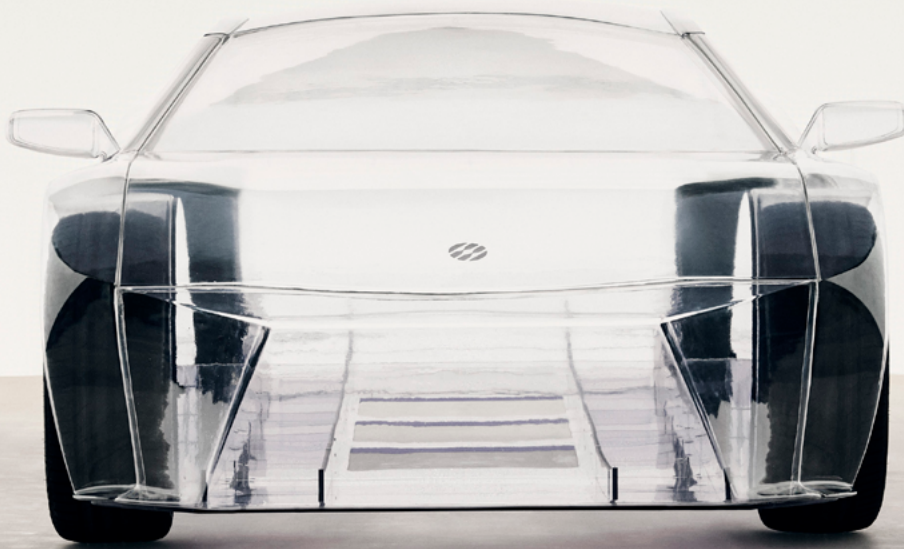


# Meeting the engineering challenge of a lifetime

Sandvik 2025



# The world is entering a decisive decade

The shift toward a low-carbon, sustainable future relies on a secure, responsible supply of minerals and metals essential for clean energy, electric vehicles, advanced manufacturing and digital infrastructure.



Mining is not simply part of this transformation; it is its foundation. Without it, there is no electrification of society.

Yet delivering on this opportunity will require more than process innovation or investment in new mining projects. It will require people – brilliant, driven, and creative minds who can reimagine what mining can be. The engineers, data scientists, geologists, and technologists entering the workforce today will shape how our industry operates tomorrow. They will create safer mines, expand the benefits of automation and AI, minimize environmental impact and ensure mining remains relevant and sustainable.

That's why we conducted global research with exactly this audience – to listen to the next generation of STEM talent, to learn what interests them, what concerns them and what they would expect from a career in mining. Their perceptions matter because they will determine who joins the industry, how it innovates and how mining

evolves to meet the needs of today and tomorrow.

However, this report is not just a snapshot of perceptions. It is a call to action for industry to listen, to adapt and to connect more deeply with the next generation of innovators – to inspire them with the scale of the challenge and to show them that a career in mining is a career that is shaping the future of our planet.

For me, the prospect of transforming an entire industry while making a critical contribution to the world's energy transition is an engineering challenge of a lifetime.

Together, we can establish mining not just as the engine of this transition, but also a sector where the best and brightest minds want to be.

**Stefan Widing**  
President & CEO  
Sandvik Group



# The future of mining talent: What STEM graduates really think, and what the industry can do about it

The mining industry has long served as a foundation for socio-economic progress. It provides the raw materials that power economies, build cities and help to feed the growing global population. As the world accelerates towards net zero, the industry's relevance is deepening – every electric vehicle, wind turbine and solar panel relies on metals and minerals drawn from the earth to function properly.

Technology and innovation are essential in supporting safe, efficient minerals production, and today's mine sites are cleaner, greener and more highly automated than ever. However, despite its growing importance to society and the health of the planet, the mining industry faces an urgent challenge that could undermine its future viability.

While the need for advanced technical expertise is accelerating, the global pipeline of skilled engineering talent is shrinking. This challenge is not specific to mining, although as an industry that's built on engineering, the sector is feeling the squeeze acutely. For instance, in the US, nearly half the mining workforce is projected to retire by 2029<sup>1</sup>. In Australia, a shortfall of 8,000 skilled professionals is expected within the next year<sup>2</sup>, while in Canada, only five

percent of the current mining workforce is under the age of twenty-five.<sup>3</sup>

A study by McKinsey found that enrolment in mining engineering programs has declined by more than sixty percent in Australia since 2014 and by almost forty percent in the US since 2016.<sup>4</sup> Globally, more students are choosing fields such as technology, renewable energy, and data science – industries they associate with innovation and purpose.

EY's latest Top 10 Business Risks and Opportunities for Mining and Metals report identified the workforce shortage as one of the top six global risks facing miners in 2026. Seventy-five percent of mining executives surveyed by the company said they were not confident in their ability to fill critical engineering and operational roles, and the report links this shortage directly to lost productivity, higher safety risks and constrained supply growth.<sup>5</sup>

New skills, particularly in digital systems, automation and sustainability are essential to modern mines. Addressing this shortage and sustaining global minerals and metals production therefore demands a stronger flow of graduates and a redefinition of what engineering in mining actually means.

Many potential recruits are not rejecting mining, they simply do not know enough about it to make an informed choice

# Understanding engineering’s next generation

To better understand the mindset of future engineers, Sandvik conducted a global survey in 2025 to examine the perceptions of 824 science, technology, engineering and mathematics (STEM) students and graduates from nine countries. The results underscored how awareness, perception and purpose can influence career choices.

Nearly 40 percent of respondents reported being unfamiliar with the mining industry, and an equal share cited this lack of knowledge as a reason for not considering it as a career option. In other words, many potential recruits are not rejecting mining, they simply do not know enough about it to make an informed choice.

As Professor Elisabeth Clausen of RWTH Aachen University notes: “Alongside the low perception of mining’s relevance, the still-prevalent outdated image of the industry seems to deter young people from choosing mining as a career path.”

52 percent of respondents viewed mining favorably, compared with 86 percent for the technology sector and 74 percent for energy. The difference varied by geography: in Chile and South Africa, where mining is visibly linked to national prosperity, positivity exceeded sixty percent; while in Finland, Canada, and the US favorability fell below half, as shown in figure 1.

Safety and environmental concerns were the most common deterrents to a career path in mining, followed by lack of knowledge – see figure 2. Yet the same respondents also highlighted

powerful attractions, including high salary potential, the chance to work with advanced technologies and challenging engineering problems. Over 90% said they would be more likely to consider mining if convinced that it contributes meaningfully to addressing climate change.

“Alongside the low perception of mining’s relevance, the still-prevalent outdated image of the industry seems to deter young people from choosing mining as a career path”

Professor Elisabeth Clausen  
RWTH Aachen University

Figure 1:  
Mining favorability by market

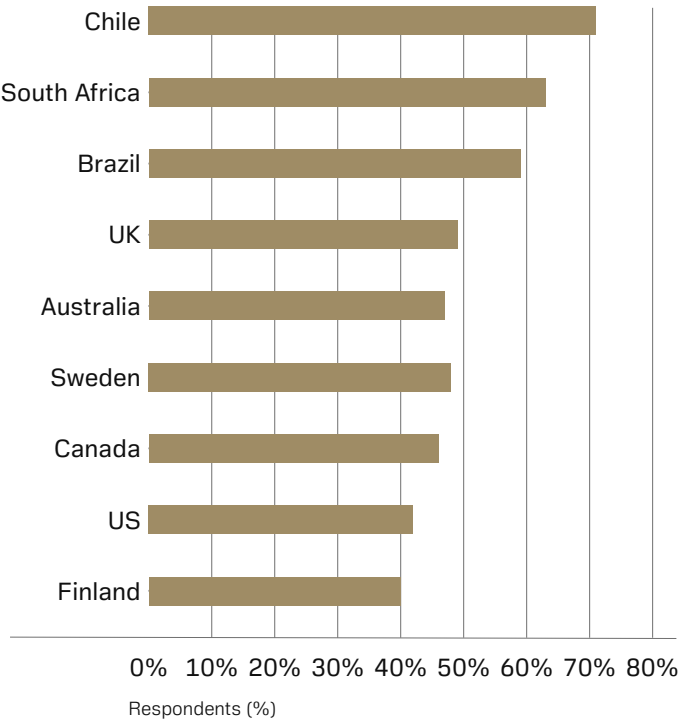


Figure 1:  
What best describes your general perception of the mining industry?

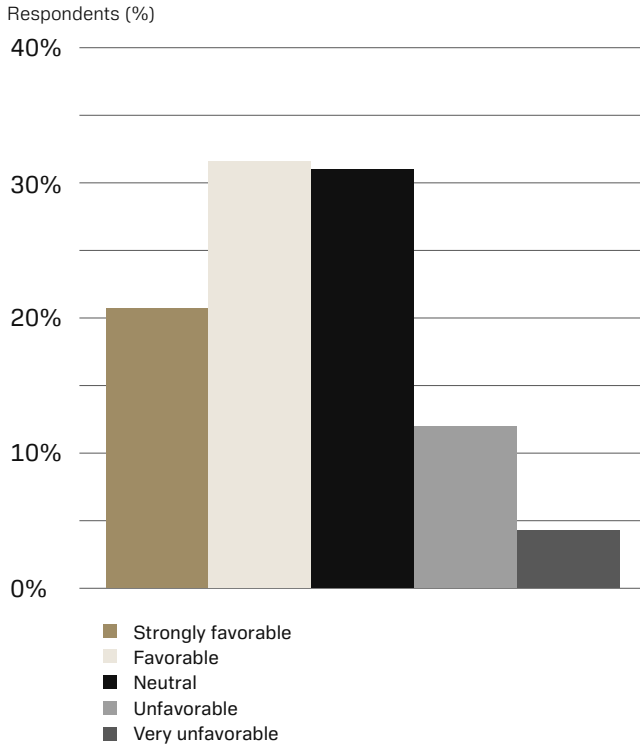


Figure 1:  
Mining favorability

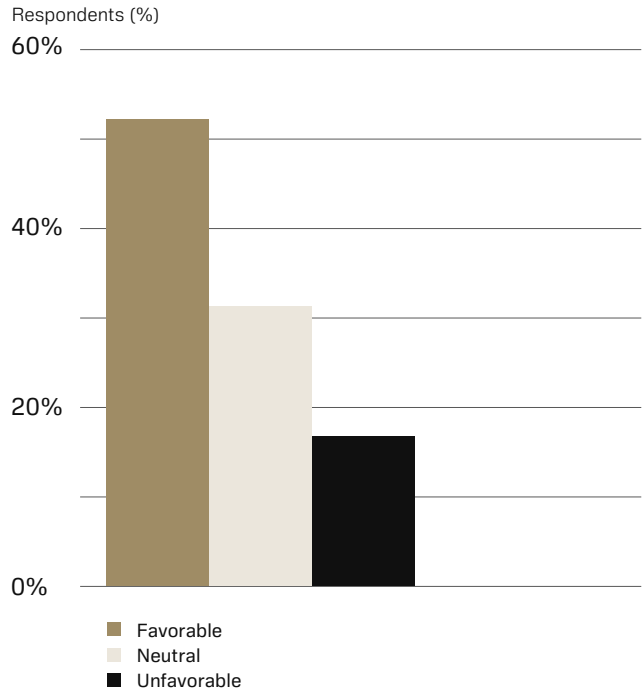
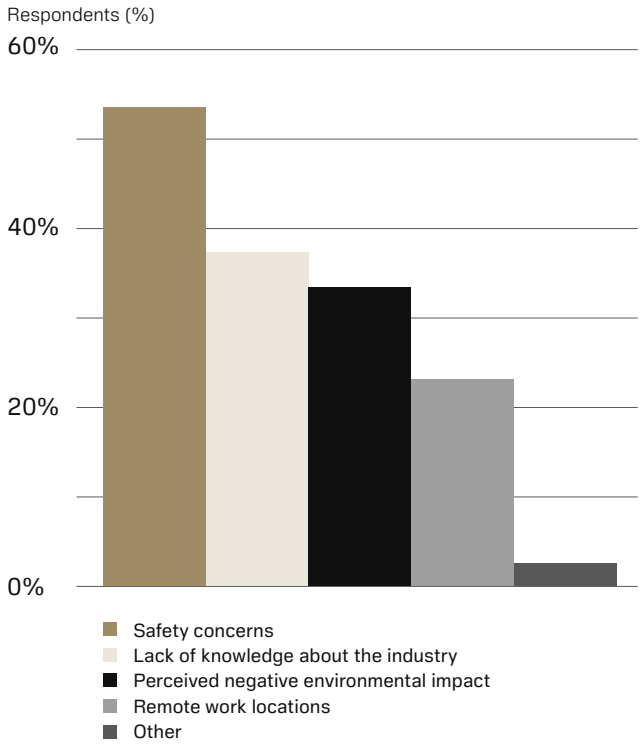


Figure 2:  
What factors deter you from considering a career in the mining industry?



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# The perception – reality gap

Modern mining bears little resemblance to the images most students hold. Many of today's operations are built around data platforms, autonomous fleets, safety systems and predictive analytics. However, the public narrative has not yet caught up.

According to the Organization for Economic Cooperation and Development (OECD), deep-rooted perceptions of mining as a physically demanding and inherently masculine field discourage many people, especially women and young people, from pursuing careers in the sector.<sup>6</sup> The Institute of Materials, Minerals and Mining (IOM3) added that the closure of mining and metallurgy departments in several universities in recent years has further weakened visibility and reduced the number of graduates entering the field.<sup>7</sup>

Bridging this gap will require an evolution in how the industry is perceived. Going forward, mining must reframe itself as a domain of engineering innovation, integral to the green energy transition, circular economy and advanced manufacturing, rather than a relic of industrial history.

Examples from across the industry already illustrate this shift. Many mining companies, for example, are automating their loading and hauling activities, introducing electrified fleets to reduce emissions and are making these projects a central part of their communications efforts. In Arizona, South32 is designing its Hermosa project to be its first 'next generation mine'. The operation will harness automation and battery-electric vehicles to drive efficiencies, minimize its environmental impact and achieve carbon-neutral status.<sup>8</sup>

Collaborations with universities and technology partners also show how academic research, automation expertise and field implementation can accelerate these types of projects. For example, the Mechatronics Program within Sandvik Academy is

the result of a 12-month collaboration with a technical university in South Africa. The course integrates mechanical, electrical and software skills, to help mine technicians manage increasingly complex equipment.<sup>9</sup>

By highlighting such initiatives, the industry can demonstrate that not only is mining a modern industry, but that it's indispensable to sustainable global progress.

## Systemic change to address a systemic challenge

Addressing mining's talent challenge will require a combination of structural, educational and cultural changes, undertaken collaboratively over a sustained time period. Guided by our research, the following are three key areas on which the industry could focus its efforts.

### 1. Redefining perceptions of mining

To attract future engineering talent, mining's identity must evolve from extraction to innovation and purpose. EY's 2026 report calls on companies to "counter outdated perceptions and showcase the exciting roles on offer," emphasizing new opportunities in AI, automation and digital transformation.

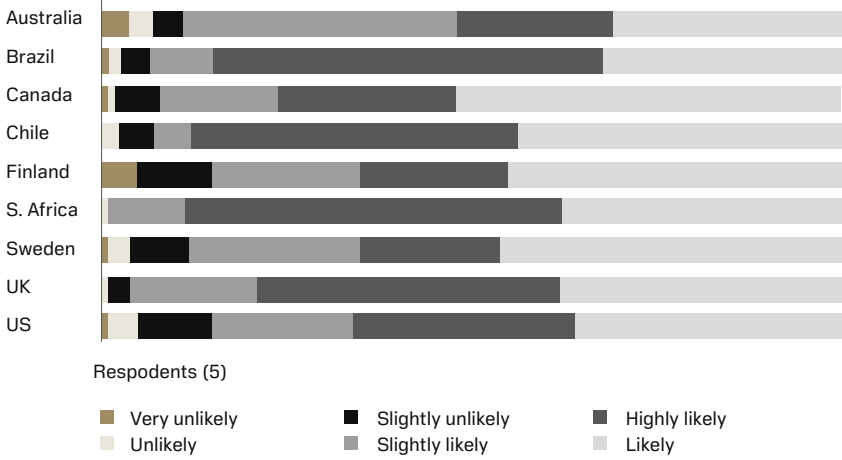
Emphasizing the work of engineers in developing solutions that tackle broad issues, such as climate change, ending poverty and supplying clean water, helps to translate purpose into practice. Case studies and collaborations that demonstrate tangible progress often resonate far more strongly than abstract messaging.

A good example of this opportunity comes from the MAS-SIV+ project in Europe; in 2024, a group of companies from the auto-manufacturing value chain, including Microsoft, Volvo Cars, Alfa Laval and Sandvik, joined forces to improve their sustainability reporting in line with the Corporate Sustainability Reporting

Directive (CSRD) and European Sustainability Reporting Standards (ESRS). Through data sharing and centralization, the project aims to make the reporting of greenhouse gas (GHG) emissions more accurate and transparent. This will enable more informed purchasing decisions and targeted GHG reduction programs.<sup>10</sup>

Sandvik’s research shows that addressing climate change is a key driver for emerging engineering talent across multiple geographies, and that contributing towards it would make mining a more attractive employer (see figure 3). In short, the more the industry speaks in the language of technology and problem-solving, the more relevant it becomes to today’s STEM talent.

Figure 3:  
Would knowing that you could make a vital contribution to addressing climate change change you more likely to consider a career in the industry?



2. Rebuilding the talent pipeline

Awareness begins long before recruitment. Sandvik’s research found that more than half of its respondents would be more open to a career in mining if they had access to learning resources and first-hand experience through internships – see figure 4. Partnerships between companies, universities, and research institutions at every stage of the talent pipeline can help to bridge this gap.

For example, not-for-profit organization, Future Is Mine, partners with UK primary schools to raise public awareness of critical minerals and their applications among children aged 4-11 years. It does this through in-person workshops, free online learning resources and its Critical

Minerals 101 hub.<sup>11</sup>

At the opposite end of the education spectrum, some mining companies and technology firms have co-created academic modules on robotics and mineral systems engineering, while others have opened digital mine labs that allow students to experiment with artificial intelligence or emerging materials. For instance, in December 2024, Imperial College London and Rio Tinto launched the US\$150 million Rio Tinto Centre for Future Materials. Over the next 10 years, this will connect researchers and industry to transform the way materials are sourced, processed, used and recycled, making them more sustainable.<sup>12</sup>

Microcredentials are another power-

ful tool in upskilling talent for critical roles in the mining industry. Engineers from adjacent fields, such as chemical or mechanical engineering, may be more willing to consider the move to mining if time- and cost-efficient training courses are available.

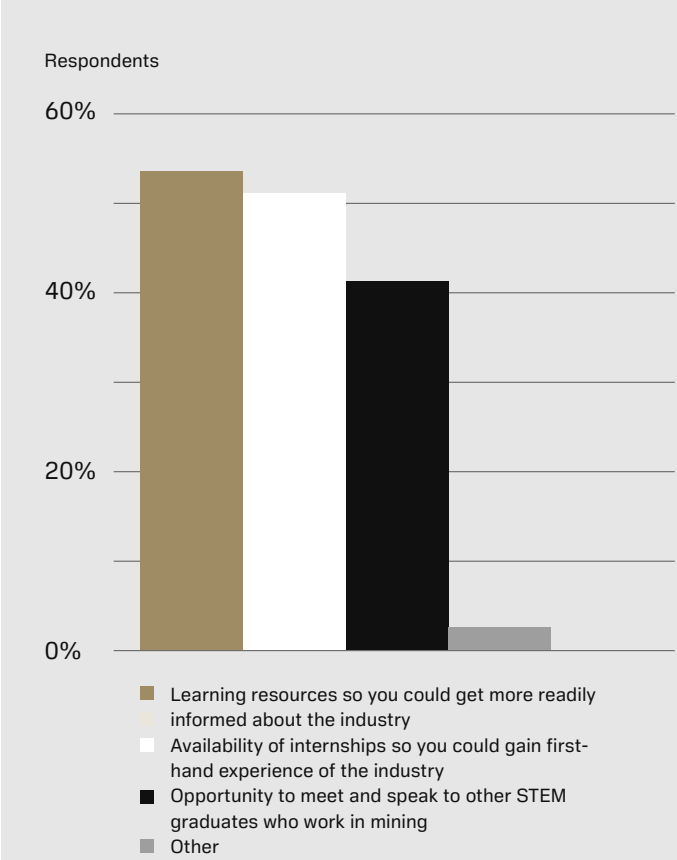
By investing in these types of programs, the industry is not only educating, but also mentoring, inspiring and, ultimately, positioning itself as a desirable, forward-thinking future employer.

3. Rethinking culture and DE&I

The modernization of mining requires cultural change as well as technological innovation. Safety, accountability, and diversity are now central to employer credibility.



Figure 4:  
What might make mining more appealing to you?



Technologies such as automation and predictive analytics have made mining significantly safer, but these achievements often go unnoticed by the public. Transparent and consistent reporting of safety performance and environmental data – both good and bad – can help build credence over time.

Equally important is inclusion. Diversity, equity and inclusion – or DE&I – is a decisive lever for closing the skills gap. EY’s study observes that diverse teams enhance innovation and resilience, while McKinsey notes organizations that actively recruit and support women in engineering outperform their peers on retention and engagement.

While women currently make up around 15% of the global mining workforce<sup>13</sup>, Sandvik’s research showed that the gap between men and women in their likelihood to pursue a career in mining is not as significant as might be expected – see figure five.

This suggests that experiences within the industry and its culture (both lived and shared) are key factors in onboarding and retaining female engineers. Companies that invest to create more inclusive hiring cultures and value propositions for diverse expertise could have a chance to expand their recruitment pool and strengthen talent retention.

**Engineering the future we all want**

The mining sector’s contribution to society’s future and to the global energy transition depend on a workforce that’s capable of designing and delivering safer, cleaner and smarter operations. The challenge isn’t just finding this talent but positioning mining

as a field that engineers consider vital to tackling the world’s most complex and consequential problems.

As industries from technology to aerospace compete for STEM graduates, mining must offer something distinctive: the opportunity to apply innovation to overcome real-world social and sustainability challenges. The future of mining will be engineered by those who can see beyond extraction and recognize that progress in materials, technology and society are deeply connected.

As Björn Axelsson, Executive Vice President & Head of HR, Sandvik Group, concludes:

“The green transition will be powered by minerals. But it will be led by the next generation of minds who are bold enough to transform how we mine.”

<sup>1</sup> ["Workforce Trends in the U.S. Mining Industry"](#) webpage, Society for Mining, Metallurgy & Exploration, accessed 17 October 2025.

<sup>2</sup> Marcus Law, ["Global Mining Industry Faces Severe Skills Shortage"](#), Mining Digital, 12 August 2024.

<sup>3</sup> ["Critical Obstacles for Canada's Mining Talent Pipeline"](#), Mining Industry Human Resources Council, July 2024.

<sup>4</sup> ["Has mining lost its luster? Why talent is moving elsewhere and how to bring them back"](#), McKinsey & Co, 14 February 2023.

<sup>5</sup> ["Top 10 Business Risks and Opportunities for Mining and Metals 2026"](#), EY, 16 October 2026.

<sup>6</sup> OECD, ["Mining for talent"](#), OECD Local Economic and Employment Development (LEED) Papers, June 2025.

<sup>7</sup> Rachel Stonehouse, ["The talent gap – critical skills for critical materials"](#), IOM3, 1 September 2023.

<sup>8</sup> Sandvik, ["Sandvik to supply its largest-ever BEV fleet to South32"](#) press release, 23 April 2025.

<sup>9</sup> ["Preparing the workforce of the future"](#), Sandvik podcast, 19 May 2025.

<sup>10</sup> Sandvik, ["Sustainability reporting can be a MASSIV+ task"](#) press release, 10 September 2024.

<sup>11</sup> ["Future is Mine"](#) homepage, accessed 17 October 2025.

<sup>12</sup> Simon Levey and Deborah Evanson, ["Imperial and Rio Tinto launch \\$150m partnership to support the energy transition"](#), Imperial College London, 2 December 2024.

<sup>13</sup> Rachel Perks and Tehreem Saifey Ford, ["Breaking barriers for women in mining"](#), World Bank Blogs, 14 June 2024.

