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CASE STUDY

Rio Tinto, Fer Et Titane Unearths a Critical Production Factor and Maintains Product Quality with the Help of Eureqa™

Founded in 1948, Rio Tinto, Fer et Titane (RTFT) is a world leader in the production of titanium dioxide feedstock and high-quality pig iron, steel, and metal powders.

A wholly-owned subsidiary of mining giant Rio Tinto, it operates the world's most productive ilmenite mine, located in northeastern Québec, and a unique complex of interconnected plants in Sorel-Tracy, just east of Montréal, where ore from that mine and elsewhere is processed.

One of the plants in that complex produces iron and steel powder and is a major supplier of these to the North American, Europe and Asia auto parts industries. Demand for metal powders has soared in recent years as metal parts manufacturers increasingly turn from older approaches requiring more milling to a more efficient powder-based manufacturing process. In a nutshell, this process involves mixing iron or steel powder with various additives, compressing that mixture into the desired shape, and hardening that shape by exposing it to high heat.

A Conundrum at the Sorel-Tracy Powder Plant

In mid-2013, Marko Litalien, Superintendent of Process Development for RTFT's Steel and Powder Division, faced a serious problem. To ensure consistent product quality, the lab in the Sorel-Tracy Powder Plant creates hundreds of sample parts each week (one part for each grade of powder) and tests those parts to ensure that they meet specifications for hardness, transverse rupture strength, and various other physical properties. What had Litalien concerned was a slow but steady slippage of one of those specifications for one grade of powder. "It was changing, month after month, and we needed to figure out why," he says. "We were beginning to get internal rejects — batches of powder that we wouldn't sell because they didn't meet our high standards for quality."

Litalien was sure the explanation for the slipping specification could be found somewhere within the RTFT databases. With sensors providing ever greater detail on processing conditions and the physical and chemical properties of every input and output, data collection had grown exponentially over the past decade — process analyses involving more than 100 variables had become commonplace. The question, then, was how to find the key variable or variables within that mountain of available data.

To handle a similar problem in the past, an outside statistical analysis firm had been employed. The result had been good… eventually. It had taken at least three months to go from making the initial call to getting a final answer. The current situation demanded quicker action.

Litalien had also had some past success with a desktop multivariate-analysis tool, but it could handle only about 15 variables. While this wasn't one of those cases involving 100-plus variables, he wasn't sure 15 would suffice. His thoughts, therefore, turned to Eureqa.

An avid follower of advances in data analysis, Litalien had previously downloaded Eureqa after reading of its success in deriving physical laws from data generated by double pendulums and other complex physical systems. "I told myself, if it works for that, it will probably work for any type of data," he says.

Eureqa Finds the Problem in 45 Minutes

Frédéric Benoit, a process engineer at the powder plant, was open to Litalien's suggestion that Eureqa be given a shot. After a little experimentation, Benoit pasted in some data, started Eureqa's formula search, watched formulas pop up for a while, then went to work on something else. When he returned, about 45 minutes into the search, he found a curious thing — an equation linking the slipping specification to a variable that was already known to be important, but also to one that was a complete surprise. "It was an aspect of chemical composition that we didn't believe

RioTinto

ORGANIZATION

Rio Tinto, Fer et Titane (RTFT), a wholly-owned subsidiary of Rio Tinto

INDUSTRY

Mining and Metals

CHALLENGE

Given a very large data set, quickly isolate the factor responsible for an unexplained change in an important product specification.

SOLUTION

Eureqa's model revealed a previously unknown link between changes in an aspect of chemical composition and changes in the product specification — a link RTFT believes is still largely unknown within their industry.

RESULTS

- New insight into the production process
- Process modifications yielding improved quality assurance
- Consistent supply of product to customers

KEY FEATURES FOR RIO TINTO, FER ET TITANE

- Fast handling of large numbers of variables allows inclusion of variables not previously known to be relevant.
- Model transparency provides clear signals regarding which variables are important and which are not.
- Normalization and other pretreatment of data can be conveniently handled within Eureqa.
- Expert knowledge can optionally be applied in the choice of mathematical "building blocks" thereby increasing search efficiency.
- A highly intuitive graphical interface provides immediate usability.

had any link to the problematic spec," he says. "In a normal statistical analysis, I probably wouldn't even have included it. I threw it in just because it was easy and I knew Eureqa didn't have a problem handling large numbers of variables."

Benoit wasn't immediately convinced that the implicated variable had a "real" effect, but after the correlation held up through a couple days of crosschecking, he sought input from the plant's R&D engineers. "They searched the metallurgical literature and found some things that would explain the phenomenon pretty well," he says. "At that point, everything started to make sense."

The engineering team went to work devising process modifications that would control the variable. After testing, these were implemented, and the specification returned to normal.

A New Tool for a New Era of Big Data

The experience has made Eureqa evangelists out of Litalien and Benoit. Their recent presentation touting Eureqa's potential was warmly received by an audience of RTFT process plant managers, engineers, and technicians. Two R&D directors reported having particular applications already in mind.

Litalien supplies a closing thought: "Knowing what we now know, we're going to use Eureqa whenever there's an opportunity. It's something special you have here. I'm convinced that if you give it good data, and the relevant variables are included, you're going to get a good answer."

Benoit adds: "We're living in an era where we have an enormous amount data that no one really understands. When I see software like this that can take that data and make sense of it, I think we're going in the right direction."

About Eureqa

Eureqa is breakthrough technology that uncovers and explains the intrinsic relationships hidden within complex data. To find out more, or to get started with a free trial on your desktop or online, visit **www.nutonian.com**.

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