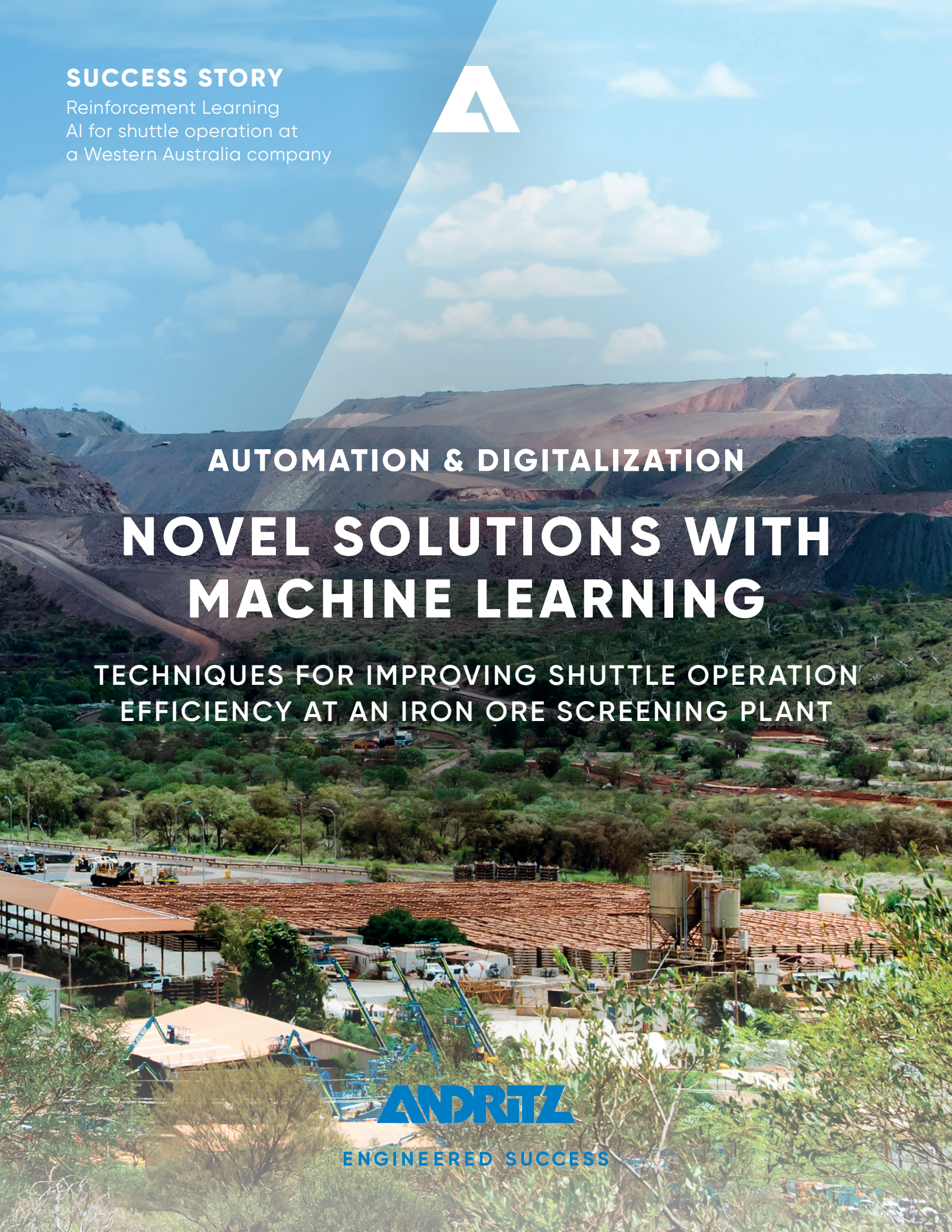
SUCCESS STORY

Reinforcement Learning
AI for shuttle operation at
a Western Australia company



AUTOMATION & DIGITALIZATION

NOVEL SOLUTIONS WITH MACHINE LEARNING

TECHNIQUES FOR IMPROVING SHUTTLE OPERATION EFFICIENCY AT AN IRON ORE SCREENING PLANT

ANDRITZ

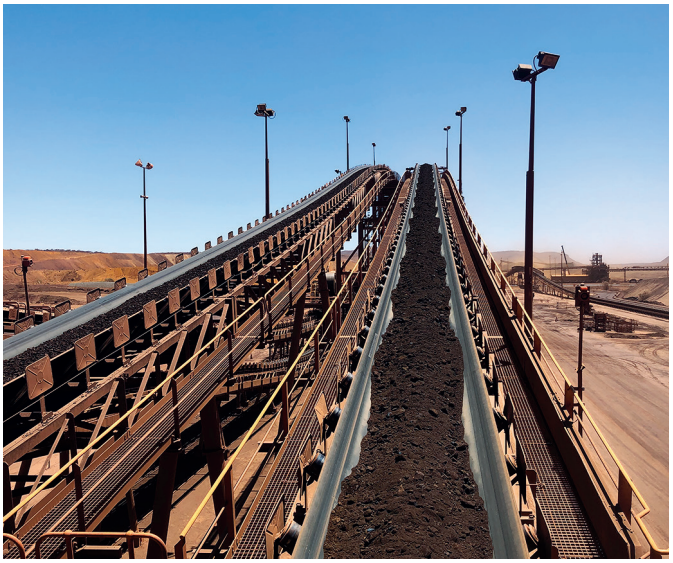
ENGINEERED SUCCESS

The challenge

Improve shuttle operation efficiency using novel methods

At the customer's ore handling plant, shuttle operation was impacting the productivity of the iron ore screening plant. The traditional methods and technologies used for controlling the motion of shuttles were causing inefficiencies in the ore distribution process across multiple screening modules, affecting utilization and throughput rates.

Operational scenarios that could not be addressed by conventional control logics were leading to undesired events, such as high-level alarms and low-level interlocks in the screening bins, which demanded excessive manual intervention by control room operators. The company had worked with ANDRITZ on past optimization and advanced process control projects in this process area, and asked ANDRITZ to apply their expertise in automation an digitalization to find a solution.



Our solution

Real-time control using reinforcement learning and artificial intelligence

To address these challenges, a Reinforcement Learning (RL) Artificial Intelligence (AI) solution was deployed to control the motion operation of the scalping and products screening shuttles. Central to the AI development was ANDRITZ's patented dynamic process simulation and modelling IDEAS® software platform, which created a real-time facsimile of the live process that allowed for extensive offline testing and design iteration.

Designing and developing an RL controller required a variety of innovative controls engineering practices. The RL algorithm was trained in advance to handle multiple operational scenarios and generate optimized outputs. In nominal operation, the shuttles were moved in a modulating and highly predictive fashion over the entire range of safely reachable bins. The AI control agent, when needed, deviated from the modulation behavior, employing strategies like bin jumping or ore break to move to other groups or clusters of available bins.

The RL platform's capabilities included real-time learning and adaptation to new operational patterns and process changes, enhancing strategies for shuttle dwelling times, target setting, and speed control.

Results

Improved control performance through machine learning

The Reinforcement Learning AI solution has better managed the challenges associated with shuttle operation and control at the customer's plant, resulting in a more efficient ore delivery process, superior operations stability, and increased production rates. Applying RL control to real-time equipment control both improved control performance and enabled functions that could not be achieved using conventional control approaches.

The ore break function in particular demonstrated significantly improved performance in scenarios where certain bins were out of service, leading to a 40% increase in screening area throughput during module outages. In addition, a 17% reduction in production losses associated with bin starvation events was realized, along with a 15% decrease in start-up duration and a 0.4% improvement in overall bin variability.

15%

DECREASE IN START-UP DURATION

17%

REDUCTION IN PRODUCTION LOSSES

0.4%

IMPROVEMENT IN OVERALL BIN VARIABILITY

WHY WORK WITH ANDRITZ

International technology group ANDRITZ offers a broad portfolio of innovative plants, equipment, systems, services and digital solutions for a wide range of industries and end markets. Sustainability is an integral part of the company's business strategy and corporate culture. With its extensive portfolio of sustainable products and solutions, ANDRITZ aims to make the greatest possible contribution to a sustainable future and help its customers achieve their sustainability goals. ANDRITZ is a global market leader in all four of its business areas – Pulp & Paper, Metals, Hydro and Separation. Technological leadership and global presence are cornerstones of the group's strategy, which is focused on long-term profitable growth. The publicly listed group has around 29,100 employees and over 280 locations in more than 40 countries.

FRANCE, SPAIN AND PORTUGAL
ANDRITZ SAS
p: +351 911 091 130
metris@andritz.com

NORTHERN EUROPE
ANDRITZ Oy
p: +358 20 450 5555
metris@andritz.com

INDIA/SOUTHEAST ASIA
ANDRITZ Technologies Pvt. Ltd
Bangalore
p: +91 80 46669600 657
metris@andritz.com

NORTH AMERICA
ANDRITZ Inc.
p: +1 770 640 2500
metris@andritz.com

AUSTRALIA AND NEW ZELAND
ANDRITZ PTY LTD
p: +61 455 745 800
metris@andritz.com

CHINA
ANDRITZ (China) Ltd.
p: +86 757 8258 6708
m: +86 186 8003 6919
metris@andritz.com

LATIN AMERICA
ANDRITZ Chile
m: + 56 9 4030 7815
Sindus ANDRITZ
m: +55 (11) 97279 0316
metris@andritz.com

CENTRAL EUROPE
ANDRITZ AG
metris@andritz.com

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