It is appropriate – at a time when wage negotiations are underway and productivity is under the spotlight – that the Journal discusses mine optimization.

Productivity is not a well-understood term in the mining industry and tends to be narrowly defined as units of production per worker. The papers presented here, though, offer a broader view – covering a whole range of productivity issues in the value chain from defining the orebody through to optimizing the logistics around getting the product to market.

The papers highlight the fact that a project's optimum value requires applying a high level of technical input and the necessary funds at the early, design stage of a project.

The impact of such work is greatly reduced if it is applied only at a later stage, such as when the project is already under construction or in production. This fact is not fully appreciated in the heat of wage negotiations, but could go a long way toward heading off future labour-management conflicts.

A thread that runs through all of the papers, then, is that detailed knowledge of the orebody is fundamental to mine optimization; in particular, it is vital to understand the geometallurgical characteristics that are now being included in the sophisticated geological block models that have been developed over the years. South Africa has been at the forefront of these developments, with the use of geostatistics in orebody analysis being pioneered by the likes of the late Dr Danie Krige, a member of the Institute and former Brigadier Stokes Award winner. His contribution to mine optimization is an example of the innovations that so many engineers and scientists in this country have pioneered; it is also a reminder of what is required to be a winning nation with a growing economy and an improving standard of living for all.

As a foundation, there have to be industries like mining to underpin the economy and these sectors have to thrive under all scenarios – not just when markets are trending upward. Now, more than ever, the mining industry has to be at the forefront of science and technology, with a mindset that prioritizes innovation. It cannot become bogged down in labour-intensive practices that by their very nature increase the safety risk, and lead to a decline in productivity over time. Sectors of the South African mining industry are continuing with practices and methods that have not changed for more than 60 years; this is simply not sustainable.

So how do we become a winning nation with an innovative mindset built on science and technology? Firstly, there has to be a strong mathematics and science base in schools. School leavers heading for careers in science and engineering must be equipped to move seamlessly into tertiary education without having to be first brought up to standard; and this standard must be comparable with that applied at leading universities in science and technology in countries such as Japan, the USA, and Britain. Secondly, South African universities have to be recognized as centres of research. Advances in mine optimization and technology must spring from postgraduate research fully supported by the mining industry and the state. State-assisted mining research at the CSIR should be fully aligned with the needs of the mining industry, and in turn with the research undertaken at universities. In other words, research at all levels must have a common purpose: to keep the South African mining industry at the forefront of science and technology, and thereby keep it sustainable.

A third fundamental element to achieving winning nation status is consistency of approach; we need a plan to take us into the next decade and beyond. The plan must be collaborative in nature with the buy-in of all stakeholders – not just the state and mining companies, but inclusive of broader society. Mining is a long-term industry, so decisions made today may only have an impact in 15 years; our plans must therefore be robust and we must not waver in implementing them. A commitment to long-term funding of research and development in science and technology, for instance, is characteristic of winning nations such as South Korea and Japan, which spend over 3.5% of their GDP on research on an annual basis. Again, this calls for a collaborative approach where funding from stakeholders is focused on a common long-term objective.

This implies that we avoid concentrating on short-term returns. In adverse economic times, such an approach makes it difficult to remain focused on long-term objectives that are 15 years away. The recent trend in asset write-downs among the major mining companies would suggest that there is not always a sufficiently strong focus on the long term. It also begs the question whether, if sufficient resources had been applied to mine optimization in its broadest sense in the preliminary stages of the projects, these write-downs would still have been necessary.

Inevitably, when mining companies have to re-establish margins in line with market expectations, they reduce their head count. This process, ironically, often starts with the retrenchment of the very engineers and scientists who are responsible for efficient capital allocation through ongoing research, innovative design, engineering excellence, and mine optimization.

The papers presented in this edition of the Journal demonstrate that professional engineers and scientists still have a vital role to play in a forward-looking minerals industry that must be driven by cutting edge science and technology.