

AMT: Mining needs new models of innovation

EMEA Editor Craig Guthrie talks to Dr.-Ing. Karl Nienhaus, endowment professor at the Ulrich-Thiele-Stiftung Institute for Advanced Mining Technologies (AMT), which is part of RWTH Aachen University in Germany, about the need to work together to face tomorrow's challenges.



Removing people from unsafe areas in the mine

Future Of Mining > Innovation

Advances in technology have fuelled a transformation of the mining industry over the past decade, but looking towards the next, it is increasingly apparent that a deepened integration of these systems will be essential.

Comments

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Craig Guthrie

Building inter-connected networks running smarter, greener autonomous systems will only be possible if companies let down their competitive guards, and allow data to flow between different departments, sectors and organisations.

Independent and impartial groups leading innovations in this area will play a vital role in facilitating and encouraging this collaboration, particularly as the leading-edge solutions gradually migrate from majors' experimental mines to mid and smaller-sized operations.

Mining Magazine: How important is R&D and academic collaboration as the industry looks towards 2025?

Dr Karl Nienhaus: Mining has always been a very complex issue, but nowadays the changes are faster than ever. The geology is becoming more challenging with declining ore grades and deeper deposits, technologically the industry is undergoing the digital transformation and thirdly the social license to operate along with pressure from investors, consumers, governments and communities is challenging the industry to rethink its role within society at large and the communities they operate in.

Adding to this, the economic pressure of increasing productivity and overall operational efficiency while at the same time increased social and environmental performance means that mining companies have to innovate in multiple areas in the sense of finding new ways of doing business and operating. This is where R&D and academic collaboration can make significant contributions. I would even say that while this collaboration has always been important, it is even more important

today and for years to come.

This is because the complexity and the kinds of challenges the industry is facing are unprecedented and multifaceted, they are not just of a technological nature. Therefore, they require a multidisciplinary approach to include, for example, social and environmental aspects in technology development. Therefore, what we need today is a "system engineering approach", which is able to integrate these multiple viewpoints and disciplines in a systemic way. Academia, especially when having an application-oriented approach, can contribute in implementing this multidisciplinary and systems approach. I believe together with industry we can achieve more and through trustful and long-term collaboration a sustainable and technologically advanced mining industry becomes an obtainable goal.



However, academia also has to keep up with the changing job requirements and conditions of the industry as well by adapting educational curricula. Educating the engineers of the future today means to best prepare them for their future work while not knowing what it may look like. Mining today is not what it was 10 years ago and we do

not know which fields of work will emerge in the coming decades. That is why our focus is on educating engineers who are able to apply concepts flexibly and are trained in complex problem solving, for example. Therefore, it is also important to learn from the industry about current and potential future challenges and needs.

What areas of R&D will be the most important as the mining sector secures its licence to operate towards 2025?

Combining economic efficiency, resource efficiency and safety in a socially accepted and environmentally friendly manner is what is at stake. With respect to R&D, there are some core areas that spring to mind. First and foremost, removing people from unsafe areas in the mine remains a top priority, not only for companies but also for R&D. This is done by advancing automation and autonomous systems.

Autonomous systems have still a way to go but they hold the vision of a connected and integrated mine that is safe and economically and environmentally sustainable. Advancing relevant digitalisation technologies is of course closely related. R&D fields of interest here are advanced analytics, big data management, artificial intelligence and machine learning as well as, and this should not be forgotten, interoperability and M2M communication. However, the foundation for all this is advanced and ruggedised sensors that can last and function reliably in harsh underground GPS-deprived environments.

Another area that is going to be very important is certainly energy. This includes the application of electric vehicles as well as renewable energy sources but also the reduction of energy consumption throughout the mine.

A third area I would say is the increase of efficiency in the extraction of material so that new and difficult deposits can become economically viable. This contributes to sustainable use of existing mines and deposits as well as contributes to securing the future supply of raw materials for which the demand is still growing for the foreseeable future. However, at the end, all efforts towards the green mine are only possible, if mining is economically viable.

What are the challenges facing R&D as the sector looks to become more sustainable?

I would say one of the main challenges here is integration. Processes, technologies and machines have to be considered in an integrated way in order to take sustainability in all areas to the next level and to find innovative ways for mining sustainably. This means also the integration of high-tech equipment into conventional processes.

Generally, we need a shift towards a common understanding and goal of responsible mining operations. This requires a rethinking of mining equipment and mining processes and methods but also retraining of employees. Operating and maintaining different kinds of equipment means skill sets are changing and require training and education.

Furthermore, someone has to bear the cost for R&D and there is a reluctance, understandably, to take the risk of high upfront investment while the return on invest is often unvcertain. This is not a company problem, it is an industry problem because it means smaller companies can often not implement innovation as they wouldn `t be willing or able to bear the risk themselves. That is why we need new models of innovation, especially for collaborative forms of innovation. Some new models have emerged in the recent past, such as innovation networks or open innovation structures as well as consortia with governmental support or other forms of public private partnerships. I think this is the way into the future and if we can make collaboration work across boundaries there is a lot of potential to address the challenges more effectively.

How can R&D help us replicating existing machinery and processes with newer and more efficient models?

Mining companies are not replacing their equipment overnight with new high-tech applications. Therefore, in my opinion, one of the areas that is very important here is the successful retrofitting of existing equipment and then integrating different pieces of equipment at different stages of automation and different OEMs into a unified communication platform.

This is still a major challenge, which is why the AMT is for example very actively supporting the development of the OPC UA standard for the mining industry and works with the VDMA Mining and the Global Mining Standards and Guidelines Group to facilitate progress in this area.

With respect to machineries and processes, we believe that based on proven principles in combination with sensor technologies and latest technological trends new technological developments are leading to minimally invasive mining practices and changing the way we do and think mining. The invisible mine is still a vision for the future, but interdisciplinary applied R&D in a collaborative approach with industry can take us there, and potentially faster than we care to believe today.

