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# Keeping the Human in Artificial Intelligence

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## Introduction

Artificial intelligence or AI is everywhere in our lives. Perhaps you start each day using facial recognition on an iPhone to activate it. Throughout your day you might speak to voice-to-text devices such as Amazon Alexa, Apple Siri or Google Assistant to check the weather, catch up on the news and get answers to any other number of queries. As you surf the web, your activity is tracked by search engine algorithms that continually learn more about you and what you care about to tailor and provide more personally meaningful experiences. Go to any consumer website and it's most likely you'll be greeted by and conversing with a chatbot ready to answer your questions or help you in some way. And think of how much more spam email you'd receive if Google wasn't blocking out more than [100 million spam messages](#) each day. All of these things happen through AI-powered applications and technologies.

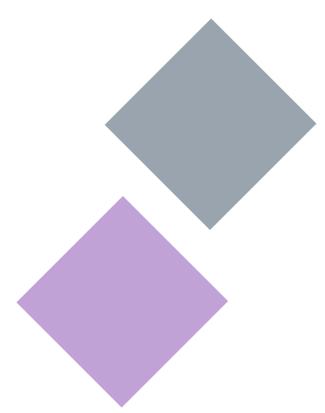
Today, nearly half (48 percent) of companies use data analysis, machine learning or AI tools to tackle their data quality issues, according to research posted on SEMRush. In 2022, companies are expected to have an average of 35 AI projects in place and 80 percent of retail executives say they expect their companies to adopt AI-powered intelligent automation by 2027.

Many human resource organizations already use AI built into intelligent software for job recruitment to screen applicants. AI helps businesses improve productivity by managing repetitive tasks and providing customer support through those aforementioned chatbots. Many companies also use it for social-media monitoring, for smart assistants that support and manage scheduling and for robotics and automation on assembly lines. The future will see its deeper application in things like self-driving vehicles, disease mapping and proactive healthcare management.

In the realm of employee health and safety, AI has the potential for enormous impact through the processing of huge amounts of business-generated data. The effort will reveal important insights that support better decision making and improve worker and workplace safety. Such capability will be highly useful in helping companies stay compliant with regulations and other mandated directives (read more about that later in this report). And, as a current generation of EHS professionals ready themselves to exit into retirement, AI may have an important part to play in knowledge transfer to a new group.

Human and machine life will become more deeply intertwined. A World Economic Forum report titled "[The Future of Jobs Report 2020](#)" observes that "algorithms and machines will be primarily focused on the tasks of information and data processing and retrieval, administrative tasks and some aspects of traditional manual labor. The tasks where humans are expected to retain their comparative advantage include managing, advising, decision-making, reasoning, communicating and interacting."

The report goes on to say that by 2025, 85 million jobs may be displaced by a shift in the division of labor between humans and machines. However, 97 million people will be needed for jobs such as AI and machine learning specialists, process automation specialists, big data specialists and more.



“ Today, nearly 50% of companies use data analysis, machine learning or AI tools to tackle their data quality issues.”



## AI Turns 65, But Its Future Looks Bright

Officially coined as a technology term in 1956 during an academic campus workshop at Dartmouth College in Hanover, NH, AI in 2021 turns 65. But far from reaching the age of retirement, AI technology is only just beginning to reveal its transformative potential.

The belief in 1956 was that AI would be fully realized within a mere generation. However, its history since has been one of fits and starts. Years of hype and early scientific research following the Dartmouth workshop showed little tangible result. By 1974, governments in the United Kingdom and United States—leading nations that were making the largest investment in AI at the time—decided to pull their respective funding plugs. What followed was the first “AI winter” of dormant interest in the technology.

AI resurfaced briefly in the late 1970s, but its resurgence was short-lived. By 1987, another AI winter of disillusionment began. Beginning in 1997, however, reliable and ubiquitous connectivity through local- and wide-area networking and the internet, exploding data creation and, with Moore’s Law regarding incremental compute power in full swing, AI-powered practical use applications finally emerged.

Where will AI go from here, how will it continue to change the way we work and live and how will it impact employee health and safety (EHS)?

This report will examine those questions and consider how, through the combination of humans working with AI technology, companies might improve EHS.



## What is AI?

The definitions of artificial intelligence are as varied as the technology's uses. AI represents many types of technology tools and intelligence applications. Perhaps the simplest description is [Wikipedia's that defines AI as](#) "intelligence demonstrated by machines, as opposed to natural intelligence displayed by animal, including humans." [IBM says AI](#) "leverages computers and machines to mimic the problem-solving and decision-making capabilities of the human mind." On a technical level, AI is software programming imbedded within computing machines that provides intelligence to control machine behavior and operation. AI today is often applied in analytics and used to rapidly analyze, process and compute massive amounts of data to reveal insights and support decision making.

Among the primary types of AI technologies in use today are:

- **Automatic speech recognition**, which distinguishes language sounds in a voice and processes a signal collected by a microphone to identify words pronounced by a user.
- **Natural language processing or NLP**, or the ability to understand and interpret text and spoken words and accordingly respond. Think of what virtual assistants like Siri and Alexa can do as common examples of this application.
- **Machine learning or ML** uses data and algorithms (step-by-step computing instructions and rules) to continually learn and improve through continual use, ongoing experience and repetition. IBM's famous question-answering Watson computer used ML to calculate probabilities for correct answers and NLP to respond using text-to-voice technology in winning on the television quiz-show Jeopardy in 2011.
- **Computer vision** applies data analytics to recognize, discern and interpret images, derive information from these then take actions and/or make recommendations. It's used to train machines to perform functions based on visual identification in an industrial setting, for example, to sort things or identifying imperfections. Computer vision is currently used in industries ranging from energy and utilities to manufacturing and automotive
- **AI planning or automated planning and scheduling** is a type of problem-solving AI where an analysis is made of a complex task and a performance schedule is mapped out as a logical sequence of steps from start to finish to achieve a goal. Take, for example, the task of building a house which requires certain things to be done in a certain order so that the construction can be completed quickly and correctly. AI planning in this case would determine what specific tasks or actions need to be taken and when. AI planning is most typically seen applied in route mapping, when traveling from one destination to another.

## AI in the workplace

There's understandable excitement about AI's application in business. Organizations everywhere are using it in near countless ways, from getting to know more about customers, personalizing their experiences and interacting more effectively with them to achieve greater efficiency, timeliness and improving customer satisfaction.

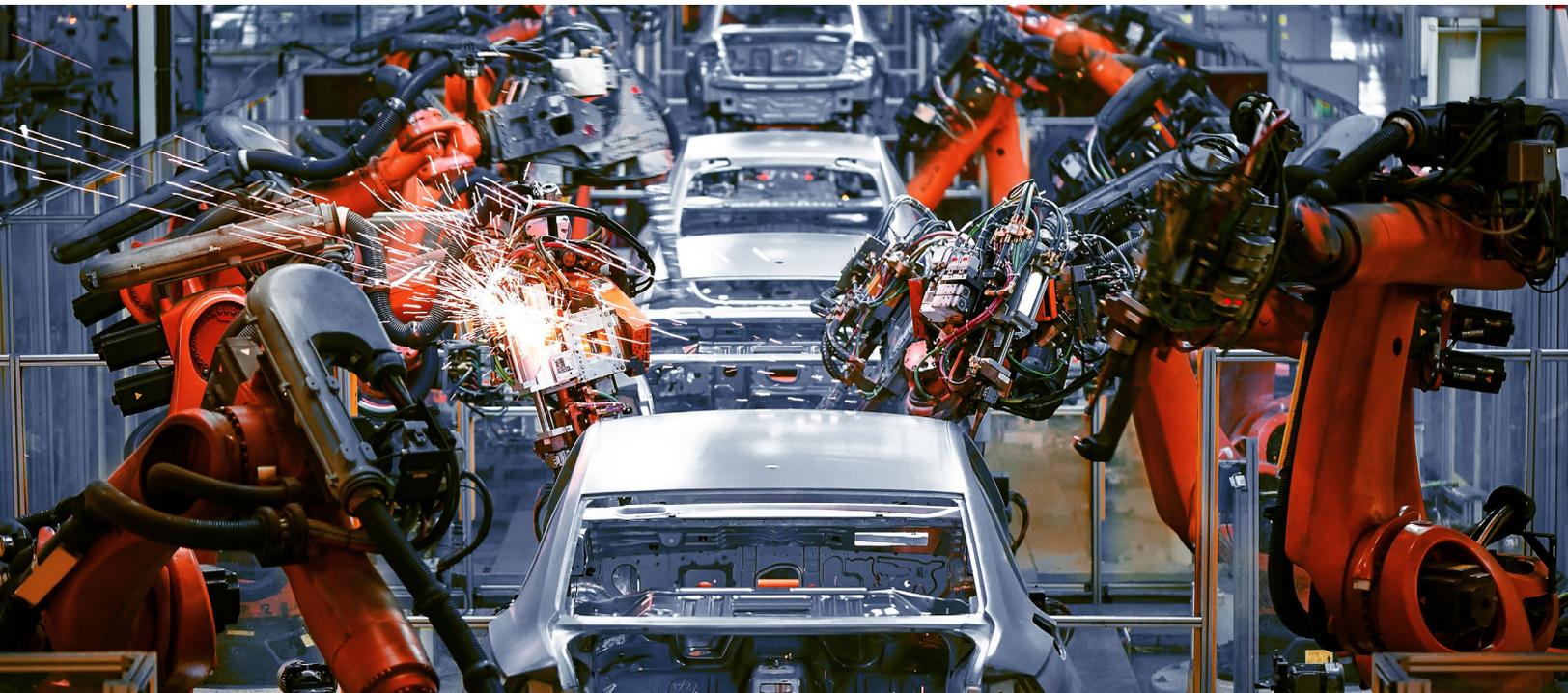
[According to PriceWaterhouseCoopers \(PwC\)](#), “In the near-term, the biggest potential economic uplift from AI is likely to come from improved productivity, including the automation of routine tasks, augmenting employees' capabilities and freeing them to focus on more stimulating and higher value work. Capital-intensive sectors such as manufacturing and transport are likely to see the largest productivity gains from AI, given that many of their operational processes are highly susceptible to automation.”

PwC also describes AI as “game changing,” estimating that by 2030, global GDP could increase by \$15.7 trillion through accelerated development and take-up of AI. Information technology market researchers [IDC says AI spending](#) by businesses as a “must” and reported in 2020 that global investment in AI systems would exceed \$50 billion, and by 2024, investment will reach \$110 billion.

Among the most discussed aspects of AI is the notion it will ignite a massive movement to replace workers. Most jobs will be impacted by AI-power automation, but [McKinsey and Co.](#) says only about 5 percent of occupations could be fully automated by currently demonstrated technologies. “We find that about 30 percent of the activities in 60 percent of all occupations could be automated. This means that most workers—from welders to mortgage brokers to CEOs—will work alongside rapidly evolving (smart) machines. The nature of these occupations will likely change as a result.”

Automation will displace some workers and McKinsey estimates it could be up to 15 percent of the global workforce or about 400 million workers by 2030. “Under the fastest scenario we have modeled, that figure rises to 30 percent, or 800 million workers. In our slowest adoption scenario, only about 10 million people would be displaced, close to zero percent of the global workforce,” they say.

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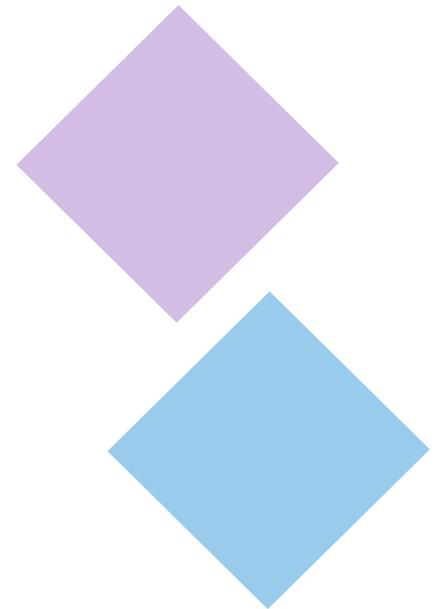


But if past history is an indicator, worker displacement may not be the dire situation some might believe. [Deloitte research](#) concluded in a recent study that during a 15-year period from 2001 to 2015 in the United Kingdom, technology may have contributed to the loss of more than 800,000 lower-skilled jobs. However, “there is equally strong evidence to suggest that it has helped to create 3.5 million new higher-skilled ones in their place.”

Deloitte also says history shows that the jobs assumed by technology and automation typically fall in lower-skilled areas such as clerical, administrative and manual occupations. But “thousands of new jobs are being created every year in technology and creative occupations, business and professional services, and caring professions. These growth jobs require a higher degree of manual dexterity or higher cognitive skills such as those that depend on management or human social interaction – a shift from brawn to brains.”

The belief by many experts is that AI adoption will follow a pattern similar to previous technology breakthroughs and augment rather than replace workers by automating subtasks of jobs. During a 2019 presentation titled “[Socially Responsible Automation: A Framework for Shaping the Future](#),” Pramod Khargonekar, a professor at the University of California at Irvine, told an audience that AI’s bigger impact will be in the composition rather than loss of jobs, noting that “the tasks in a job will change” as AI-powered automation performs some activities while humans do others. During the same presentation, Meera Sampath, vice chancellor of research at the State University of New York, explained that among the four core applications of AI-powered automation is something called human-centric automation that specifically supports worker performance, skills and quality. AI in this case is all about helping employees perform better than ever. In its application, “human capital is core to business strategy and the business management philosophy is that people are indispensable” she says.

Experts reason that AI and people are most effective when the two work together, and that the technology’s larger impact will be to complement and augment human capabilities rather than replacing people in their jobs. In fact, AI won’t replace the people who provide data analysis, software development, creativity and jobs that are less likely to be automated, such as marketing and sales. Human skills are needed to train AI smart agents to understand human behavior, while AI agents, in turn, assist people with information gathering, data crunching, routine customer service and physical labor.



“Today, I see AI more and more as an augmentation to the existing workforce,” says [Matthew Gierc](#), a vice-president for consultants 3AG Systems in Vancouver, Canada.

“It’s like giving every employee the ability to be two times, five times or 10 times more insightful in their job. Applying this calculus, if your job involved any kind of judgement, analysis or expertise, you are now going to be that much better - that much more valuable - at providing such insight to the company.”

[Kathy Seabrook](#), the CEO of [Global Solutions Inc.](#) and a thought leader in health, safety and wellbeing at work, says she believes people and companies need help with making decisions and that’s where AI steps in. But humans can’t be replaced in certain types of decision making. She specifically cited value judgements and some risk decisions.

“Taking business risks vs playing it safe can mean the difference between a future Google or Apple and that start up going bust in the first three years,” she says.

“The ability to think outside the box is not going to come from AI. The data and potential inputs will, but actual decision making won’t. There will be a need for some human decision making.”

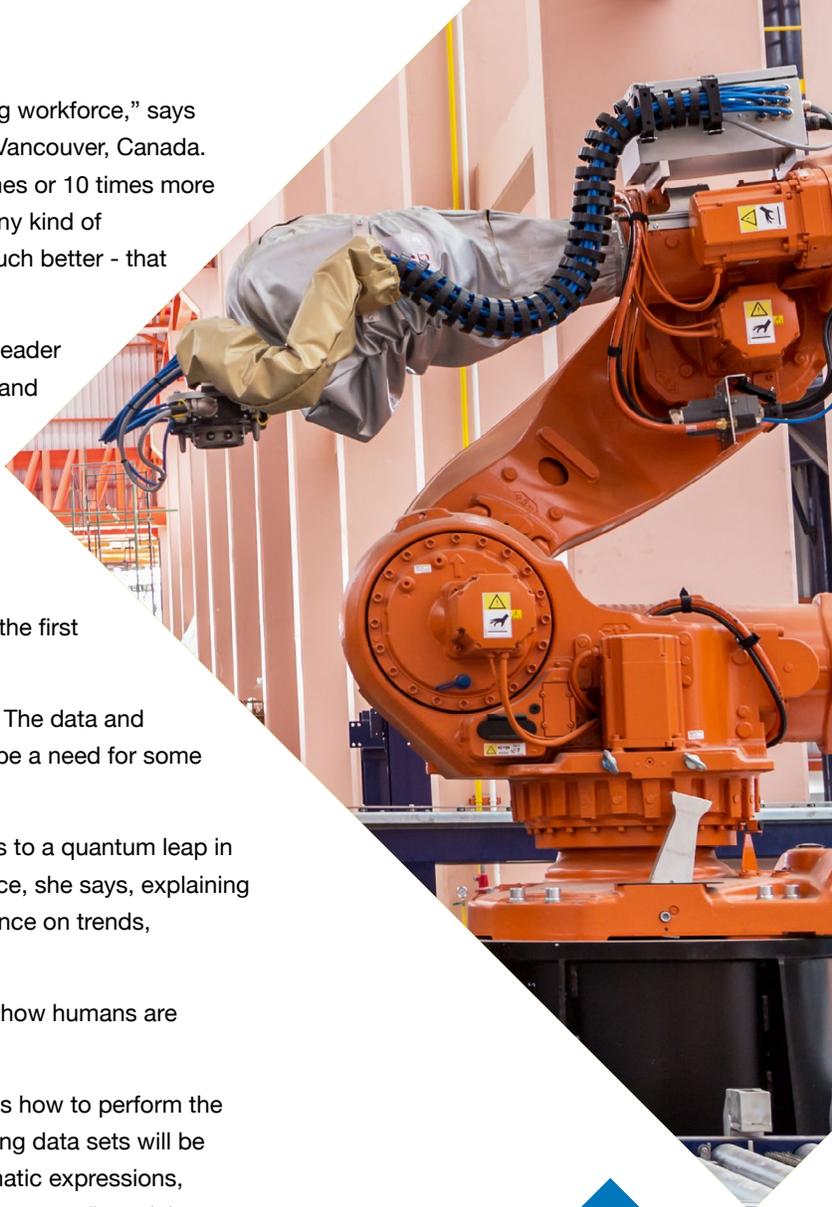
AI technology creates value where it doesn’t exist by taking things to a quantum leap in terms of information and synthesizing data for business intelligence, she says, explaining that AI technology mines out data and provides business intelligence on trends, demographics and leadership issues.

A [2018 article](#) published in the *Harvard Business Review* outlined how humans are essential in supporting AI in three crucial roles.

**Training:** People are needed to teach machine-learning algorithms how to perform the work they’re designed to do. Humans working with massive training data sets will be required to instruct machine translation apps how to handle idiomatic expressions, medical apps to detect disease and recommendation engines to support financial decision making. AI systems must also be trained by humans to understand how to interact with humans.

**Explaining:** AI can’t intuitively understand or interpret opaque processes and it will take human experts and their insights to explain things. These “explainers” are particularly important in evidence-based industries, such as law and medicine, where a practitioner needs to understand how an AI weighed inputs into something like a sentencing or medical recommendation. Explainers will be integral in regulated industries where a machine’s output could be challenged as being unfair, illegal or wrong.

**Sustaining:** Employees taking on an overseeing role as “sustainers” will ensure that AI systems function properly, safely and responsibly. Their ranks include safety engineers looking to anticipate and prevent harm done by AIs, such as industrial robots that work alongside people. Careful attention must be paid to ensuring these intelligent machines recognize humans nearby and don’t endanger them. Sustainers would review analysis from explainers when AIs do cause harm. In another sustainer role, data compliance officers might be needed to ensure data feeding AI systems comply with the GDPR and other consumer-protection regulations.



# AI Applied to EHS

## DATA IS THE KEY

A large continuum of companies currently uses various types of technology for health and safety tracking and managing performance. However, according to Seabrook, many continue to rely on basic applications like Excel spreadsheets and SharePoint, so there is little if any data aggregation capability.

She explains that the integration of new and existing technologies is also a challenge, and while mining information in data dispersed throughout an organization is essential to EHS processes, data is often not easily accessible or integrated.

Seabrook describes EHS as an activity that should be an integrated single process within a company and collectively tie together all business processes to provide a complete picture of what is necessary and required to mitigate and reduce risks. But at many companies, business processes such as quality, procurement, legal, operations, research and development, EHS, human resources and maintenance are siloed, and data is not shared.

“You’ve got quality that doesn’t talk to safety, that doesn’t talk to environment...and never talks to maintenance – the asset management folks. All of these are so interconnected. To me, that interconnection is where AI can really create value,” she says.

Data is the key to the effectiveness of AI, but because data is usually siloed, realizing the full value of AI for EHS can be difficult.

## SUPPORTING WORKER WELLNESS

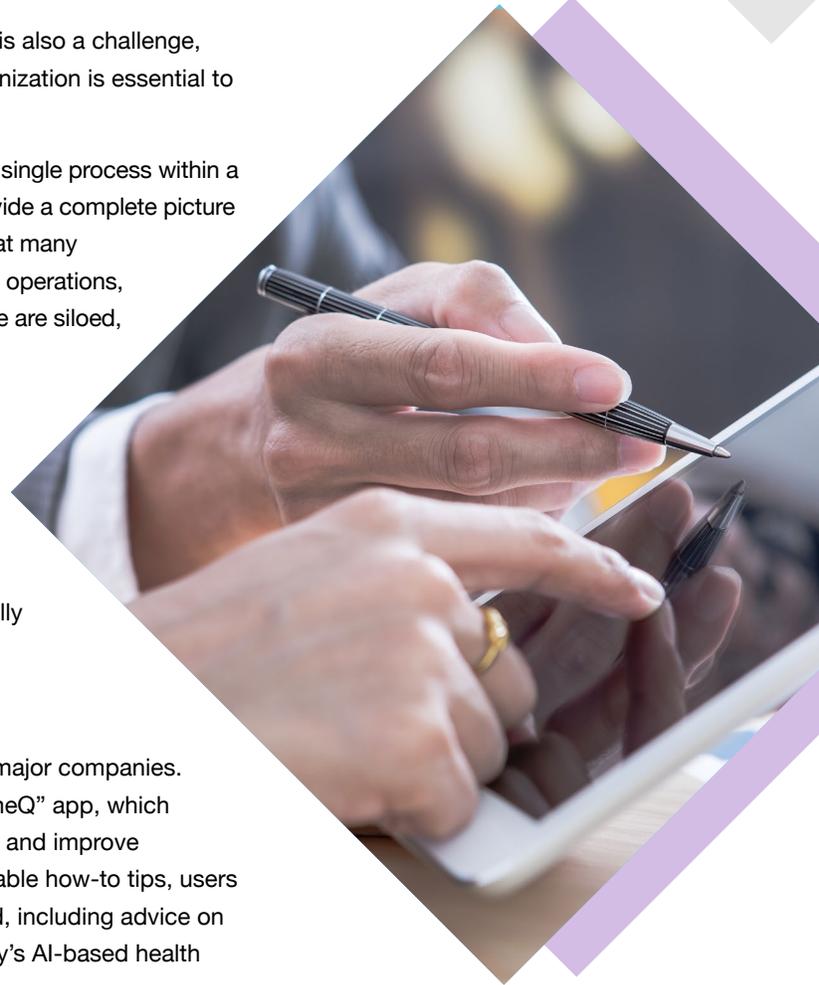
AI tools are appearing as part of health and wellness programs at major companies. Johnson & Johnson offers to its employees the meQuilibrium or “meQ” app, which applies the science of behavioral psychology to help reduce stress and improve resilience, agility and productivity. Through customized and actionable how-to tips, users learn behaviors that can help keep them feel healthy and energized, including advice on how to practice mindfulness throughout a hectic day. The company’s AI-based health app is used by 90 percent of employees.

Amazon CEO Jeff Bezos earlier this year reported that 40 percent of the employee work-related injuries at Amazon are musculoskeletal disorders (MSDs)—things like sprains or strains caused by repetitive motions. The company introduced new automated staffing schedules that use sophisticated algorithms to rotate employees among jobs that use different muscle-tendon groups to decrease repetitive motion and help protect employees from MSD risks. This new technology was used for job rotation programming throughout 2021.

## EHS DOCUMENT DECONSTRUCTION

AI, in the context of EHS, seems a perfect fit in an essential area—that being the need to wade through a morass of complex and ever-changing regulations, compliance, permits, consent decrees and other critical EHS documents. It’s a human-intensive and often error-prone task that, if done improperly, risks fines and other penalties for failure to comply.

Document deconstruction to identify the actions that EHS professionals are required to take is difficult, time-consuming, complicated and expensive because of the manual



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grunt-work need from many people to pore through and analyze EHS documents.

Vancouver, Canada-based [ehsAI](#) has developed an AI technology based on machine learning and NLP to automate EHS document deconstruction and analysis. Their cloud-based platform applies NLP algorithms to interpret and extract EHS requirements from various types of regulatory documents then converts unstructured data and extracts actionable compliance obligations written within these documents. This output can be exported into EHS software systems to manage requirements and tasks and ensure timely execution.

According to company Chief Technology Officer [Mahdi Ramezani](#), the time was right for AI and EHS because the past 10 years have seen significant improvements made in machine learning and deep learning that now makes it possible for AI to process and analyze massive volumes of data.

He explains that AI doesn't make decisions in document deconstruction but supports EHS decision making by flagging compliance action items. ehsAI's technology uploads files, scans through compliance, regulatory and other documents, identifies important items then generates an indexed list of compliance action items. AI can quickly process and analyze documents much faster than humanly possible and among the intersections of people and technology in this case is having information created by AI that supports human decision making.

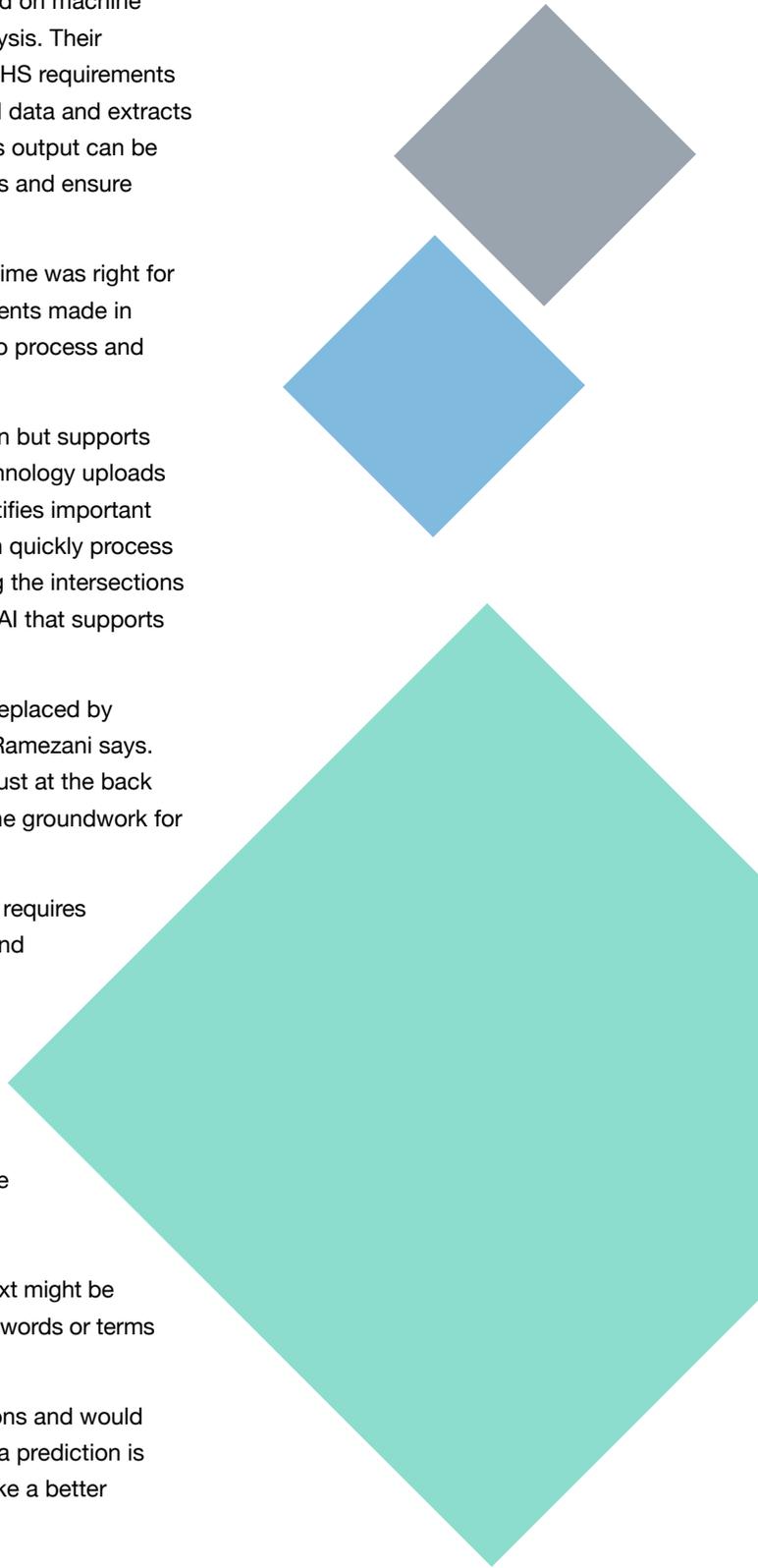
Many day-to-day human tasks that are not complicated can be easily replaced by training an algorithm or set of problem-solving computer instructions, Ramezani says. But the people part of AI in document deconstruction is essential, not just at the back end of decision making and action, but also at the front end of laying the groundwork for EHS algorithms.

Ramezani says that necessary instruction for building an EHS algorithm requires basic details that people must input, including things such as defining and identifying numeric chapter numbers and citations in documents, and adding indications of new paragraphs, chapters or other items. The algorithm created has an instruction sequence of things that should happen when encountering a citation and if formats are consistent, and words spelled exactly the same, then things move along.

“The problem with (certain basic algorithms) is this can be too strict a rule and can't be generalized for new scenarios, in the case of a typo or an abbreviation, for example,” he says. In this case, an AI module must be programmed to make certain assumptions based on things like where text might be placed or located in a document, what other text might surround certain words or terms or if a spelling error or abbreviation is encountered.

The AI module as it is working may encounter discrepancies or deviations and would then make a prediction or assumption for a correct answer. Every time a prediction is wrong, however, the module incorporates that lesson and learns to make a better prediction next time.

“We use lots of samples—thousands of documents, hundreds of thousands of pages, perhaps a million samples of sentences—to help make the module learn and improve,” Ramezani says.



Prior to applying technology to the task, EHS professionals at ehsAI spent nearly two years mapping out how the machine learning algorithms and NLP of AI needed to understand the workflows of EHS managers responsible for and managing compliance as well as the requirements in near countless regulatory and compliance legislation. It was also essential to recognize how these might relate to other requirements in other documents.

“We literally had to write the playbook...the training manual for novice AI programmers to help them think like an EHS pro and appropriately create the algorithms,” said [Margery Moore](#), the company’s chief executive officer. She describes this lengthy process as a massive brainstorming effort that involved intricately mapping every regulatory process on white boards and tracing through the minutia of regulations and compliance documents, as well as fully understanding the workflow of EHS professionals.

Literally thousands of decision trees were constructed during 24 months of manual EHS analysis work that couldn’t be performed by simply scanning documents because, as Moore explains, “so many are written differently...or poorly.” Data within these documents needed to be cleaned up, normalized and structured for consistency so that it could be read.

“Many documents are not written in a consistent format and even grammar can often be challenging since regulators who author regulations aren’t always writers,” she said.

Tens of thousands of samples and past experiences are behind accurate predictions and assumptions. Certain basic things are relatively simple to program while others are much more complex and require the higher expertise of experienced EHS professionals working with AI developers.

At the end of the day, AI used in document deconstruction saves time and human effort. How much time is a difficult question to answer, according to Moore.

“What we can tell you is it takes about 40 to 60 hours to deconstruct a Title 5 (Title V Operating) permit and our application can do it in about 3 hours,” she says. “It might take 10 hours to do a 60-page standard. But (our application) can probably do it in about 20 minutes.”

It’s the sort of work that consultants often do for large enterprises and they would bill by their time, Moore says. “But they don’t have people to read all of the documents,” she adds. “And it’s the consultants who realize that their lunch will be eaten shortly if they don’t use tools (like AI), which should be able to boost their margins, which are already really thin.”





## Case Study: APTIM

APTIM is a Louisiana-based EHS consultancy and ehsAI customer that works with various industries across North America, including government, oil and gas, chemical, industrial and power. APTIM supports the regulatory and compliance efforts of these companies, helping them to safeguard and maintain critical power infrastructure, help communities recover from natural disasters, support the armed forces and enable first responders to meet the needs of any situation.

Their clients need to manage numerous and complex regulatory requirements at federal, state and regional levels by extracting key information required for compliance while also maintaining a schedule for compliance deadlines. They need to continually review thousands of pages of regulations, compliance documents and permits then capture requirements and specific conditions, analyze complex compliance documents then produce detailed, structured outputs that highlight what organizations need to know to ensure compliance on every project.

Recent APTIM projects include:

- The Inner Harbor Navigational Surge Barrier Project in New Orleans, which required the construction of a surge barrier measuring 26 feet high and 1.8 miles long,
- The New York City Rapid Repair and Build It Back program after Hurricane Sandy, which helped 20,000 families and repaired 6,400 homes, and,
- The Newtown Creek Wastewater Treatment Plant in Brooklyn, NY, which received the Best Project Award from *Engineering News-Records* and featured \$4.5 billion in new construction.

Organizations need to mobilize quickly in response to crisis situations and AI technology is critical in helping APTIM clients understand regulatory requirements for environment, health and safety and quality.

## EHS Crossing the Chasm

It's early days for AI's application in EHS. Document deconstruction and analysis seems a natural fit for the technology and will have an enormous impact on current EHS workflows. As is often the case with the introduction of information technology in working environments, the greatest challenge might be with people.

"You have to be willing to try a new technology," Moore says, explaining there can be resistance to technology in general, especially among professionals who are unaccustomed to using it in their jobs.

"You have to be willing to break the current workflow you've been working with for 30 years. We're training a lot of people in their 60s, and some prefer to use pen and paper because that's what they've been doing for the past 35 years," she says.

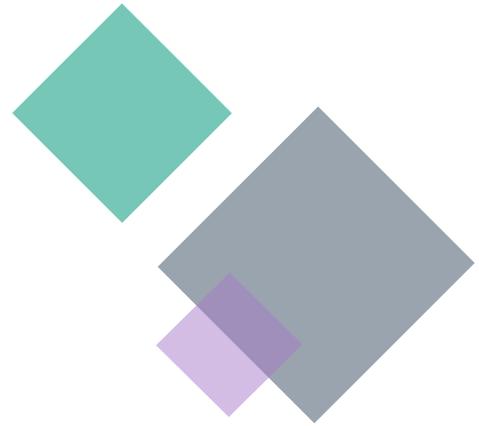
But AI applied to document analysis can take thousands of hours out of convoluted workflows. Moore says everybody knows AI is coming to the EHS workspace and many corporations use and are budgeting for it in their operations. She believes AI will inevitably make its way to wider EHS adoption.

And it couldn't come at a better time for the EHS profession. There's high attrition happening among EHS ranks as many of those who currently do the jobs are reaching a retirement age. According to Moore, the knowledge gathered by those who've done the job for a lifetime typically doesn't get passed along by those with the greatest experience when they leave their roles.

"(Fewer people) have the skillset to critically analyze a permit, a regulation or a standard," she says.

"That's gone when people retire. So, more novice EHS pros are looking for tools."

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## Conclusion

It's only the beginning for AI as a transformative technology. Most of the applications seen in use today throughout our personal and professional lives could well be described as rudimentary considering what many believe is AI's tremendous promise and potential.

A report published this year by Stanford University discusses where AI innovation may be focused in the near future. It describes "AI agents on their own," citing examples of how today's AI systems can convert handwritten forms into structured fields and automate medical billing. The future may see AI agents used to "monitor and adjust operations in fields like clean energy, logistics, and communications; track and communicate health information to the public; and create smart cities that make more efficient use of public services, better manage traffic and reduce climate impacts."

The report also noted that the COVID pandemic spurred an increase in the use of AI-based education tools that teach without a human educator and cites the potential for AI "to assist with virtual reality scenarios for training, such as practicing how to perform a surgery or carry out disaster relief." The report also suggests many mundane and potentially dangerous tasks to be taken over by AI systems in the near future.

Experts define most of AI in use today as narrow artificial intelligence or narrow AI. Narrow AI is single purpose built to excel at a single task and it relies on extensive supervision and training by people. But narrow AI knowledge isn't funneled through to other tasks and a narrow AI system isn't useful for anything other than the task for which it is designed.

The next level of AI innovation is likely to be general artificial intelligence systems that can understand the world like a human and perhaps perform any human task. Today, it is more sci-fi than reality and many experts suggest such technology doesn't truly exist today, although the nearest primitive examples might include the earlier mentioned IBM Watson computer, facial recognition, self-driving cars and speech understanding. But who knows about tomorrow?

The future path seems clear and perhaps it's not as far off as we might think.

## About the Author

### DAN MCLEAN

Dan McLean is a senior content marketing manager at Intelx Technologies. He has been an information technology editor and writer for more than 25 years and spent seven years as an IT market research director for International Data Corporation in Canada. In addition, Dan directed content marketing teams for Rogers Communications, OpenText Corporation and Vendasta Technologies, plus was a senior executive communication manager at Cisco Systems for eight years.

## About Intelx

With almost 30 years of EHSQ experience, we know a thing or two about how safety, quality and sustainability can preserve lives and protect the planet. And we know you need to drive productivity and operation excellence, too. That's why our technology solutions are built for EHSQ experts by EHSQ experts.

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If you would like a free trial of our software solution, please [click here](#). You will have the opportunity to experience the basic “plug-and-play” software before making a commitment.

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If you would like a demonstration of our software solution, please [click here](#). This includes a product tour and a conversation with our software experts.

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If you would like to receive a custom quote or pricing-related information, please [click here](#). This includes the total business value that our software will provide, projected ROI, financial benefits via a “hard dollar” analysis and total business benefits via a “soft dollar” analysis.

