Vale autonomous haul trucks and drills in Brazil

IMPLEMENTED 2016–2026 · MINING AND RESOURCES · BRAZIL · BAND C · CLAIMED ONLY
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Vale runs driverless haul trucks, drills and yard machines at Brazilian iron ore mines, controlled from remote rooms, and is expanding the fleet at Carajás.

ABOUT THIS SYNOPSIS

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NOTICE WORDING LAST UPDATED 16 NOVEMBER 2026

AT A GLANCE

AI and automation used: Autonomous haul trucks, drills and yard machines (computer systems, GPS, radar and artificial intelligence, per Vale).

Implemented: 2016–2026. Grade: band C, Process change, Claimed only.

Headline result, as reported: Vale reports 11% higher hourly productivity and no truck-caused accidents at Brucutu after five years; no independent check found

1 · The case

The facts, as reported by the 5 sources listed at the end. Where a source is silent, the field says "Not reported".

Organisation

Vale. Brazilian mining company. Operates iron ore mines in Minas Gerais and Pará, among others. The autonomous programme covers haul trucks, drill rigs and yard machines. Headcount or turnover: Not reported in the sources used. Canvas block: 4. Operations and process. Also 5. People and skills, 6. Data and technology.

Business challenge

The challenge. Vale says the aim is to reduce people's exposure to risk in mine pits and stockyards, while improving productivity, fuel use and component life. Its release names tipping and collisions as risks to truck operators.

How it was addressed. Vale fitted trucks, drills and yard machines with autonomous kits

Who implemented it

Caterpillar and Sotreq (Equipment or robot maker): Supply Cat MineStar Command for hauling and truck conversion under the 2025 Northern System agreement.
Komatsu (Equipment or robot maker): Its FrontRunner system runs the 14 autonomous trucks at the N4E mine, per International Mining.
In-house (In-house): Operates and supervises the autonomous fleet from remote centres.

Technology (SEAM pillar E)

SEAM types: T9 AI in physical systems. Deployment: Not reported. Vendors and products: Caterpillar, Komatsu, Sotreq, Cat MineStar Command for hauling, Komatsu FrontRunner.

Where it was built in: Autonomous kits (sensors, cameras, radar, navigation) fitted to trucks, drills and yard machines, with communications networks, control software and remote operation centres.

What changed

Before: operators in every cab. After: at Brucutu all 13 trucks run without a driver, supervised from control rooms, and operators moved to other roles (Vale, 2021). Vale reports hourly productivity up 11%, fuel use 11% lower than crewed trucks, tyre life up 35% and no accidents caused by autonomous trucks since 2016. By April 2022, around 300 employees had stopped working in risk areas, by Vale's account. [1] [2] [3] [4] [5]

What it cost

Reuters reported that Vale's total investment in autonomous trucks reached about US$210 million through 2024, citing Vale's executive vice president of operations. Terms of the 2025 Caterpillar deal were not disclosed.

What it saved

Not reported in money terms. Vale reports 4,300 tons of CO2 a year saved from lower fuel use at Brucutu (2021) and says trucks can run 20 hours a day instead of 15 (2026 report, as relayed by International Mining). [1] [2] [3] [4] [5]

Governance and control

No named accountable owner, AI policy or assurance process is described in the sources. Vale describes safety systems that slow or stop trucks when sensors detect unexpected objects or people, and training for all staff involved.

S2 · Accountable owner · Not reported
Not reported.

A1 · Safe use · Claimed
Vale says all vehicles in the pit are adapted so that manned and autonomous vehicles interact safely. [1]

A2 · Human in the loop · Claimed
Teams supervise the autonomous operation from control rooms, and the control centre can stop trucks,

A3 · Monitoring and assurance · Not reported
Not reported.

A4 · Vendor AI · Not reported
Caterpillar and Komatsu systems are named; how vendor AI is assessed is not reported. [5]

A5 · Agent controls · Claimed
Vale says trucks reduce speed or stop on unexpected obstacles, per its 2021 release. [1]

A6 · Standards and regulation · Not reported
Not reported.

What worked, what did not, what is unproven

WORKED

– Vale reports no accidents caused by autonomous trucks at Brucutu from 2016 to 2021.

– Vale reports hourly productivity up 11%, five points above its expectation, and tyre life up 35%.

– The programme has grown from one mine to Minas Gerais, Pará, Maranhão and Rio de Janeiro, and Vale is expanding it at Carajás.

DID NOT

– Not reported: Vale's sources describe no failures or setbacks.

UNPROVEN

– Productivity, fuel and safety results have not been independently checked.

– Which share of the 11% gain comes from the AI and which from fleet management, road design and other changes.

– Whether Carajás, with a different climate and ore, will match Brucutu.

Timeline

2016 Autonomous trucks begin in test mode at the Brucutu mine in Minas Gerais [1]

2019 All 13 trucks at Brucutu run autonomously, the first fully autonomous mine in Brazil, per Vale [1]

Jun 2021 Brucutu trucks reach 100 million tons moved; Vale reports 11% higher hourly productivity [1]

Apr 2022 Vale reports 72 autonomous machines in Brazil: 24 trucks, 18 drill rigs and 30 yard machines [2]

Dec 2025 Vale, Caterpillar and Sotreq agree to expand autonomous haul trucks in the Northern System [3]

Jul 2026 Vale's 2025 innovation report counts more than 70 autonomous units in Brazil, including 29 trucks [4]

2 · Grade and SEAM assessment

MarLuc's opinion, made on the evidence above. How cases are graded: marluc.co.uk/case-studies/how-we-rate

Level of change and impact

Claimed: Not applicable. Grade: C, Process change. Proof: Claimed only. Level of change: Process change.

Process change (Level 2, band C). Haulage, drilling and yard work were redesigned around remote control, with training and role changes; results are Vale's own.

Graded C, marker Claimed only. Haulage was redesigned around remote control rooms and results are reported over five years, but every figure comes from Vale itself. Autonomous haulage is partly AI: Vale's release lists computer systems, GPS, radar and artificial intelligence together.

The SEAM view and lessons learnt

The result came from a decade of staged work: test mode, one mine, then a fleet, then conversion kits for existing trucks. The AI's part cannot be separated from sensors, radar, control rooms, road changes and fleet planning, and Vale reports one combined result. Before copying it, a leadership team should ask how safety is verified when manned and autonomous vehicles share a pit, and what the economics are once retrofit costs are counted; Vale has not published them.

1. Start in test mode at one site and expand only after results are measured.
2. Plan new roles and training for operators before the first truck goes driverless.
3. Publish safety and productivity results with their method, so they can be checked.

Evidence

Score 1 of 4. Self-reported with some outside relay: figures come from Vale's releases and its 2025 report as relayed by International Mining; Reuters (republished by Kitco) reports a Vale executive on the expansion and investment. No independent evaluation.

Evaluation method. Self-reported company figures: before-and-after comparisons published by Vale. A Reuters interview reports the fleet expansion plan; no independent evaluation of productivity or safety was found.

Sources disagree. Start date: Vale's 2021 release says autonomous trucks began in test mode in 2016; Vale's 2022 release, Reuters and Vale's 2025 report (via International Mining) say the first trucks began operating in 2018. Northern System: International Mining (December 2025) says autonomy there began in 2019; Vale's 2022 release dates the Carajás truck implementation to September 2021. Truck numbers: Reuters gives 18 autonomous trucks at the end of 2025, growing to 90; International Mining says the Northern System has 14. Tyre life: up 35% at Brucutu (Vale, 2021) and up to 25% in Vale's 2025 report.

Status. Ongoing: expansion to about 90 autonomous trucks in the Northern System by 2028, per Vale's executive in Reuters.

3 · Original sources

Read these in full. To challenge a fact or a grade, use the contact form at marluc.co.uk or the link on https://marluc.co.uk/case-studies/vale-autonomous-haul-trucks-brazil

[1] Vale: Vale completes 100 million tons handled by autonomous trucks at the Brucutu mine with safety and environmental benefits
https://vale.com/w/vale-completes-100-million-tons-handled-by-autonomous-trucks-at-the-brucutu-mine-with-safety-and-environmental-benefits

[2] Vale: Vale expands the use of autonomous equipment and has 72 pieces operating in Brazil
https://vale.com/w/vale-expands-the-use-of-autonomous-equipment-and-has-72-pieces-operating-in-brazil-benefiting-directly-more-than-300-employees

[3] Kitco (republished Reuters report): Vale to boost autonomous truck fleet in deal with Caterpillar
https://www.kitco.com/news/off-the-wire/2025-12-08/vale-boost-autonomous-truck-fleet-deal-caterpillar

[4] International Mining: Vale's mine of the future journey continues
https://im-mining.com/2026/07/18/vales-mine-of-the-future-journey-continues/

[5] International Mining: Vale confirms autonomous truck fleet expansion deal with Caterpillar
https://im-mining.com/2025/12/08/vale-confirms-autonomous-truck-fleet-expansion-deal-with-caterpillar/

Vale website: https://vale.com

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