



Business challenge

Woodside Energy had no systematic way to tap into the 30 years of engineering and drilling knowledge that lay buried in unstructured documentation and with its most experienced engineers.

Transformation

Woodside harnesses the power of cognitive computing to extract meaningful insights from 30 years of dense and complex engineering data. IBM® Watson® technology puts decades of knowledge at the fingertips of employees across the company, helping answer tough questions faster to enable fact-driven decision making on complex projects.



Peter Coleman,
Chief Executive Officer,
Woodside Energy

Business benefits

AUD 10 million

savings in employee costs

because of faster access to and more intuitive analysis of engineering records

75%

reduction in time spent

by the geoscience team reading and searching through data sources

Accelerates

expertise

by giving staff unlimited access to 30 years of tribal knowledge

Woodside Energy

Using IBM Watson technology to extract decades of experience from an ocean of data

Based in Perth, Woodside is Australia's largest independent oil and gas company, which is recognized through its global portfolio for its world-class capabilities as an explorer, developer, producer and supplier of energy. In 2014, Woodside celebrated its 60th anniversary, 30 years of domestic gas production and 25 years of liquefied natural gas (LNG) exports. Today, the company employs approximately 3,500 workers across worldwide locations. Woodside is pioneering remote support and the application of artificial intelligence (AI) and advanced analytics across its operations.

"It's not just about retooling and having the same culture in place; we're fundamentally changing our culture with cognitive computing."

—Peter Coleman, Chief Executive Officer, Woodside Energy

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Mining an ocean of data

A seasoned engineer leads another, some 25 years his junior, through a maze of pipes, dials and valves on a natural gas platform a thousand miles from anywhere. The older man knows the facility like he knows his home back in Australia. He should; he was there when Woodside turned on the power. But this youngster—how can he ever gain the decades' worth of knowledge he needs to make sure that the facility keeps running smoothly, even in the remote conditions of the North West Shelf?

Woodside is a 63-year-old company with more than 30 years of experience operating some of the world's largest—and therefore most complex and expensive—offshore petroleum and LNG production platforms. Like many companies in the sprawling oil and gas business, Woodside was leaving a lot of its internal wisdom—accrued over the past 30 years from thousands of engineers—essentially untapped. Making these knowledge assets accessible to the broader population of employees could supercharge productivity in engineering and beyond.

Shaun Gregory, the organization's Chief Technical Officer (CTO), explained in an interview at the 2016 IBM World of Watson event: "In 30 years, we've generated a lot of information, a lot of knowledge that is buried in reports, documents and data." To remain competitive, Woodside knew it needed to streamline corporatewide access to its archives and accumulated knowledge, to spread not only information but also the contextual relevance of this information.

As Chief Executive Officer (CEO) Peter Coleman stated during a keynote speech at World of Watson: "It became very evident to me that we spend a lot of time building big things, but each time we build one we have to go back and recall what we did last time. We have to find the people who were around last time." Put another way, Woodside was "extremely data rich, but that data wasn't going anywhere," said Coleman.

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Companies such as Woodside often rely on the institutional knowledge of experienced engineers, which they hope is passed on to the next generation. "By the time you get to be a project director on a project worth AUD 15 billion, it's probably your last project," Coleman explained to the World of Watson audience. That career's worth of experience may be lost to the organization by the time the next big project comes along.

Many in the Woodside workforce had been with the company since the first day of operations, challenging the business with the potential loss of an entire generation's worth of knowledge and experience. "They aren't going to be around to teach our graduates in four or five years' time," said Gregory. "We have a big bank of knowledge from over 30 years of operations; all that engineering expertise sits internally within the

company and is almost like a latent asset that we need to bring to the forefront."

Woodside believed that by improving its employees' ability to tap into engineering insights that lay hidden and dormant throughout different parts of the organization, it could solve problems faster, reduce costs and drive greater engineering efficiencies. The CEO therefore wanted to transform the business from reactive to predictive and from opinion-based to fact-based in its decision making.

The question remained: how to drill into three decades of information spread across internal and external reports, journals and human experience. The company recognized that it had far too many documents for simple keyword searches to be effective anymore. As Russell Potapinski, Head of Cognitive Science at Woodside, said during his interview at World of Watson, "We needed a cognitive system that could actually understand the languages that we speak, reinterpret all of those documents that we have in our systems, and then surface those insights really quickly."

Drilling into cognitive

That's when cognitive technology entered the picture. In his interview, Gregory recalled: "In 2014, when we started to analyze this problem, we knew about AI. AI had been through a few false starts. But we could see with the rise of Moore's law and computing, and the cost of data storage, that it was going to be unlocked this time." The business created a cognitive science team that spent time with IBM Research to understand, post-Jeopardy, where IBM® Watson solutions stood and whether they could successfully meet the Woodside data challenge. "We really understood how AI could work on our data sets. We understood how much unstructured data we had and how we were going to bring that to life with AI and cognitive," Gregory concluded.

As Coleman noted in his address, this was "all about knowledge and creating shareholder value through our knowledge and competencies," and it was about the competitive advantage stemming from that knowledge. However, he stated that it



might be difficult to define a business case around knowledge, whereas "it's easy in manufacturing, because I can count how efficient I've become."

Ultimately, it wasn't all that difficult to bring the executive committee around to seeing the benefits of cognitive computing. Coleman explained how the firm had just completed a project worth AUD 15 billion and had identified 8,000 lessons learned. When asked to name five of those

lessons two years after the project, the executive team had difficulty coming up with consistent answers. "There's the business case," asserted Coleman. If the company's executives could barely remember the lessons learned after only two years, how would the rest of the organization find that information? And where would that knowledge be when it came time for the next big project?

To help improve its ability to disseminate engineering knowledge and insights in support of decision making, the business engaged IBM to implement the IBM Watson Engagement Advisor solution, delivered as a cloud-based service. In the course of the deployment, IBM Watson Lab Services performed the architectural planning and implementation while IBM Research developed improved methods of ingesting engineering content from existing documentation.

A team from IBM Global Business Services®—Business Consulting Services provided project management and training services. Business Consulting Services also worked with a user-experience team in Sydney, Australia, to develop and produce the look and feel of the system's custom user interface (UI). As IBM Watson solutions become more embedded in Woodside operations, Business Consulting Services will continue to provide business analysts, testers and process experts while IBM Watson Services will supply subject matter experts (SMEs) to round out the project.

Working with IBM and the IBM Watson Developer Cloud portfolio, Woodside developers identified the application program interfaces (APIs) needed to craft an architecture and build an intuitive design that helps engineers find the advice they need. These APIs include:

- IBM Watson Natural Language Classifier: This API allows users to search a corpus by asking questions as if they were talking to a person. The API parses out the intent of a question even if people ask it in different ways.
- IBM Watson Retrieve and Rank: After understanding the question, this API retrieves all relevant information from the corpus, ranks it in terms of relevance, and responds with the best matches along with related points of inspiration.
- IBM Watson Conversation: By incorporating a human tone, this API creates a better user experience and allows the IBM Watson solution to interact with engineers in their own language.

The Watson for Projects instance was Woodside's first IBM Watson deployment. To start, the organization worked with IBM to create the corpus of knowledge at the center of the solution by uploading approximately

30 years' worth of documents related to activities in constructing and running its facilities. The vast majority of the content—which includes testing data and results, project management reports, and associated correspondence—was in unstructured form. During this phase, advanced text analysis and machine-learning algorithms within IBM Watson Engagement Advisor software scanned all the content to create a web of relationships among data elements.

Potapinski described the process and the expected outcome. “We put in approximately 33,000 technical documents from our previous projects. These could range from technical evaluations and geological studies to key decision logs, engineering reviews and reports. That way, if an engineer or a project manager wishes to figure out how we did something in the past, all they have to do is type in a simple question. ‘How did we design and select the compressors on the North Rankin II platform?’ That allows them to instantly surface the insights of all the people who came before them.”

Ingesting and correlating the information was only the first step. The IBM Watson solution also needed training. A core group of Woodside employees began to test the IBM Watson technology on what it had learned, guiding its answers and teaching the system to think like one of them. Despite some senior engineers' fears that the system was designed to replace instead of assist them, finding volunteers to help train IBM Watson technology was surprisingly easy according to Potapinski and Gregory.

Potapinski recalled: “We were training Watson, and a very senior engineer and project manager was helping select good answers to let Watson know which answers are effective and should be used in the machine-learning models. When Watson surfaced a particularly obscure and very difficult technical problem, I saw him cheer!”

Gregory concurred. “It turns out that (the engineers) were almost first on board. They got to leave behind a legacy for future generations.” Further, he noted, “For the juniors coming through, their ‘aha’ moment was, ‘I can gain competence in a few months by asking questions of Watson that would have taken me years.’”

Once the teams established the foundational set of content connections, engineers could begin querying the solution for recommended information to support particular decisions. Woodside could also start scaling the solution to different areas within the company.

The next step after launching the Watson for Projects instance was to develop the Watson for Drilling instance. Creating and training this took six months' work in collaboration with Woodside's geoscience team.

Drilling an offshore well can cost approximately AUD 50 million, so precision is key. Before drilling can begin, the company's geoscientists need to read 20 – 25 well-completion reports, which can be 2,000 pages long. This manual process could take 6 – 8 weeks to uncover past drilling events that could affect the current project. "It might be where we had a stuck pipe or other drilling event that we should be aware of before we start drilling in that particular area," said Potapinski. Only after that lengthy report review process could the geoscientists begin to formulate how to adjust the well design in response to prior events.

In addition to historical Woodside reports, the teams must read external reports from other oil and gas companies operating in the same regions. Potapinski noted that keyword searches don't work with these reports because the language and wording vary so widely across organizations and even generations. The Watson for Drilling instance turns the process on its head. It can read and analyze the free text and language of those critical well-completion reports and return results in real time.

Woodside engineers can now draw a circle on a relevant area of the map and "all of the drilling events that they should be aware of are instantly highlighted on the screen, in depth order," said Potapinski. The geoscientists and engineers are then free to harness their own expertise and decades of experience to make critical decisions such as: What should we do about this? Is this something of interest, or is this something we don't need to be aware of? Or, no, we need to adjust our designs subtly here.

Gregory summed it up this way: "That is the real value of cognitive technology. We get to answer better questions, tougher questions faster and with more accuracy."

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Woodside is now home to approximately a dozen IBM Watson instances, including health, safety and environment (HSE) and drilling. Gregory described the logic behind creating new instances of IBM Watson technology for each business discipline by explaining that each area of competence has its own terminology or, as he says, different languages or sublanguages. "A driller and someone who builds something, they (each) have their own dialect. So we trained Watson in the subdialects of the different disciplines. It's currently learning HSE. And so as it goes through all the different disciplines, that's how we're scaling it."

Potapinski noted: "Learning is one of the unique features of a cognitive computing system. In fact, it's actually learning while the system is in use, so it gets better with age rather than traditional software that tends to degrade and get less useful. For example, when we ask a question of Watson, our staff members are able to give it a thumbs-up. And that little thumbs-up actually conveys a whole lot of information for the Watson system to use."

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In summing up the value that Woodside gains from cognitive technology, Gregory stated: "I think that's the most exciting thing about cognitive is that it keeps learning. Once Watson's been taught and gotten better at an answer, it is immediately available to all employees no matter where they are."

Building the future of energy

Woodside can now tap into years' worth of data and personnel experience to uncover its tribal knowledge while processing new information as the company adds to its knowledge corpus. The business continues to expand its use of IBM Watson technology to different areas of the organization.

Regarding using cognitive computing throughout Woodside, CEO Coleman told his audience, “It’s not just about retooling and having the same culture in place; we’re fundamentally changing our culture with cognitive computing.”

Woodside believes it can transform its own—and perhaps its industry’s—working culture by using technology that helps its engineers and other employees perform more effectively.

The company’s adoption of cognitive computing can help realign the careers of its key people to focus on the innovation side of the company’s business. “No geologists or engineers go into their career thinking, ‘I’d really love to spend Monday to Thursday just hunting for the information I need and only on Friday getting to come up with innovative solutions,’” Potapinski asserted. “I think it’s just going to completely redefine what it means to work and how much

fun it is to work when (information discovery) is an easy step in your day.” Once the system delivers the answer or pinpoints an issue, engineers and geologists can then apply their cognitive abilities to the problem to derive creative solutions that were previously unattainable or only achieved after weeks of research or trial and error.

Gregory framed it this way: “It’s about empowering the engineers to be able to do a whole lot more and answer those tougher questions. I think that it won’t be long until those (companies) that aren’t on the cognitive journey will get left behind.

“Rather than viewing technology as a way to take out tiny incremental costs, we are trying to unlock bigger problems like how we can drive exploration costs down and how we can cut construction costs in half. These are the bigger problems,” concluded Gregory. At the same time,

the company expects to drive down employee costs by AUD 10 million by improving productivity through faster access to and more intuitive analysis of the company’s tribal knowledge.

Gregory and Potapinski agree that cognitive computing provides a huge advantage both to the engineers and to the whole company, reducing the time spent finding data by 75 percent. Specifically, instead of spending 80 percent of their time on data collection and only 20 percent of the time figuring out what to do with it, engineers can now spend 80 percent of their time deriving insights from the data that IBM Watson technology presents.

Although Woodside doesn’t expect to solve all the world’s problems, the company hopes to become an industry leader in health and safety practices, geosciences and environmental protection—all supported by cognitive computing technology.

Solution components

- IBM® Global Business Services® – Business Consulting Services
- IBM Research
- IBM Watson® Developer Cloud
- IBM Watson Conversation
- IBM Watson Engagement Advisor
- IBM Watson Retrieve and Rank
- IBM Watson Services

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