

CHAMBER OF MINES: 23 MAY 2017 PRE-AGM-DINNER SPEECH***The role of the mining industry during this difficult time in our academic environment and how tertiary institutions can continue to support the mining industry's skills pipeline*****(Prof Cuthbert Musingwini, Head, Wits School of Mining Engineering)**

The Honourable Minister of Mineral Resources, Mr Mosebenzi Zwane, President of the Chamber of Mines, Mr Mike Teke, Chief Executives of mining companies, Leaders of our industry's Labour Unions, Senior Officials of the Chamber of Mines, distinguished guests, all spouses and partners gracing this evening's event, Ladies and Gentlemen. Without running the risk of having left out other important guests, let me qualify my salutation by noting that all protocol is observed. It is indeed a great honour and privilege for me to address you and would like to sincerely thank the Chamber of Mines for inviting me to do so.

When I got the invitation to speak my first reaction was, **"let me cleverly excuse myself out of it"** because I knew that there were many individuals out there that are more qualified, deserving and appropriate to speak to you. However, I remembered the story of Jeremiah from the Bible who was skillful at the art of making excuses. When he felt inadequate to fill the role of a public speaker, he begged the Lord, **"Oh no, Lord, GOD! Look, I don't know how to speak since I am only a youth"**. But, the Lord was having none of it! The Lord had seen value in Jeremiah undertaking the task at hand! So, I realised that the Chamber of Mines had seen that I have something to share with you this evening and I obliged to speak on the topic **"the role of the mining industry during this difficult time in our academic environment and how tertiary institutions can continue to support the mining industry's skills pipeline"**.

This topic is very relevant and important for the mining industry, given that our industry has been experiencing declining productivity in the past decade, yet equipment efficiencies have been increasing. For example, according to a McKinsey study released in 2015, the US mining labour productivity had declined nearly 30% since 2007, while other production sectors such as motor vehicle manufacturing had improved their productivity by as much as 200% over the same period. The same report by McKinsey also pointed out that mining productivity in Australia had declined by about 50% since 2007. Again the same report by McKinsey indicated that here in South Africa our mining labour productivity had declined by about 35% since 2007. In contrast, original equipment manufacturers have been reporting increased equipment efficiencies. For example, Atlas Copco have reported about 50% increase in the efficiency of

their drilling equipment between 2000 and 2005. So, why are we regressing as an industry in terms of productivity, yet equipment efficiencies are improving? What should we be doing to improve productivity?

It is not rocket science that by increasing productivity we are able to improve profitability. If the profitability increases, we can be able to do the things we would like to do as an industry. We can be able to do the things that government would like us to do. We can be able to do the things that our labour unions would like us to do. We can be able to do the things that our communities would like us to do. So how can we get productivity on the right path given that we seem not to be adequately exploiting improved equipment efficiencies? This requires a broader discussion between industry and academia but I will get back to this key touch point in a few minutes.

The mismatch between productivity and equipment efficiencies speaks to the unique skills set that is required to convert the improved equipment efficiencies into increased productivity. It is possible to generate the unique skills set if we nurture the partnership that exists between tertiary institutions and the mining industry because issues of relevant skills are a natural spin-off from a thriving partnership. It is therefore important for us to discuss the role of the mining industry during this difficult time in our academic environment and how tertiary institutions can continue to support the mining industry's skills pipeline, but with the right skills set.

Navigating productivity and equipment deployment requires timely and effective data handling. This has been necessitated by the historical transition from predominantly labour-intensive operations to mechanised operations that are now transitioning into data-intensive operations. We have entered an era of data explosion or the so-called "Big Data". The current buzz-talk around "Mechanisation"; "Modernisation"; "Mine of the Future"; "Digital Mine"; "Smart Mine"; "Internet of Things (IoT) for Mining" and "Mining 4.0" is all about effective data management for quick real-time decision-making. These are all views about what I prefer to call "Mining 4.0" and I need therefore to provide a brief history of why the preference for the term "Mining 4.0".

Let me therefore turn to that history. In 1784, the first mechanical weaving loom was invented marking the start of the 1st Industrial Revolution that saw the introduction of mechanical production facilities using water and steam power. Later, in 1870 the first assembly line was established, marking the emergence of the 2nd Industrial Revolution which was characterised by mass production using electrical energy as a power source. Then in 1969 the first programmable logic control system (PLC system) was developed and the 3rd Industrial

Revolution had started with the use of electronics and IT to automate production. Since then we have progressed into the beginnings of the 4th Industrial Revolution (or “Industry 4.0” from which we derive the concept of “Mining 4.0”, hence my earlier preference for the term “Mining 4.0”). “Industry 4.0” relies on Artificial Intelligence to control physical production systems through cyber space and visualising operations in Virtual Reality platforms. The consecutive transitions of the industrial revolutions has also brought and will continue to bring attendant increases in complexity in the operating environment, thus requiring a new skills set. In mining this increased complexity has been compounded by a number of factors such as geology of the orebody which is not always fully understood, increasing depths of mining which will eventually preclude human access to deeper-seated mineral resources and commodity prices that have remained sluggish post the Global Financial Crisis of 2008 or the GFC. For example, platinum price which reached a high of US\$2,270.50/oz on the 5th March 2008 has largely remained below US\$1,000/oz to present day, since the onset of the GFC.

The skills set envisaged for what I referred to earlier on as “Mining 4.0”, are high-end skills that are critical for the advancement and sustainability of the mining sector. The skills set required can be summarised into four broad areas which I believe will help the industry not only to survive but to thrive:

- Firstly, mining engineers with high Intelligence Quotient (IQ) will be required because of the increasing complexity of the operating environment. As educational institutions we have a responsibility to produce graduates with high IQ for an increasingly complex mining environment.
- Secondly, mining engineers with high Emotional Intelligence (EQ) will be required because shareholders, governments, employees and communities will continue to rightfully demand to see benefits of the mineral resources that are mined. The world is changing and the changes require mining engineers with the ability to handle socio-economic issues. They will need to have high relational skills, good negotiating capability, good management and leadership skills, to mention but a few.
- Thirdly, mining engineers with a high Creative Quotient (CQ) will be required as they will work in teams across multi-disciplinary boundaries. They will require a systems thinking mind-set. I am of the view that we will be having more engineers in mining than only mining engineers.
- Lastly, mining engineers with a high Adaptive Quotient (AQ) will be required because the only constant in our industry is change. The ability for mining engineers to adapt to

change and therefore address existing and new challenges is central to handling the changing landscape of the mining industry.

Given this skills set of IQ, EQ, CQ and AQ, the question then is “Do we want to be leaders or followers in creating this skills set?” It is our choice as an industry and academic institutions. As the 4 mining schools in the country, Wits, Tuks, UJ and UNISA, we do realise that as public universities we are a national asset that needs to be sweated sufficiently to provide adequate return on investment by both government and the private sector. In 2015 as the Heads of Schools of the 4 mining schools we established a Mining Engineering Education South Africa (MEESA) initiative to strengthen our collaboration, so that we can serve our country better and also produce engineers with the required skills set for “Mining 4.0”. We are collaborating on many fronts in teaching, research and service activities. For example we have joint participation in Mine Health and Safety Council (MHSC) research projects and research projects identified by the Mining Phakisa process inclusive of the Mining Precinct.

It is important that we collaborate because every time we discuss the importance of collaboration in our School I am always reminded by my colleagues that there is a Pedi saying which says: I quote *"Ditau tsa hloka seboka di shitwa ke nare e hlotsa"* (translated into English as *"Lions that fail to work as a team will struggle to bring down even a limping buffalo"*). This is why I am happy to be here this evening to speak about collaboration between the mining industry and our tertiary institutions. For example, I understand from the Chamber of Mines that the mining sector has in the past 5 years supported about 12,500 students with full bursaries to study at various tertiary institutions. This is quite remarkable given the current funding challenges faced by our higher education institutions. Most of you will recall that the funding crisis led to the nationwide *#FeesMustFall* protests in 2015 and 2016 in our universities. Hence we are in challenging times in the academic environment. Therefore, tonight I would like us to acknowledge this financial support by the mining industry, so, please allow me the liberty to thank all of you in the mining industry with a round of applause!!!

It is also a fact that the mining industry supports all the 4 mining schools in various ways. Firstly, mining engineering academics in all the 4 mining schools receive salary supplementations through the Minerals Education Trust Fund (METF) initiative which is fully-funded by the mining industry. This is a very important strategic initiative that ensures that universities can attract and retain the best academic talent to produce graduates with the right skills set that can take our industry forward. Without this support there would be a haemorrhaging of talent out of the universities into industry in search of more competitive

remuneration. Secondly, industry provides financial support for multi-million rand infrastructure such as laboratory equipment, teaching facilities and research facilities that can ensure that our mining schools remain ahead of the pack internationally.

Surely, you can expect me to do a bit of PRO at this stage and abuse my privilege as Keynote Speaker. I am happy to share with you the good news that because of support from the mining industry, Wits Mining was ranked in the Top 100 of 403 mining schools worldwide in 2015 by the UK-based Quacquarelli Symonds (QS) Ltd World University Rankings. We have since moved up several notches to be ranked 22nd out of the Top 50 mining engineering schools in 2016. In both 2015 and 2016 we have remained the No. 1 Mining Engineering School in Africa and the only mining school in Africa to feature in the Top 50 mining engineering schools worldwide. We could not have achieved such enviable recognition without your support. So much for PRO. Therefore, let me leave the commercial break and return to a third and equally vital contribution by the mining industry to mining institutions.

The mining industry accommodates our students for the much-needed vacation work before graduating as this is a requirement in terms of the Washington Accord guidelines for the international accreditation of our engineering degree programmes. I could go on and on about the various ways in which the mining industry supports the 4 mining schools. Therefore, one can expect that whatever happens to the mining industry has a direct bearing on us as educational institutions. The corollary is also true as we keep the industry's skills pipeline flowing.

Those in the coal mining industry will tell you that a CM is a Continuous Miner, so I guess you can understand why my students call me the Continuous Miner. My initials are CM and I just can't stop talking! But, to break that chain, here are my thoughts that I would like to leave with you about how I see us continuing to partner as the mining industry and academia:

- **In the short term**, the industry needs to survive so that so that it can still be in business in the long term. This is vital for everybody because it is a goose that lays the golden egg. Commodity prices remain depressed making cost containment a priority, hence the need to urgently address productivity challenges. Our academics are always willing to work with you on projects aligned with this and other initiatives because it is in their interest that you can continue to survive and thrive. Please continue to respond positively to our calls for you to come and see for yourselves what the universities are doing and when you come it is our expectation that you will critique our activities

because this is where the future skills for your operations reside. For example, at the recent Wits Mining 120th year anniversary on 23rd March 2017, Mr Nick Holland, CEO of Gold Fields, delivered a Keynote Address that challenged us as educational institutions on what we should be doing in our curriculum to address our industry's future challenges. I now turn to the medium term.

- **In the medium term**, I acknowledge that our industry cannot escape commodity price cycles. We therefore need to be innovative in building flexibility into the planning of our operations in order to ride out tough times. This will require continued investment in the generation of appropriate skills in educational institutions to be able to address medium term challenges. In addition it is strategically important that we have a seamless integration between the mining engineering classroom and the mining company boardroom. For example, Mr Kelello Chabedi, a Senior Lecturer in the Wits School of Mining Engineering serves on the Northam board. I am sure Mr Paul Dune, CEO of Northam can attest to the contributions being made by Mr Chabedi. I am also aware of a colleague of mine at the Colorado School of Mines in the US, Prof Kadri Dagdelen, who serves on the Rand Gold Resources board and Dr Mark Bristow, CEO of Rand Gold could also attest to the contributions being made by Prof Dagdelen. I urge you to continue scouting around mining Schools for senior academics who can make positive contributions to your company strategies in similar board roles.
- **In the long term**, it is my humble assertion that in order to be part of the future of sustainable mining we have to be part of the solution to current its challenges. When cyber-controlled production systems in a "Mining 4.0" environment becomes the norm of the day, as I alluded to earlier, we will need mining engineers with skills that can operate those systems and this requires high Intelligence Quotient (i.e. IQ), Emotional Intelligence (i.e. EQ), Creative Quotient (i.e. CQ) and Adaptive Quotient (i.e. AQ). The time to create this arsenal of skills is now! So we all have a duty to create the right kind of future leaders for our industry. On that note let me remind you of what John F Kennedy said in his Presidential Inaugural Address in 1961. I quote **"My fellow Americans, ask not what your country can do for you, ask what you can do for your country."** Close quote.

So, what can we do for our mining industry and mining schools?

President of the Chamber of Mines, Mr Mike Teke, thank you once again for the invitation to speak this evening. In closing, it is quite befitting that I had the opportunity to speak at your pre-AGM gala dinner for the 128th AGM which is in the same year that the Wits School of Mining Engineering celebrated its 120th year anniversary. Not only do both our institutions

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have a long history, but both also have a common focus on the future that speaks to realising the concept of "Mining 4.0". My best wishes to you for the AGM tomorrow. I thank you!