Engineers for the 21st Century—minerals and metals industry

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Synopsis

Outcomes from a workshop organized through the SAIMM revealed that the minerals and metals industry must develop its 'Engineering Team' if it is to continue to meet the challenges of globalization. The very economy of the country is largely dependent on a competitive and stable engineering team within the minerals and metals sector.

With the Chamber of Mines (COM) passing on its education and training initiatives to the industry, the professional bodies like SAIMM must (despite meagre resources) continue the good work done through the COM in the past. The workshop highlighted recruitment and selection, further/higher education, socialization and initial training, deployment and retention and continuing education as priority areas. These are further detailed in this report.

Office Bearers have considered the outcomes and the areas where the Institute should or should not be involved have been stated.

Introduction

At a SAIMM workshop attended by practising engineers, trainers and educators, the perspective of the engineers within the minerals and metals sector was discussed.

The objective of the workshop was to identify the real needs of industry in terms of number of members of the engineering team and the skills required by these members. The focus was on members of the 'professional' engineering team in the areas of Mining, Extraction Metallurgy and Materials Engineering. An attempt was made to highlight, for the benefit of employers, engineering employees and the youth, a realistic view of the 'Engineering Team of the Future' within the minerals and metals sector.

Setting the scene

Senior members of our industry, respected for their overall vision of the future were interviewed to provide an insight into the engineering profession of the future.

The following trends were highlighted.

Business factors

Globalization and international competition require members of the engineering team to be able to effectively access and utilize the latest technology. Engineering team members will have to apply an holistic business approach to all the production activities. The role of the 'Mega Company' is rapidly changing to focus on ROI Return on investment activity with the outsourcing of specialist and even core business activities.

There is a move to multi-skilling, cost containment and an emphasis on maximum plant and equipment utilization. Innovative technology is likely to develop through international research partnerships rather than through internal company R&D programmes. Tightening legislative policies are likely to inhibit industry expansion within South Africa.

Education and training factors

The Mine Qualification Authority (MQA) and the South African Qualifications Authority (SAQA) policies will impact on the structured requirements from tertiary education and career-based education entities. Funding to educators and student support is likely to decrease with consequent challenges to both groups. The minerals and metals industries and engineering in general, do not enjoy the positive image of other professions. (The school system weak in mathematics and science does not prepare scholars for engineering). Life-long learning and professional development is vital to maintaining a competitive edge.

Outcomes from the workshop

The workshop outcomes are summarized under the headings of:

- Recruitment and selection
- Further or higher education
- Initial training
- Deployment and retention
- Continuing education and training.

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 SA ISSN 0038–223X/3.00 + 0.00. Paper received Jan. 2002.

It is recognized that these themes/action steps have been known for many years—the COM has spent millions of rand per annum to address them. Recent changes to the COM have devolved these activities to individual companies, who have continued to address the issues as they are able. It is strongly felt that with the down-scaling of career guidance and education activities by the COM a void has resulted. This void must be filled if our industry is to continue to grow and prosper into the 21st Century. With the support of industry, the SAIMM believes it can make a meaningful contribution in meeting some of the identified challenges.

Key steps identified and the possible role of the SAIMM in the form of questions are given below.

Recruitment and selection

It is known that the industry is shrinking, but it can only survive if the quality of the new entrants match the challenges of the future industry. Some of the challenges are:

- The minerals and metals industry must be marketed to the public and particularly in schools.
  This role is considered to be too large for the SAIMM and not of direct interest to members. The Institute will limit itself to the production of the current brochure on the Minerals Industry aimed at school level.
- Bursaries must be available to students and well advertised for both technikons and universities.
  The SAIMM should be a centre for information in respect to bursaries, using for example, the Web site.
- Mathematics, science and technology teaching in schools must improve.
  This area is considered too large for the SAIMM to play a significant role and do such things as influence the government funding formula. Limited resources mitigate against organizing teacher training visits to mines and plants.

Further and higher education

The education for young engineers in mining, metallurgy and materials technology must be appropriate. The roles of technikons and universities in serving industry needs must be detailed. Whilst the MQA is likely to provide major inputs in the required outcomes, teaching capacity must be insured by suitable industry investment.

This could be done in the following ways.

- *Market Research to establish numbers and skills*.
  Attempts to predict the future requirements for skilled personnel have met with little success given the volatile nature of our industry in recent years. Although it is important for funding and planning purposes that such numbers are estimated. This information would be fed to tertiary institutions, the MQA and back to industrial companies, so that maximum utilization of educational resources is obtained and realistic planning done.
  Surveys of current and future requirements of technical personnel are considered the role of an industry association and not the SAIMM.
- *Provide vacation and/or Experiential training opportunity.*
  Where experiential training semesters or vacation work is required for a particular course of study, opportunity must be given to students. There are also many advantages to the provider of experiential training and vacation work.
  The SAIMM should not become a broker for experiential training opportunity and vacation work.
- *Curricula according to industry needs*.
  Providers of education need to focus on the educational content required by the users. The MQA is likely to identify all directly applicable, 'useful outcomes' and to register these with SAQA. The MQA will ensure that these outcomes are included in syllabi of providers of education and training. The providers must also input the broader educational aspects that will give body to the qualification. Involvement in these areas will ensure that industry needs are incorporated in the educational curricula.
  The SAIMM input into this area is through the Engineering Council of South Africa (ECSA) and members, representatives on the MQA.

Initial training

The rate of change in the economic, political and social areas both in the minerals and metals industry as well as the country as a whole, has had a negative impact on the success expected when bringing young engineers into the industry. Many of the new breeds of engineer cannot readily adjust to the responsibilities or expectations of their environment. Cultural conflict is inevitable. New ideas on handling these problems and the maximization of human resource potential are essential.

Areas that need attention follow.

- *Dealing with change.*
  The understanding of the culture of others must be promoted actively. Strength can be found in diversity provided the approach is correct. Only by open and frank discussion, can the barriers of resistance to change (RTC) be overcome!

  The changes that must be handled include:
  - cultural/racial
  - economic/business
  - academic/practical.

The SAIMM should be an agent to expose these problems and possible solutions through colloquia and articles in the *Journal.*

- *Breakdown cultural barriers.*
  Barriers must be broken by promoting understanding of the cultures of the great range of persons within our industry. Young engineers will not realize their full potential until they can work together with persons of all cultural backgrounds.
  The SAIMM should be instrumental in breaking down cultural barriers by bringing people together at workshops to hear of cultural norms that are different to their own.
- *Improve induction training and mentorship.*
  Many young engineers do not realize their potential and stay in the industry because of inappropriate induction programmes and lack of mentorship. For university graduates the induction period is in extreme contrast to their university life and often their expectations. These initial impressions of the industry result in large numbers of graduates leaving the

industry at the earliest opportunity. This also impacts negatively on the image of engineering as a career. Induction programmes could be improved by giving the young engineer more responsibility and thus gaining a feeling of worth during the first years of employment. The early years of development of a young engineer are most critical. Successful members of the engineering team seem to have had a supporting mentor in their early years as a young engineer. Every successful member of the engineering team has a responsibility to mentor one or more young person entering the team.

The SAIMM should assist with the training of young engineers by championing the cause of good mentorship through creating an awareness of the need for seasoned professionals to provide mentorship to young engineers. The Institute should use the *Journal* for this, to promote a suitable mentoring programme for young engineers and to publish a guide for mentors.

Deployment and retention

Despite the current climate in the mining industry it is believed that retaining skills has significant advantages for a company. Many young and not so young engineers are incorrectly deployed in areas that do not suit their personality or interests. Successful members of the engineering team are invariably those that have found the right niche for themselves. Improvements and possible SAIMM involvement could be brought about by:

- *Change the employment model to meet changing industry requirements.*
  While it is important to fit the right person to a job, it must be recognized that the employment model is undergoing overhaul. Outsourcing is resulting in opportunity for specialist self-employment in a wide variety of engineering fields. The resurgence of decentralized profit entities/business units allows initiative to be displayed by young engineers who find themselves in management positions.
  Although an important area, there is no involvement for the SAIMM.
- *Performance based remuneration.*
  The systems of a fixed salary are being replaced by performance based remuneration. Thus the young engineers that perform at a high level are recognized and suitably rewarded.
  Should the SAIMM conduct a survey that identifies the relative remuneration that is performance based?
- *Strategy for maximizing career paths.*
  Young engineers are responsible for their own career paths, although this responsibility is often taken over by the large companies. It is believed that most minerals and metals companies are aware of the need and have on-going career planning sessions with their young engineers.
  Should the SAIMM conduct a survey that identifies the relative satisfaction of young engineer career pathing?

Continuing education and training

One's base qualification becomes only a pleasant memory within a few years of qualifying. The real learning comes about by job experience and focus areas relevant to the specific discipline. This life-long learning activity is vital for young and old engineers alike. Areas that need to be developed and possible SAIMM involvement are:

- *Develop top technical specialists.*
  S.A. cannot rely on the developed world for solutions to local technical problems. Relatively few top specialists are required locally, but these individuals must serve the local market. Centres of excellence suited to the South Africa's needs should be coordinated at local universities and research organizations. Young engineering academics must be nurtured to serve the industry.
  The SAIMM already contributes to the development of technical specialists through the *Journal* and colloquia.
- *Inculcate business and entrepreneurial skills and ethics*.
  The mega company ethos is disintegrating and opportunities exist for young engineers to run their own business/small mines, etc. Even within the remaining large companies the business ethic is becoming more and more important.
  The SAIMM has a code of conduct like all professional bodies. The importance of professional ethics is appreciated and role models could be highlighted in the *Journal.*
- *Promote personal responsibilities for on-going development*.
  It will, however, always remain the prerogative of the individual to maintain his/her level of professional development.
  The SAIMM already makes available professional development opportunities through schools and colloquia. The promotion of continued personal development is recognized by the Institute's involvement in ECSA and the MQA.
- *Promote professional registration*.
  The value of registration within the minerals and metals industry has been much debated. With the new dispensation in S.A. and particularly in the fields of metallurgy, professional registration will become a prerequisite for many of the senior positions and within small private companies. Even within the mining discipline where traditionally there was seen to be little value in registration, registration will become the norm for persons holding management positions in the industry.
  ECSA already offers a discount of fees for registered members of the SAIMM. This amounts to one-third of the ECSA annual registration fee. Interviews for registration are arranged through the SAIMM. The benefits of registration should be promoted by the Institute.

Conclusion

The large numbers of areas that are part of the development of the engineer as part of the professional engineering team have been highlighted. The SAIMM can make a meaningful contribution to the success of our minerals and metals industry by involvement in this development. The places where, and where not, the Institute should be involved have been stated.

Limitations are, as always, financial and manpower.

New safety and health guidelines for the non-ferrous metals industries*

Production of the major non-ferrous metals—aluminium, copper, lead, manganese and zinc—totals about 45 million tonnes per year. About 2 million workers are employed in this sector. On 4 September 2001 in Geneva, a tripartite group of 24 experts adopted a pioneering Code of Practice on Safety and Health in the non-ferrous metals industries which provides specific guidelines for the industry.

The new Code of Practice provides workers, employers and governments with global guidelines—based on international labour standards and established best practice—for addressing specific occupational hazards.

The code focuses on foundries and on the production of primary non-ferrous metals, including from recycled material. It does not deal with mining, nor does it address the fabrication of commercial products made from non-ferrous metals. It is a Code of Practice that deals with the production of metal in bulk.

The Code starts by setting out the general principles of prevention and protection, including the duties of regulatory authorities, employers and workers. This part covers a range to topics, including risk assessment, risk management, training and workplace and health surveillance.

The core of the Code identifies and examines a range of physical hazards that are commonly encountered during the production of non-ferrous metals. These include noise, vibration, heat stress, radiation, confined spaces, dust and chemicals.

Separate chapters deal with furnaces, molten metal, alloys and recycling.

The non-ferrous metals industry is diverse and is expanding. Increasingly sophisticated products are being produced using an array of chemicals and treatment processes in the smelting, refining and finishing stages. Recycling, including the separation of complex compound materials, is growing in importance for economic, environmental and sustainable development reasons.

This new Code of Practice provides practical guidelines for ensuring that the safety and health of all those involved in non-ferrous metals production, in large and small enterprises, is afforded the highest priority.

*For further information or to obtain a copy of the Code of Practice, which is available in English, French and Spanish, please contact the Sectoral Activities Department (SECTOR), phone: +41 22 799 6154, fax: +41 22 799 7967, e-mail: sector@ilo.org ◆

Pyrometallurgy principles and their application exported to Australia*

Professors Kobus Geldenhuis and Chris Pistorius from the Department of Materials Science and Metallurgical Engineering at the University of Pretoria, were invited to present a short course titled 'Quantitative Analysis of Iron and Steel Production'. Professor Rian Dippenaar coordinated this four-day course that was presented at the University of Wollongong, New South Wales. The course attendants comprised six Metallurgy Ph.D. students, one engineer from One Steel (Whyalla), one from New Zealand Steel and 17 engineers from BHP-Billiton's Port Kembla Iron and Steel production plant.

In the course, the thermodynamics of the reactions (what are the equilibrium reaction products; what does departure from equilibrium tell us about the process?), the reaction kinetics (how fast does the reaction occur; how much processing can be done in the available time?), and mass and energy balances (what are the required material and energy inputs to achieve the product composition and temperature?) were covered. These approaches were illustrated with quantitative process examples, using plant data where possible. The attendants were provided with a set of skills that are useful in process understanding and process improvement. These skills are based on calculations using Excel (approximately 50% of the course time). The attendants were provided with workbooks containing the thermodynamic and kinetic information that they required and that they are likely to require in future.

The course was well received and indications are that BHP-Billiton would like to have the course repeated in two to three years' time. Similar courses were previously presented to Saldanha Steel and to Iscor's Vanderbijlpark Works, at their premises. Pyrometallurgy courses related to copper, ferrochrome, ferromanganese, silicon or platinum production could be tailor made for these types of plant and presented in the same way. A general pyrometallurgy course (three blocks of two days each) is presented every year at the University of Pretoria by these two lecturers. Please contact Prof. Chris Pistorius (pistori@postino.up.ac.za) or Prof. Kobus Geldenhuis (kgeldenh@postino.up.ac.za) for further information. ◆

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