Innovation in the South African mining industry

I have always been fascinated by innovation and the ever-evolving landscape of science and technology. The allure of innovation lies not only in the novelty of groundbreaking ideas but also in their transformative potential—how they reshape industries, elevate human experience, and address pressing global issues. Curiosity serves as a driving force, inspiring individuals and communities to push boundaries, challenge conventions, and actively pursue improvement.

The terms 'innovation' and 'invention' are frequently used interchangeably, often leading to confusion. Invention is a term deeply rooted in creation—the act of conceiving and bringing something entirely new into existence. It represents the initial spark of inspiration that leads to the development of a unique or novel device, method, composition, idea, or process. Inventions are not necessarily useful, or in some cases, their uses have not yet been discovered.

Innovation involves the practical implementation of an invention, or the adaptation of existing products or services to make a meaningful impact on society. Creating value is a defining characteristic of innovation. Incremental innovation is the continual refinement and improvement of products, services or processes based on the requirements of the beneficiaries. This is essential to remain competitive in business.

Disruptive innovation occurs when a new product or service creates a new market and renders existing products or services obsolete. While disruptive innovation may be unwelcome, its early adoption often provides a strategic advantage, allowing pioneering individuals or businesses to capitalize on emerging trends and gain a competitive edge. Those who embrace disruptive technologies in their infancy can often position themselves as industry leaders and reap the benefits of being at the forefront of transformative change.

The South African mining industry is associated with conventional labour-intensive methods, due to the narrow, tabular, shallow-dipping reefs in gold and platinum mines. It has been extremely difficult to adapt modern underground mining equipment for use in this harsh environment with confined spaces. These challenges necessitated a comprehensive industry research programme, which commenced in the 1960s, and is summarized in Brian Protheroe's book entitled *COMRO's Legacy: Research and Development of Stoping Mining Machinery and Technologies*, recently published by the SAIMM. This book describes numerous creative and innovative ideas that were conceived and put into practice. While some imaginative concepts could not be applied at the time, there is potential for their use with the aid of recently developed technologies. Regrettably, much of this research was terminated in the 1990s due to a cessation of industry funding. The global gold supply has since been dominated by international miners with more accessible orebodies. However, in South Africa we continue to operate platinum mines and deep gold mines, necessitating further innovation to stay competitive. Two former presidents of our Institute have proposed strategies for adapting mining machinery and embracing new technologies (Rod Pickering, 2007 and Jim Porter, 2014). More recently, the Mandela Mining Precinct has established a 'Test Mine' in Rustenburg, to provide an industry hub for research, development, and innovation. The Test Mine also serves as a platform for technology demonstration and testing.

Cutting-edge technologies like drones and satellite imaging are enhancing geological and geotechnical surveys. Autonomous, GPS-denied drones are being used to accurately survey inaccessible underground cavities, using smart navigation and collision avoidance, providing essential data for production and

President's Corner (continued)

geotechnical monitoring. Additionally, the adoption of real-time monitoring and sensor technologies has increased safety measures and optimized resource extraction. Furthermore, the integration of data analytics and artificial intelligence has the potential to predict equipment failures or provide early warning of instabilities in tailings storage facilities, slopes, and underground workings. This will enable mining companies to make informed and better decisions.

The South African mining industry has also undergone a paradigm shift towards sustainability, recognizing the importance of environmental stewardship and community engagement. Companies are increasingly investing in eco-friendly technologies, renewable energy sources, and water recycling systems in order to minimize their ecological footprint. In addition, there is a growing emphasis on responsible mining practices, with a focus on biodiversity conservation and land rehabilitation post-extraction. This shift towards sustainability not only aligns with global environmental goals but also enhances the industry's social license to operate, fostering positive relationships with local communities.

In last month's President's Corner I emphasized the significance of diversity and inclusion, stressing that a diverse array of skills, experiences, and knowledge is essential for developing novel and improved ideas. Successful innovation relies on effective collaboration between mining operations, research institutions, government bodies, consultants, and technology providers. The SAIMM organizes forums and conferences as a platform for stakeholders to exchange ideas, showcase success stories, and address shared challenges.

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SAIMM Events: https://www.saimm.co.za/saimm-events/upcoming-events.

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