowledge discovery solution?
- A company was just acquired and senior engineers need to get started understanding what information is available in the new company's assets. How do we give this team the ability to search and discover content to which they currently don't have access because of file permissions issues?

These are only two examples of the same basic dilemma: You need the ability to enable strict security controls and occasionally the need to selectively override security without losing control. The answer lies in an enterprise knowledge discovery solution with an adaptive set of controls functioning at different levels in the application.

YOU WILL ASK A LOT OF YOUR ENTERPRISE KNOWLEDGE DISCOVERY SOLUTION—CAN IT ANSWER AND RESPOND TO THE CHALLENGE?

An effective knowledge discovery solution unlocks your organization's technical knowledge regardless of where it "lives," using knowledge discovery and analysis tools that go beyond traditional search to deliver answers and distill information into highly relevant, actionable insights. When researching available knowledge discovery options, organizations should consider the answers to these six important information security questions:

1 What kind of internal knowledge can be searched with an enterprise knowledge discovery solution?

Out of the box, an enterprise knowledge discovery solution has to be "connected" to many different commonly used content sources such as Windchill®, SharePoint, relational databases, shared drives, websites, IBM Notes (formerly Lotus Notes), Documentum, Teamcenter and more. If your company has uncommon content sources (or even a proprietary content source for which a standard connector does not exist), then a custom solution must be available from the vendor. In the case of highly-sensitive or confidential information, there must be an option to allow you to create your own connector.

2 With documents and data coming from any number of shared drives, repositories, or enterprise systems, how are permissions managed?

To use a single enterprise knowledge discovery solution to search content stored in various sources with differing security models, the solution must support many different approaches to obtain the security settings. If you need to enable strict security, the access restrictions specified by these security settings must then be able to restrict access on a document-by-document basis (i.e., document level security). In this way, individuals only see results from documents they have access to in the target content source. Such systems should periodically go back and check security settings. That way, even if a specific document's contents haven't changed, the solution will identify changes to the access list and correspondingly show changes to the search results based on each individual user.

3 How do you avoid exposing data to users who shouldn't have access to it?

Ideally, a solution will offer two primary levels of security: one at the content source level and the other at the document level. Your company needs tools and options to make decisions regarding who should or shouldn't have access to the information. To avoid accidentally exposing a user to confidential or sensitive data, enterprise knowledge discovery solutions should default to not showing any results from a given content source. That way, you can make a conscious decision about the information and whether it should (or shouldn't) be made available to selected users or groups or to the entire user community. If, for example, you want users to get results from a content source they don't have access to, an enterprise knowledge discovery solution should let you determine which users do have access and then limit how much information is shown to the end user.

4 What if I want to selectively override security without losing control?

There are various reasons why a company may want people to know about content that those individuals don't have access to. For instance, right after a merger or acquisition, users at Company A probably don't have network access to content on Company B's drives. It could take weeks or years to go through and properly grant access to folders after the merger or acquisition. Using the proper enterprise knowledge discovery solution, companies can quickly index the content (with DLS disabled), and give Company A's users access to search that content source. That way, those users can search content on Company B's drives. Put simply, they can do the discovery, but they'll still need help from someone at Company B to retrieve the file. To match content specific needs, each knowledge base on an enterprise server may contain a different combination of knowledge base access and DLS.

Benefits of an Effective Enterprise Knowledge Discovery Solution

» **REDUCE PROJECT DELAYS** by targeting the single-biggest use of an engineer's time—searching for information.

» **MINIMIZE RISK** by avoiding duplication of efforts and finding tried and true solutions vetted internally.

» **TRANSFER KNOWLEDGE EFFECTIVELY** to more junior engineering staff, new project and program members—hedging against knowledge loss and slow ramp up.

5 What security controls should a knowledge discovery solution for the technical enterprise integrate with?

Solutions should conform to the security protocols used for local files on a shared drive as well as those used in commonly used platforms such as SharePoint, IBM Notes, eRoom and Livelink. If you're using a custom connector to access the content, then the only limit to providing security controls like DLS is getting access to the information in the target system. Custom connectors can also be developed to map user names in a target system over to active directory user names for compatibility.

Picking the right enterprise knowledge discovery solution is not an exercise that should be taken lightly.

For more information on enterprise knowledge discovery solutions, visit **www.ihsmarkit.com/knowledge-discovery**.

By Neil Baumann

How Many Books Does It Take TO CHANGE A LIGHT BULB?

New tools help engineers keep pace with the ever-increasing volume and velocity of information.

Back when Thomas Edison and his contemporaries were looking to change the way we illuminate our world, these engineering pioneers could rely only on their own ingenuity and whatever few reference materials they could get their hands on. Today's engineers have a vastly more expansive universe of reference information at their fingertips—and therein lies the problem.

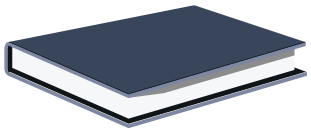
In the age of "Big Data" and the Internet of Things, it's become a cliché to say that global data is accumulating at an ever-increasing rate. And yet the numbers still stagger: Analyst firm IDC predicted that the amount of data generated in 2020 will be about 44 times greater than it was in 2009, reaching 40 zettabytes (40×10^{21} bytes) annually.

The engineering domain is undoubtedly a significant contributor to this information boom—not surprising when one considers the amount of information required to support a product or engineering project throughout its life cycle. Engineers, of course, are both the victims of, and the culprits behind, this information avalanche, generating reams of data while also challenged to find the materials they need to make the best decisions.

59%

of engineers surveyed said they continue to use print sources

— ENGINEERING.com



44x

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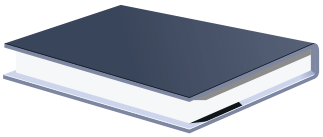

56%

of time workers can find the information they need to do their jobs

— Analyst firm IDC

Surprisingly, despite the digital tide, many engineers remain loyal to print and hard copies. The 2018 report from ENGINEERING.com, "How Engineers Find Information," for example, notes that 59 percent of the 1,187 engineers surveyed said they continue to use print sources. That said, as a group, engineers have adapted to the information tsunami by increasingly consuming the bulk of their content electronically; the same survey found that 98 percent of engineers are reading content on their computers, and 70 percent are using their smartphones to find information.

Or, should we say, "trying to find information." Because as the volume and velocity of information have continued to ramp up, the challenge for engineers is to navigate through the waves of data to locate the best answers to their questions. One illustration of how hard this challenge has become: Research firm IDC found that workers can find the information they need to do their jobs only 56 percent of the time. The more data that accumulates, the harder it is to get answers—and value—out of it.

CHANGING THE LIGHT BULB

Returning to the question posed by the title of this article, how many books does it take to change a light bulb? When Edison and his contemporaries were working to make their game-changing advances in electric illumination, they had a relatively small universe of reference materials to guide them, and they created much of the science themselves along the way. How many books did it take for Edison to change the way we light our world? Not many.

This isn't to demean the value of books by any means, but merely to acknowledge that the world had fewer engineering texts and handbooks and journals in the late 19th Century than exist today. Over the years, engineers and researchers have continued to build on the innovations of Edison's generation and have likewise expanded the "known universe" of reference information to the point where "books" —as shorthand for printed materials in general—are no longer fully capable of encompassing all the knowledge that technical workers need.

Advances occur so rapidly now that books simply can't be written fast enough to keep up with the pace of innovation. The scope of knowledge that engineers must incorporate into their decisions has also expanded, and they need the ability to search easily across many different content sources and compare data between sources quickly to find the best answer for any given problem they need to solve.

MATERIAL ISSUES

Let's take one relatively narrow but extremely important niche: information about materials and their related properties. This data is critical for all engineers worldwide who deal with materials, and without this information they simply can't do their jobs properly.

The basic need is to understand the fundamental parameters of a material and align those to the material's intended application. Consider the simple example of the components that go into a vehicle front axle. An engineer receives a specification from Japan and needs to find an equivalent material in the U.S. market, and also needs to be absolutely sure that the replacement material will behave the same way as the original. This means answering questions such as:

- What are the basic properties of the materials?
- How strong are they?
- Will the material be able to withstand a combination of forces from potholes on the road to bumps off the road?
- What about environmental conditions, loading, overloading and so on.

Getting accurate answers to these kinds of questions about materials is clearly essential. After all, the root cause of many engineering failures can be traced to lack of correct information about materials and their specifications. One researcher at a major science and technology organization found that 30 percent to 40 percent of all FDA recalls for medical devices are related to materials, often associated with an over-reliance on material data sheets. It frequently is the case that the information is "out there somewhere," but engineers simply can't find the correct needle, buried deep in some haystack somewhere, that they need to get their design right the first time, let alone advance a technology or make an innovative breakthrough.

AN ILLUMINATING SOLUTION

Fortunately, modern-day Edisons can avail themselves of solutions that bring all the wealth of knowledge from the print world (and more) into the digital age, while making it exponentially easier to find needles amongst the haystacks.

For example, in the sphere of materials information, engineers today can take advantage of an online database solution like Total Materia, from the Swiss company Key to Metals AG, that provides online access to properties information for about 450,000 materials. That translates to some 20 million individual property records, such as chemical composition data, mechanical and physical properties, and around 15 million material equivalency connections.

Putting all this information into print form would require about 150,000 standard pages—that's a lot of books just to change a light bulb. The thought of searching through 150,000 pages to find and compare materials would be daunting at best, simply impossible at worst. But a cloud-based database solution makes properties data easily discoverable through intuitive search capabilities, the properties can be augmented and kept up-to-date on an ongoing basis, and engineers can quickly compare materials and properties for selection or replacement.

No one would dispute that Thomas Edison set the world alight with his innovations in electric power generation, communications, and, of course, illumination. But by putting essential information at the fingertips of researchers worldwide, the new generation of technical reference solutions like Total Materia is helping engineers (including light bulb designers) and their organizations to be the leading lights in their industries today and into the future. EI

To learn more about how you can accelerate research and design through access to a comprehensive materials database, go to **www.ihsmarkit.com/ktm**.

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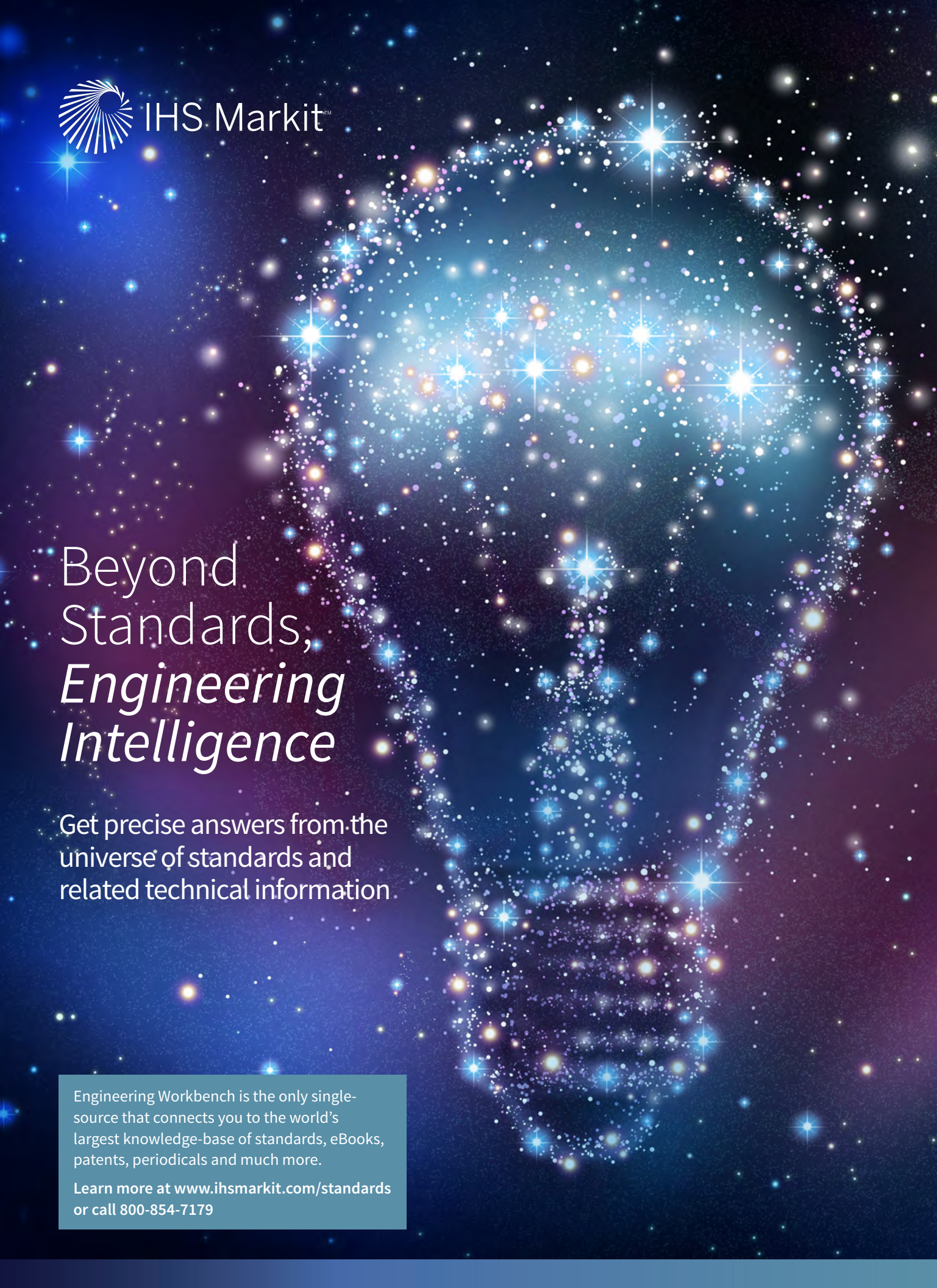
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