



# **THOUGH LEADERSHIP FORUM TRANSCRIPT REPORT**

**VENUE: PREMIER HOTEL, OR TAMBO**

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**Thought Leadership Forum  
Premier Hotel, OR Tambo  
Friday, 12 April 2013**

**1. OPENING AND WELCOME**

**Mr Edgar Sabela, Programme Director**

**Mr Adrian Peters, ECSA Vice President**

- 1.1** Following a safety briefing, delegates were welcomed to this very strategic event in the engineering world by the Programme Director, Mr Edgar Sabela.

Mr Adrian Peters, the Vice President of ECSA, extended a word of welcome to what promised to be a ground breaking event. He highlighted that professional engineers are typified by three characteristics, namely ethics, problem solving and intellectual capacity, all of which are crucial to addressing our society's needs. People who are trained to solve any possible problem are what South Africa needs. Given all the engineering and related challenges that we face, the God-given talent of intelligence is critical, but this intelligence has to be tempered by a good measure of ethical behaviour and humility. This is an important theme in the context of thought leadership. We should apply our intellect and our God-given talents to start thinking about how we can make a difference. It is hoped that the discussion will address some of the problems facing our country, and solutions to address our infrastructure and service backlogs, poverty, unemployment and inequality, poor infrastructure investment decisions, and in many cases the need far outstripping the resources. The skills pipeline needs to be optimised from schools to tertiary level, from undergraduate to professional practice. Thought leaders in the engineering field should apply their minds to addressing these issues.

Fraud and corruption have to be rooted out; government should be helped to make correct decisions to respond to broader challenges, create jobs, stimulate industry and create jobs. Government should be re-capacitated to be able to translate budgets into actual projects that deliver value for money. Issues like climate change and other environmental factors have to be borne in mind. There are energy and water crises facing our country. Succession planning and skills transfer should be addressed; our children should be provided with the skills necessary to keep delivering on the legacy of previous generations. We would have failed if we neglected creating a capable society to take our good work forward. All these issues should feature in responding and supplying demand. As the intelligentsia of our society, we should endeavour to reach the twilight of our lives with the assurance that our achievements will live beyond our lifetimes. We should think not only about excellence in our lifetimes, but also creating excellence for the future. We should, as organisations, think of our prominent and respected roles in society, and should provide government with the support and knowledge to make a real difference in society.

**2. CONTEXT**

**Dr Oswald Franks, ECSA CEO**

- 2.1** Dr Franks reiterated the word of welcome to all delegates. He apologised on behalf of Mr Cyril Gumede, the President of ECSA, who could not be present at the conference.

Putting the conference in context, Dr Franks emphasised the importance of ethics, intelligence and being a trained problem-solver as attributes in the engineering field. Engineers are generally also unnecessarily modest, and it may be necessary to find ways to incorporate ways to combine these characteristics in an assertive way that will establish the leadership role of the profession.

Regarding the structure of the profession, ECSA is a statutory body that was established by government. Many organisations associate on a voluntary basis, of which 44 are registered with ECSA. These relationships can benefit from being strengthened, and this discussion could be a valuable opportunity to further this agenda. Other components include the commercial and business sector, as well as government, the education sector and international partners.

The purpose of ECSA is to promote the health and safety interests of the citizens and the environments from potentially hazardous work carried out by the engineering profession. A number of mandatory functions are specified in the Engineering Act, such as standards setting, conducting of accreditation visits, registration of professions, and regulation of the profession, managing complaints and disciplinary hearings, and on-going professional development. ECSA also manages research into the profession, and aims to maintain the dignity and promotion of the profession. This last aspect provides ECSA with a broader scope to respond to the development of the profession and national development needs. It is necessary to look at the characteristics of the profession itself, and to construct interventions that will shape the profession going forward in an inclusive and representative manner. Female members constitute only 11% of the ECSA register, which is an area that will require development. Building a capable state and promoting the notion of active citizenry are particularly important focus areas. To make a real difference, it is essential to take active action. ECSA works closely with VAs to comment on government initiatives, given the economic activity's reliance on infrastructure initiatives and skills development. ECSA has a working group to work constructively with government on issues like procurement and interventions to address skills shortages.

Through the PICC, ECSA heard of six 'hot-spots' that government has identified. These include an increased focus on constructing schools throughout the country, where the profession can make an important contribution. Student accommodation is another area where the engineering profession can make a real difference. The increasing rate of electrification of households presents another challenges, with 200 000 households joining the grid annually. Government wishes to increase this rate to 300 000 per annum. In many municipalities, water leakages lead to huge losses of an important resource. Broadband rollout and healthcare provision are other important areas where the engineering profession can contribute in an incremental way and make a difference.

In order to promote the profession and to attract students, engineering careers are promoted through the Ingenious Programme, a career advice programme reaching out to high-potential rural students. A work group is also aiming to secure funding for the training of high-potential graduates. Much like the medical and accounting professions, if a company can attract a subsidy for the candidates that they appoint, a better conversion of graduates to professionally registered practitioners will be possible through focused mentoring.

ECSA's Council approved the establishment of an Engineering Education Trust (mimicking the Thuthuka Programme run by SAICA) to support engineering students, and a MoU will be signed to structure certain programmes.

For the next five decades, engineers will be responsible to ensure continued economic development on the African continent. There are numerous projects being driven by the African Union to promote economic and social infrastructure development. In terms of thought leadership, it is important to construct progressive and innovative ideas that will effectively communicate aspects of the engineering profession. This is an opportunity for ECSA and the engineering profession to contribute to national debate, influence public policy and make the expertise and knowledge of the profession available to government, and to make the engineering profession an advisor of choice to various stakeholders. Minister Manuel challenged the engineering profession to think of the poor distribution of skills throughout the country. The National Planning Commission also identified the need to reconsider nuclear energy versus smaller renewable energy projects, which the profession could also debate.

The deliberations will be structured along disciplinary lines, and delegates were asked to brainstorm the profession's contribution to development and infrastructural needs. Facilitators were asked to guide the discussion in each discipline, following a defined structure. Policy developers and government, practitioners and students all have to be engaged, and the messages for each of these stakeholders should be defined. Research in particular areas and the relevant issues that must be prioritised should be identified, as well as appropriate mechanisms to disseminate the information to the target audiences. Resource requirements for the various initiatives must also be clarified, and champions/spokespersons for each of the issues should be identified. After the discussion groups, feedback will be provided to the plenary.

### **3. AGRICULTURAL ENGINEERING**

**Facilitator: Mr AA Louw**

#### **1. Relevant Issues**

##### **1.1 Water**

With increasing demands on water resources and reports of climate change, there is likely to be less water available in South Africa. It will therefore be necessary to consider:

- The role of water storage for agricultural use;
- Efficiency irrigation;
- Ground water and its uses;
- Alternative methods of using water such as hydroponic farming;
- Water demand management (in collaboration with Civil Engineering);
- Strategic planning to mitigate the risks in terms of water availability for agricultural use of dammed water in the different provinces, and optimising water use during dry periods;
- Water quality and availability trade-offs between agricultural, industrial, environmental and mining stakeholders; to be understood and optimised.
- Water pricing structures and allocations should acknowledge the risks of water availability. During periods of above average rainfall and high runoff irrigation can be increased but is reduced periods of shortages, which impacts on the economic viability of farming activities.
- Agriculture is a prime producer with a range of economic spin-offs affecting the rest of the economy that have to be considered in the pricing of water.
- Limiting silting of dams through the provision of soil erosion protection measure in sensitive areas;
- Political interventions and policy decisions in order to improve water usage; mechanisms to get the message out and identifying target audiences;
- Inefficient urban and industrial water use reduce the availability of water for food production and security;
- Acid mine water drainage and the impact of litter on water systems.

## **1.2 Soil**

Important aspects to be considered:

- Soil erosion control;
- Reduction in available soil due to alternative land use;
- Contamination of soil through acid mine water drainage and industrial and human effluent;
- Reduction in available prime land due to mining-activities require sustainable long term trade-offs;
- Promotion of good farming practices regarding the use of chemicals and fertilisers that affect soil and water quality;

## **1.3 Energy**

- Reducing the agricultural sector's carbon footprint through limiting energy use;
- Reducing energy price impacts through; unlocking energy from bio-resources, turning waste into alternative sources of energy;
- Increased use of alternative energy sources – 11% of the country's diesel consumption is used in agriculture;
- Promote and implement energy conservation measures;
- Use solar and alternative-energy to grow crops.

## **1.4 Other issues**

- Emphasise the role of agricultural engineering in agricultural development;
- Need for training facilities at universities other than UKZN;
- Investigate improved, appropriate and cost-effective agricultural mechanisation and standards that will suit the local context;
- Improving productivity;
- Improve on international competitiveness.

## **1.5 Education and Training**

- Quality of schools education to be addressed to increase the quality of students;
- There is only one university faculty offering an agricultural engineering course;

## **2. Messages**

- Increase a contextual understanding of agricultural engineering in terms of food security, bio resources, rural development, and the conservation and optimal use of natural resources.

## **3. Target Audiences**

- Government departments at both national and provincial level;
- The broader farming community and organised agriculture;
- General public;
- Educational institutions: schools and universities;
- The media;
- Other Engineering disciplines;
- Commerce and industry (e.g. mining).

## **4. Research**

- Referring to the activities and roles of the different engineering disciplines regarding the utilisation and the impact on the natural (soil and water);
- Research is required to develop a uniform strategy regarding engineering practices in agriculture and the environment incorporating multi- and inter-disciplinary approaches;

- Available research information needs to be disseminated, to create an understanding of causal relationships.
- Agricultural engineers should market their role to other engineering disciplines, and particularly mining.

#### **5. Mechanisms**

- A uniform strategy to be developed;
- Media (internet, social media, traditional media, TV and radio coverage) and public relations exercises such as conferences and forums featuring international speakers and experts;
- Education;
- Discipline-specific forums and/or conferences on engineering disciplines;
- Agricultural engineers need to be part of (or presented in) management and policy discussions in order to positively influence technical related decisions;
- Demonstrate value for money to bring sponsors on board.

#### **6. Resources Required**

- Guiding/housing structure/support (ECSA);
- Availability of experts able to provide individual inputs;
- Time = money;
- Money for media, public relations and liaison;
- Recruiting sponsors;
- Participation by bodies and associations, whether regulated or voluntary.

### **4. CHEMICAL ENGINEERING**

**Facilitator: Prof. T Majazi**

#### **1. Relevant Issues**

##### **1.1 Energy, Water and Environment**

- What would be considered a good energy mix given the development needs of South Africa?
- IRP 2010 is clear that nuclear energy should form part of the mix, yet nuclear energy is not included in the nine engineering disciplines for purposes of professional registration. Should South Africa not start thinking about recognising nuclear engineering as a recognised profession? There is a lot of scope to expand nuclear engineering in the SA context, and it should be noted that nuclear engineering goes beyond reactor technology.
- It would be necessary to consider the design role that can be played by engineers in terms of creating cleaner energy, which relates to environmental considerations. It is important to consider how to limit carbon dioxide emissions. Other alternative energy sources should also be considered.
- Energy efficiency using contemporary systematic method should form part of the curricula offered by our universities; curricula have remained largely static even though industry has evolved over the years.
- Truly systematic approaches to energy efficiency are necessary to optimise the resources available. Optimisation is a well-developed field in engineering, but South African undergraduate programmes do not incorporate international best practices emanating from process/systems engineering approaches. All possible synergies across the engineering fraternity must be exploited.
- It was stated that it is difficult for institutions to decide how to structure programmes to incorporate new developments such as nuclear energy.
- Eskom power cost is increasing steeply which should make for better energy efficiency.



## **1.2 Curriculum**

- Approaches should be systematic to increase optimisation especially at undergraduate level – i.e. process systems;
- ECSA could play an important role in designing curricula, and ensuring linkages with other disciplines;
- It may be worthwhile to start developing nuclear programmes at postgraduate level, working downward to the undergraduate level;
- Optimization is necessary and relevant, and must be standardized across all universities.
- Research should focus on the appropriateness of curriculum, and the question should be asked what influence industry has on university programmes. A symbiotic relationship, including ECSA, industry, academia and VAs, will be essential. University advisory boards are key partners and should work closely with ECSA.
- It is necessary to determine what is core to teaching chemical engineering and what the supporting specialities are. Universities and industry to supply information in this regard, but in the South African context, universities are not working in unison. ECSA is ideally positioned to address this core aspect, and could steer the agenda to cover environmental or nuclear engineering, for example. Experiential training should also be made possible through increased funding or subsidies.
- The professional engineering level should be revisited and strengthened. ECSA has an important role to play in this regard; there should be incentives in place for senior and junior engineers to register as professional engineers. National projects are underway to mentor high-calibre professional engineers. There is however no real accreditation of training programmes by ECSA, which could form part of a possible solution. Professional engineers do need opportunities for practical experience. It is only in exceptional cases that engineers qualify for registration as Professional Engineers within three years.
- It would also be necessary to do a specification of the work required from a professional chemical engineer. There is no sense of convergence in terms of the scope of work of an engineer, and specifically of chemical engineers. This is an area that has to be resolved.

## **1.3 Education**

- Graduate support mentorship programmes should be strengthened in terms of financial support and training interventions.
- Extend vacation period to 6 weeks per semester (propose June, July) to increase experiential training exposure.
- Formalize experiential training programmes with companies to train graduates.

## **1.4 Shortage of engineers**

- No research is being conducted in terms of qualified engineers who are not registered as professional, practicing engineers;
- ECSA should be asked to look into the pipeline of engineers; and it may be useful to look at how many chemical engineers can be absorbed by the economy and how many students drop-out before completing their studies;
- Quality graduate outputs should be prioritized over quantity.

## **1.5 Identification of work as a Chemical Engineer?**

- Define what needs to be done and who should do what?
- ECSA and CBE to resolve the complexities.

### **1.6 Labour Environment in SA**

- The labour issue in South Africa should be addressed, but it is uncertain whether ECSA is the most appropriate body to start this discussion.
- In an environment where engineers design highly automated machines and plants which reduce employment high-level skills training are crucial to increase production. South Africa still has a predominance of highly unskilled labour, but reducing jobs is practically unadvisable. How will we continue to find employment for the number of unskilled workers? Everything links back to the importance of education.
- It is also necessary to engage stakeholders such as the DoL and unions on safety aspects. Automation will help to address safety concerns. Given growing occurrences of labour unrest in South Africa, it may also be helpful to make it clear that automation may become the way to go.

### **2. Target Audience**

- Broader engineering community;
- Universities;
- Industry;
- Government;
- South African society at large.

### **3. Research**

- Research must be conducted into the core curriculum and specialisations, as noted earlier.

### **4. Mechanisms for outreach**

- Getting closer to government;
- VA's and publications from VA's;
- Engineering News;
- Train competent, experienced, credible and eloquent spokespersons for the engineering profession (e.g. retired engineers following the Australian example).

### **5. Champions**

- Presidents of VA's could play leading roles since these structures house the discipline-specific knowledge. The voluntary aspect may be problematic, however. It would be necessary to think about the fact that people have other, dedicated responsibilities associated with their jobs.
- ECSA has a facilitative role to play;
- Experts;
- Government i.e. policy issues,
- Companies should be incentivised to increase opportunities for experiential learning. Most companies will gladly look after bursary students, but additional support will be required to increase the number of students who need experiential training exposure. Supervision is another aspect that will require particular attention.

## **5. ELECTRICAL ENGINEERING**

### **Facilitator: Mr T Maphumulo**

The points made today must be of such a nature that ECSA could use them to guide its response to the National Development Plan and the recent BRICS Summit. ECSA, as the body governing engineering in South Africa, should respond to the country's strategic direction and should be able to prevent outside influences impacting of the South African industry.

A number of challenges were mentioned in the introduction of the conference, and it will be necessary as electrical engineers to clarify its message to relevant stakeholders. ECSA has various vehicles to communicate its message, but it would be necessary to determine whether these vehicles are adequate. The personnel and other resources required should also be identified, and it would be necessary to identify champions to take the message forward.

## **1. Relevant Issues**

### **Discipline specific issues**

- The energy mix – which types of energy suits the South African context – should be debated. In America wind energy is widely used; in other countries nuclear energy is used. People should be given choices; government should be encouraged to think creatively about energy options. Electricity should not be viewed as the panacea; people should be educated to consider other options like gas and solar power and should not only think that they need to be connected to the electrical grid. Thinking differently about energy sources will also encourage people to take ownership of their energy sources, which may help prevent cable theft. More research should be done into the timing of the implementation of renewable energy sources; for example, costs are coming down in terms of solar energy while in terms of wind energy there is a need to determine the base-load requirements. The timing, cost and urgency intersection has to be understood, and should be measured against the energy requirements of the country for the next thirty years. Sustainable development also has to inform the debate around the energy mix for a country like South Africa. Government cannot be relied upon to do the research; a body like ECSA may have to take charge of the research project, but should involve VA's and the private sector.
- To be able to integrate renewable energy into the base-load energy grid, it will be necessary to understand smart grids. As far as the control of the network is concerned, it will be necessary to liberate the grid, which will require research into integration of small scale energy sources. Government and the regulators (which will have to make some changes) will have to be brought on board through research to ensure the stability of the network. Fair competition will also be necessary to ensure affordability for the public.
- Different spectrums that will unlock new technologies must also be researched and understood, particularly to facilitate rollout to rural areas and ensure universal access. Additional investment to make this research possible will be necessary.
- Communication and promotion to increase uptake of e-services will be necessary. The upgrade to IPV6 has to be coordinated at a national level. The capacity of IPV4 has run out; government must be advised on how this strategy can be supported.
- In terms of broadband in rural areas, the fundamental issue is that there is a national policy, but no hard targets at a national level. It is necessary to separate national targets and commercial operators' issues. Sectoral role-players should play a strong guiding role in this regard.
- The liberation of the energy supply infrastructure by setting up independent electricity providers separate from the distribution network has to be addressed. Currently government is involved in all processes, which is preventing the introduction of independent and probably more efficient energy providers. The SAIE has done an exercise to identify issues in this regard, most of which are crosscutting.
- The way that engineers are being procured, where the focus is no longer on quality and competence but strictly on price, is sacrificing the ethical aspects of good service and quality for money.
- A particular issue was identified, relating to the disempowerment of engineers in the workplace. Training and mentoring is not possible for young graduates, which is crucial to addressing the skills shortage. The value that experienced engineers can add is disregarded and thwarted in the procurement area; engineers are compelled to execute projects but they have little or no influence over the projects.

- The actual cost or funding model to produce electricity, versus what it would cost to produce electricity from alternative energy sources;
- The condition of electrical infrastructure, and the lack of capacity to maintain infrastructure is a concern.
- Integrating the smart-grid in electrical provision will be essential in future;
- Water leaks and a lack of automation in the industry where the bulk infrastructure is managed should be addressed. If it is possible to measure accurately, it will be possible to manage resources better.
- It would be wonderful to be able to solve technical problems, which will only be possible if the lack of skills was resolved. The appalling state of basic education should be addressed first; South Africa is rated the second worst country in the world in terms of school-level maths and science.
- The issues of electricity theft and illegal connections have to be addressed.
- There is a challenge in terms of testing products because of a lack of adequate testing laboratories and facilities, especially in terms of biometrics and smart cards.
- Without energy and adequate communication, it will not be possible to go forward, but it is also uncertain what ECSA can do besides making government aware of these issues. The framework in which we operate – cross-cutting issues – and government understanding the role of engineers, nothing will be achieved. Without unravelling complexities in terms of procurement and education, or skills development and mentorship, no progress will be achieved.

**Crosscutting issues** include:

- The lack of skills;
- Loss of skills due to job losses and retrenchments, and mergers;
- Sustainable lifecycle thinking to address aging infrastructure;
- Lack of ethics and corruption on a grand scale;
- Interference with regulators;
- Lack of downstream beneficiation, despite huge resources being available;
- Lack of capacity to deliver infrastructure and services, particularly in the public sector;
- Lack of accountability, which relates to ethics and nepotism;
- Lack of local electrical industry capacity;
- Youth unemployment;
- Increased bureaucracy;
- Global economic recession;
- Presence of global multi-national technologies in South Africa;
- Regional migration of people;
- Dumping;
- Agendas for engineering, including CBE;
- The slow pace of transformation is a consequence of a lack of adequate high-level planning in terms of skills development and job creation;
- The fragmented approaches by different stakeholders (ECSA, SETAs and CBE) mean that there is no consolidated approach to speak to the needs of the sector in terms of skills training and development.
- The role of engineers in managing financial risks has to be clarified. Engineers are often undermined in terms of procurement decisions made to manage financial and IT risks.
- The issue of working in different environments relating to Government Certificates of Competence also has to be addressed; perhaps discipline-specific GCCs will make more sense to get more people certificated. It would also be necessary to align this process with ECSA's processes to limit duplication.
- Community awareness of engineering work and the benefits and dangers associated with it.
- Lengthy procurement processes have to be addressed; it delays the progress of projects. To award a tender takes at least six months.

## **2. Education and Training**

- There is a lack of strong mentorship in the engineering world, which impacts on skills development.
- The lack of skills;
- Loss of skills due to job losses and retrenchments, and mergers.

## **3. Structures and Systems**

- Research and communication structures to communicate the message to the public and government will be necessary. Research into the most appropriate energy mix for South Africa should ideally be undertaken by ECSA, with possible sponsorship by other parties.
- A task team or committee may be helpful to address short- and long-term strategies, driving research work and consolidated research that had already been carried out. There are some programmes that are approaching implementation, where ECSA could also contribute.
- CIDB started a process for professional services, intended to ensure full utilisation of the skills available in the sector and to assist municipalities to improve their capacity. Is this programme still underway? Should there not be a consolidation of efforts and an avoidance of in-fighting that is holding back progress.
- The engineering sector has to approach giving advice to government differently; strategies and suggestions rather than merely identifying issues of concern will have more success. It is also necessary to find ways to get government and the engineering profession to work in unison. Specific working groups could focus on particular issues, and feed into relevant structures at government level. Industry should also be involved in this process.
- It may be helpful to nominate ECSA members to serve on bodies like NERSA and ICASA, working from the inside rather than merely making suggestions from the outside.
- It was proposed that it would be helpful to nominate volunteers/champions to assist ECSA to comment on and develop a strategy in the areas of energy and telecommunications. These nominees should also be able to take forward follow up discussions.

## **6. INDUSTRIAL ENGINEERING**

**Facilitator: Ms C Botha**

### **1. Key Issues**

- Service delivery in the Public Sector should be systematised through processes and information management systems in the following areas:
  - Public Healthcare;
  - Education in schools;
  - Systems should be simplified to manage them properly and effectively;
  - Social Infrastructure;
  - Housing;
  - Accommodation;
  - Service Billing;
  - Multidisciplinary;
  - System approach;
  - Processes and systems;
  - Government and associated structures.

## **Public Sector Service Delivery**

- Public Healthcare
  - Education
- Social Infrastructure
  - Schools
  - Housing
  - Accommodation
  - Healthcare
- Service Billing
  - Multidisciplinary
  - System approach
  - Process and System, Government and Associations.
- Target Audience
  - Departments of Health, Education, Human Settlements and Housing
  - Municipal Authorities

## **2. Specific Discussions: National supply chain capacity and procurement**

### **Service Delivery Public Sector (Industrial Engineering context)**

- Systemizing work;
- Supply chain (Procurement);
- Environmental effects (Human Productivity) - increased human productivity and staff retention enabled through conducive, 'happier' working environments;
- Health care (consumables) and the reliability of data to institute improvements and improve service delivery;
- Customer satisfaction, client need analysis and functional requirement specifications - how are the expectations of people ascertained and accountability enforced? How can industrial engineers present real solutions to these problems in terms of service delivery?
- Capacity building, building experience and transformation in the workplace;
- Schooling (text books);
- Modular and rational construction and the supply chain approach to ensure systemic delivery;
- Industrial engineers can also play an important role in terms of service billing in municipalities.

### **National Supply Chain Infrastructure**

- Lack of or inappropriate infrastructure limitations to support the private sector in terms of export logistics;
- National supply chain competitiveness as a contributor to export effectiveness;
- Turn-around time;
- Effectiveness linked to labour productivity;
- Effectiveness and efficiency should be linked; from a national point of view there should be a focus on establishing the right infrastructure and systems to ensure national supply chain effectiveness to ensure efficiency;
- Supply chain infrastructure management should be addressed from an industrial engineering perspective to align multi-disciplinary inputs;
- Capability is often driven by need (identified by management);
- Skills needs to ensure proper running of systems; experience needed to understand urgency of the end result, working with the end goal in mind; get the right people for the job on board;

- Maintenance management;
- Assets life cycle management.

### **3. High-level messages:**

#### **3.1 Public Sector Service Delivery**

- Creating conducive working environments;
- Address issues affecting the country in a holistic, multi-disciplinary fashion; a systemic approach taking note of the gaps and coming up with workable solutions.
- Human settlements;
- Processes and systems should be designed to enforce accountability; governance and assurance.

#### **Research**

- Understanding existing problems in terms of value chain components, environmental constraints and measurement;
- Data-mining of current data to do a data-analysis and determine measurement systems;
- Determine what capabilities are in place through a central research registry;
- Use data-analysis to put pro-active monitoring and evaluative systems in place;
- ECSA is the primary communications channel for this exercise.

#### **Resources**

- Subject to research findings;
- VA Special Interest Groups;
- Systemic, multi-disciplinary approaches are necessary.

#### **3.2 Supply Chain Capacity**

- Industry/sector supply chain requirements for export competitiveness;
- National infrastructure.

#### **Research**

- Various studies across various sectors; a multi-disciplinary task team should be established to look at issues identified.
- Industries.

#### **3.3 Productivity Improvement**

- Labour productivity and increasing international competitiveness (task optimisation) for which a holistic view is essential.
- Considering inputs versus outputs, the value that is added compared to the income generated is mismatched. Performance measurement and management play a role in this regard. In South Africa labour productivity is linked closely to task optimisation, which deals with the issues that industrial engineers can help address. People's attitudes and motivational impulses cannot be changed through industrial engineering interventions, which will not affect the human psyche. If people understand their actual functions they may be better able to exert ownership for the jobs to which they were appointed.
- Industrial engineers can make a contribution to the systemic issues relating to industrial psychology; there is no single lever or mechanism to fix these problems. A multi-disciplinary approach at large may be necessary to tackle these problems successfully.

- There is a generational gap of about 15 years (in especially construction) which will require an urgent need of skills transfer. This boils down to the availability of resources. The problem is that there is an 'entitlement culture' that would have to be emphasised and addressed.

## **7. MECHANICAL ENGINEERING**

### **Facilitator: Mr K Nyangoni**

Mr Nyangoni reiterated the overall aims of the engagement, namely identifying issues that ECSA could present, as a critical and reliable consultant, on policy issues and the national discourse. The aim is to identify both cross-cutting as well as discipline-specific issues.

#### **1. Key Issues**

- At a CBE Built Environment Indaba recently, the need was again highlighted for the state to generate its own engineering capacity. The state has to understand that there are too few people employed to fulfil the current delivery needs. The state has got the political will, the projects and the funds to develop skills in the public service, for which a partnership model based on national service was proposed. The Department of Public Works could manage this process, setting up a graduate training programme and aiming to accelerate skills development for the public service.
- The Budget Speech and the State of the Nation Address both mentioned infrastructure development as a priority strategy. The state is looking at spending R 830 billion on infrastructure development over 3 years, which will be split into two: R 400 billion will be going to parastatals such as ESKOM, but the balance will be spent by the municipalities and provinces on assets such as sewage plants, water distribution, roads, etc. Yet, there is growing level of anger because of the lack of infrastructure that is evident from the social and other media. This money has to be spent over a distributed user base; but projects have to be owned and managed in order to move from concept to design to completed project. If 1.4% of Total Installed Value of R 340 billion over three years is applied to the owner's team capacity alone, some 2 000 competent and skilled engineers and project managers over a wide spectrum will be required. The 'owner' in this case will be the Department of Public Works; the DoPW has recently advertised a huge number of positions for professionally registered engineers with at least 6 years' experience. These kind of people are not that readily available; and if the people are available, they may not be willing to work for those salaries. The resources necessary to meet the goals of the Development Plan do not exist in our community at present, noting that the downstream supply and contracting parties will be drawing from the same labour pool. We know we have some unemployed graduates out there, but one still needs administrators and mentors to do the work. The engineering profession will have to come up with ways to solve these problems. If the government really is serious about spending billions of Rand, as small a percentage as 0.1% of that could be allocated to the engineering profession for the urgent development of graduates through mentoring in some accelerated programme to enable more efficient and effective spending to take place project implementation. Without the required competencies in the owner's team, projects will fail at the start.
- Transnet recently aimed to recruit engineers from university graduates, hoping to find 70 mechanical engineers. So far, only 9 competent engineers could be secured. There simply are not enough people available to make government's plans a reality. People are also not aware that an employer could expect a certain level of competence that links to the pay structure; the value add has to be clearly understood.
- The point was made that apart from engineers, there are a high number of technologists and technicians that have valuable experience and could benefit from a focused training programme.



- These people could also be used as mentors to help train young engineers, because their experience is invaluable. Research should be conducted into the available skills pool, considering age, race and gender.
- The importance of not only focusing on the skills required for the job, but also the values and other attributes that can only be developed through mentorship, were highlighted. Individuals need on-the-job development by people with knowledge and expertise. Industry should understand that its belief that productive, experienced engineers are available directly from universities is misguided.
- Industry should be prepared to invest in training graduates. While apprenticeship incentive programmes cannot be addressed in this forum, it is necessary to ensure that industry supports/partners universities. Businesses need long-term commitment to contracts to enable skills development, while government needs enabling policies to expedite skills development, and businesses need incentives.
- Voluntary Associations may be helpful vehicles to identify and drive projects to develop engineering skills. Other skills such as financial management, administrative and project management should also be developed. However, this discussion focuses specifically on high-level, professional engineering skills.
- Proposals around student articulation and RPL may also have to be considered. Most companies talk about engineers, but may actually need technicians. The differences between the scope of work have to be clearly understood by companies. ECSA and VA's are fairly certain about defining the scope of work of an engineer. It also has to be clarified that the discussion focuses on anybody that can be registered as an engineering professional, including technologists, technicians and engineers.
- While ECSA should not get involved in the work of the SETAs, it has tried to access skills development levies. ECSA stresses the need for candidate training programmes to be regarded as SAQA registered qualifications so as to provide access to SETA funding.
- Apart from encouraging companies to offer apprenticeships, it is also necessary to address the long-term strategies of education at both school and university level. There is a need to look at both the short-term as well as the long-term skills needs of the profession.
- Businesses need long-term commitment contracts and incentives to enable skills development. Companies need to understand that there is a need to bridge the gap between university graduates and a skilled professional; it must be understood that a university graduate has got academic skills, but that the professional skills and experience have to be developed in industry. The competent professional can only be developed once somebody is employed in the profession. A forum for engagement between the private sector and universities is essential; universities have advisory boards, but industry is often not keen to participate on these structures.
- Mentoring is a crucial element of training experienced engineers. While a graduate may have a degree, the degree taught graduates a structured thinking process and the actual learning only takes place in the workplace. One cannot take a non-thinking person into an engineering environment. The problem is that in the workplace businesses are driven by profit and the bottom line, with associated KPIs. Businesses feel that they cannot afford to train engineers, because the return on investment is not enough.
- Businesses expect engineering graduates to hit the ground running, but this has led to an inherent problem that people are on accelerated career paths, and not on accelerated development programmes. This is a major problem which is further exacerbated by transformational and equity goals, but people often do not have the expected competencies. It also does not help that companies are willing to employ people without the required skills at inflated salaries. Companies feel that they are already spending huge amounts on salaries, and do not want to spend more money on further skills development.

The root cause of the problem is BBBEE; it is distorting the employment landscape. In the current dispensation there is a shortage of engineers across the board; finding sufficient engineers from the designated groups will be virtually impossible.

- As a mitigating factor, the retirement age may need to be pushed up from 65 to 70 to ensure enough mentors to train the younger generation. In many cases it may be better to employ inexperienced people, and to use experienced people to train them. The state has to be willing to employ young, inexperienced engineers to help develop their experience.
- If there is a national imperative to spend money on projects, ECSA should come up with a business proposition to step up to the mark. One of the issues aligned to national provision is the importance of universities as a training ground for new engineers. Constructive proposals linked to national proposals are required. It is hoped that the MoU mentioned by Dr Franks will be concluded in this year, and that this engagement will help to further this initiative.

## **2. Messages**

- Make engineering visible and attractive to the youth. Engineering is not viewed as a 'cool' profession, such as accounting and medicine.
- Introduce mechanical engineering into public awareness through the popular media, e.g. the SABC through local soap operas. It is however important to emphasise the positive aspects such as ethics, problem-solving, etc. so that engineers are seen as good role models.
- Other events that promote engineering to the public should be explored. Visits to engineering companies or plant visits should be promoted at school level.
- Young people should be given opportunities through bridging courses to gain entry to programmes if they did not have the necessary entry requirements.
- Review the engineering supply chain for the constraints in the education system; the fact that there is space to educate a graduate may not mean that there will be an opportunity to gain practical experience.
- Highlight career and earning opportunities associated with the engineering profession.
- Who can represent/co-ordinate the mechanical engineering "thoughts"? Identify the champions to take the messages forward.

## **3. Target audiences**

- The youth, through the schools system;
- The public, through the media;
- Universities;
- SA Institution of Mechanical Engineering;
- ECSA;
- Government, particularly built environment departments such as Public Works.

## **8. METALLURGICAL ENGINEERING**

**Facilitator: Mr M Cresswell**

### **1. Key Issues**

#### **Beneficiation of minerals:**

- Government has identified the beneficiation of minerals as a priority.
- This is a bit of a misnomer, because virtually all minerals are beneficiated and economic value is added before exportation. Minerals are also beneficiated before being used locally in the manufacturing industry.

- There are different economic drivers for each mineral; at present pyro-metallurgy is a major stumbling block because smelters had been closed down over the years mainly due to power costs and availability. These decisions have had a ripple effect that is now affecting the capacity of the industry to respond; existing capacity and knowledge to create the equipment needed had been lost.
- International competitors are able to offer cheaper equipment, but generally the solutions are not sustainable. There are no fall back situations left.
- The notion of 'buying South Africa' should be strengthened, although it will be difficult to instil this principle given the diversity of the mining industry and different economic drivers. Mining ranges from small to massive operators, meaning that their capacity is variable. In many instances, companies were started in South Africa to beneficiate particular minerals, which was how the automotive catalyst industry started. The process should start with a thorough economic analysis to determine the status quo in terms of current production, beneficiation and export, as well as limitations.
- In many instances, mines produce products that are not used optimally, such as magnetite. It may be useful to think about how these metals can be used. In Mozambique a new project is underway to beneficiate magnetite, where the objective is to develop and export pig iron. This reduces the final export volume significantly and the availability of thermal coal is making it viable. Different drivers exist in South Africa, where the power sources may not be available to exploit available sources.
- Government does have a beneficiation policy, which looks at how royalties are calculated on different grades of ore. It is not clear if the document actually addresses the end-goal. It is possible that companies are penalised for exporting un-beneficiated minerals.
- ECSA could be requested to look at beneficiation of all minerals in the country, creating a matrix to determine what is mined, what is beneficiated, and what is exported.
- Organisations like Mintek and CSIR could be asked to do research into niche markets for beneficiated products. It will be helpful to understand what is available, and what can be done with it.

## **2. Import substitution affects the industry in terms of:**

- Basic mechanicals – steel, pipes and equipment;
- Chemicals;
- Government interventions can make a difference, but can be counterproductive. For example solar geysers are being imported instead of stimulating SA's stainless steel industry. On the positive side, attaching a financial weight to buying local products, much like BEE, could help stimulate industry.
- In the steel industry lots of products are exported, while a viable local industry could be stimulated using locally produced steel. Only two local factories produce stainless steel tubing, for example.

## **3. Issues affecting the local steel industry:**

- Competition issues – in countries like China factories focus on producing massive amounts of the same product, which creates economies of scale. The Chinese government also supports such factories to ensure their sustainability. If producers could supply local businesses at the same price that they get for exports, the local industry would benefit.
- Legal issues;
- Niche market opportunities - local primary suppliers could incentivise smaller producers to use their products;
- In the past, Iscor had a monopoly on the market and controlled the industry. Mittal needs iron ore to produce steel at a profit, because it does not operate its own mines. Despite calls for nationalisation, it is unlikely that the original model will be reinstated. Mittal therefore has to buy cheaply and sell at a profit to survive.
- Lots of misinformation exists in the industry, and should be addressed.

#### **4. Skills gaps:**

- While some contributors felt that skills gaps exist, others felt that good work is being done to address gaps through industry sponsored initiatives such as the Minerals Education Trust Fund (METF).
- This fund, which uses contributions from mining houses, gives assistance to universities specifically to improve the salaries of university lecturers in geology, mining engineering and metallurgy to ensure parity with the industry and ensure a steady stream of graduates for the mining industry.
- It was stated that there appears to be a skills gap in terms of people from the ages of 35 – 45, where there are few people able to share industry experience and develop younger people. Mentorship and guidance is necessary to ensure that graduates become valuable as engineers.
- Stimulate curiosity and encourage analytical skills at school level; young people are no longer taught to critically process information, which is a critical thought pattern for an engineer.
- Many projects are initiated in South Africa but there are examples where the engineering is done elsewhere such as Australia, which also means that skills are not developed locally. Where local companies are used but managed from Australia, there are often communication problems. This has brought the realisation that it is better to house projects locally in their entirety.

#### **5. Environmental, power, water and labour issues impacting the metallurgical sector:**

- Coal discards can potentially be used to generate power, following Indian and Chinese examples. Pooling all discards will require some more study particularly the transportation economics.
- Acid mine drainage, water management and continuation;
- Labour and social issues around housing and the migrant labour system;
- It was proposed that ECSA could request retired engineering professionals to do pro-bono work to debate some of the challenges identified.
- Society.

### **9. MINING ENGINEERING**

**Facilitator: Mr Richard Jennings**

#### **1. Key Issues**

- What contribution can engineers make to achieve the National Development Plan and the country's infrastructure needs? From a mining perspective, there are generic and specific issues. It will be necessary to state the desired outcomes upfront. Secondly, what are the gaps or challenges preventing us from getting where we want to be?
- Most issues can be related to perceptions, which have to be managed. All people working in the engineering field should be able to come up with solutions for the problems facing our country. The ability to think out of the box does not only reside with engineers, but also with technicians and technologists.
- For the purpose of this discussion it will be better to talk about the engineering profession as a collective.
- The mining industry could contribute to the following issues:
  - a. Water usage and abuse;
  - b. Water pollution;
  - c. Electricity supply and the use of power – many mines are not doing deep shaft mining because power supply cannot be guaranteed. Some of the operations are closing down because there is insufficient power to run optimally.
  - d. Usage of other national resources and energy;
  - e. Financial contribution from the mining industry to address skills imbalances;
  - f. Skills imbalances and skills shortages;

- g. Social responsibility of the mining operations to their immediate communities; engineering to address social and environmental issues.
- h. The mining industry and the engineering profession no longer have time to coach and mentor young graduates, which is problematic. Young entrants are not able to cope in the workplace, and the corporate structure is so flat that there is no longer anybody available to provide coaching and mentoring. Young engineers have major responsibilities, but they don't have the necessary context to do their jobs properly.
- i. The competency testing and certification process (we had GCCs in the past) are vital to ensure that people can prove their competence, and be held accountable. A major challenge in the mining industry is the regulation of the professionals in the industry (similar to the medical profession), and how legal aspects relate to the profession. What is the role of the MQA in certifying people competent in the mining industry?
- j. Infrastructure and roads – maintenance and minimising overuse. There is a huge bitumen shortage in the country, meaning that roads cannot be fixed.
- k. The railway system should be reinstated, because overuse of the road system by large trucks transporting bulk goods has knock-on effects for the country as a whole.
- l. Labour and the labour force's expectations have a tremendous influence on the mining industry. Are labour expectations unrealistic, or can poor management and communication be blamed for misperceptions about the industry.
- m. Research and development taking place on behalf of the mining industry appears to have fallen by the wayside, which is affecting performance in terms of OHS and general operations and productivity.
- n. In the South African mining industry equipment that had been banned in other countries for longer than 15 years because of inherent dangers to noise and vibration is still in use. The use of outmoded technology should be addressed, and best practice should be implemented.
- o. Proactive mine closure and environmental management – many mines are not adequately prepared, funded and does not have the will to address all issues. Many do only the absolute minimum to stay out of trouble. Many mines in the past had rehabilitation funds, which is still being prescribed.
- p. Perceptions about the supposed 'rape and pillage' strategy employed by mines have to be managed.
- q. The regulation of the mining industry should be appropriate, should be monitored and should be enforced. Companies that contravene the regulations should be penalised.
- r. Government's capacity (DMR and DWAF) to deal with mining applications may have to be addressed to ensure that mining companies toe the line. While legislation is in place, are the departments responsible for its enforcement able to implement legislation and are they working together in this regard. The belief is that there is a understaffing problem?
- s. Using coal, gold and diamonds as examples, there appears to be no consolidated mining industry position on issues. The Chamber of Mines, representing employers, as well as other constituencies, should collaborate on the regulation of the industry.
- t. It is also necessary to ensure that labour, government and employers should collaborate on these issues.
- u. In terms of beneficiation, government is aiming to make beneficiation part of the operation from start to finish. The notion of sourcing materials locally where possible was supported by government.
- v. When mines are planned and designed, it is necessary to consider beneficiation and all related processes. When we talk about the mining process, should manufacturing operations also inform the debate?

## 2. Summary of issues

- Crosscutting or generic issues:
  - a. Infrastructure – the mining industry is impacting heavily on the road infrastructure through overloading, because railway lines are inadequate to serve its needs in terms of bulk loads;
  - b. Resources – natural resources like minerals, water, and water usage and abuse;
  - c. Electricity and alternative energy sources; the amount of energy that can be generated using wind energy is limited, and this message should be communicated;
  - d. Human resources and skills development; addressing skills shortages and skills imbalances;
  - e. Education and training to create a pool of competent persons;
  - f. Competency testing and accountability;
  - g. Coaching and mentoring;
  - h. Regulation of engineering practice to ensure implementation of legislation and accountability;
  - i. Government departments' (DMR, DWAF and DEA) capacity and cooperation should be highlighted as a concern. The harmonisation of legislation has to be addressed – different acts like the OHS Act and the Minerals Act address the same issues, and should be aligned. Roles and responsibilities should be clarified and aligned. The government should also address regulations in terms of illegal mining practices.
  - j. Research, development and technology should be guided by a strong sense of direction; there is a need to identify the sector's needs and guide research activities in a directed manner. Capacity needs also have to be addressed. Appropriate technologies have to be identified and implemented. Ensure that best practices are adopted where possible.
  - k. Different standards apply in different contexts, e.g. open cast mining has different imperatives than deep shaft mining.
  - l. Mine management should be guided by national regulations and standards in terms of safety and technology; these aspects cannot only be driven by profit or ego.
  - m. Buy South African to support local industry and further beneficiation.
  - n. Social responsibility – think about people's quality of life, support the community, make an effort to do things that benefit the community such as creating parks, employ people from the community where possible.

## 3. Messages

- ECSA should be requested to highlight the following generic issues to government about the role that the engineering sector can play:
  - a. Human resources development:
    - Government should spend more money and resources on schooling to ensure that there is a base group to train;
    - Skills development and capacity building to deliver competent engineers;
    - Coaching and mentoring should be addressed once graduates start work;
    - People's expectations and value systems should be addressed.
    - Research is required to identify and address the real causes of the problems experienced in the system.
  - b. Infrastructure development:
    - The rail system is insufficient and poorly managed, putting strain on the road systems; heavy traffic should be taken off the roads;
    - Roads are being damaged by overloading, and there is a need to focus on roads maintenance and repair;
    - Research and political will is necessary to ensure that these issues are addressed.

- ECSA should convey the message that the engineering sector can make a contribution to addressing infrastructure constraints and problems.
- c. Industry coordination and collaboration:
  - Industry forums should be created to ensure coordinated application of leading practice; where necessary, benchmarking and sharing of best practices should be employed.
  - ECSA must coordinate the engineering industry's contributions to ensure a single, consolidated input expressing the views of all role-players.
- d. Do research on alternatives to the problem, and who the stakeholders are that can address shortcomings.

#### **4. Target Audience:**

- Government departments;
- Industry;
- Educational institutions;
- ECSA.

## **10.**

### **CIVIL ENGINEERING**

**Facilitator: Ms M Padayachee-Salman**

#### **1. Key Issues**

- Attention should be paid to safety standards and the requirements of the OHS Act, and how these issues affect the quality of the engineering profession's outputs. OHS specifications should be included in the process to register as an engineering professional.
- There is a serious problem in terms of the maintenance of infrastructure, and particularly roads. Maintenance of infrastructure can be a useful way of creating jobs.
- Regulation of titles of registered engineering professionals and their status; development of technologists and technicians.
- Dysfunctional and under-capacitated government departments and lack of leadership;
- Capacity building and skills transfer; building of complementary skills for artisans; career guidance in rural areas and access to FET's.
- Responsibilities of individual trades should be clarified;
- Tender and procurement processes of professional services, corruption and the funding approach;

#### **2. Challenges:**

- Employment creation;
- Institutional roles and responsibilities, i.e. clarify roles of those responsible for maintaining infrastructure and roads;
- Standardization of different models to capacitate municipalities and PPPs;
- Capacity building and the role of engineer; there are many engineers employed by government but without the necessary skills to initiate projects, not knowing how to spend budgets and how to take projects to fruition. Mentoring and coaching is required to grow capacity, particularly in terms of decision making, in the workplace. The right factors have to be considered when decisions are made, which many engineers employed in the public sector are not capacitated to do properly.
- Increase the number of engineering students and graduates, and once they are employed, find ways to retain them in the workplace.
- Align OHS to quality in the workplace. If somebody is required to register as a professional, OHS have to be included in that certification.

- There is need for a procurement policy based on quality; currently the focus is on capital expenditure, but no focus on infrastructure maintenance. The full life cost of an asset should be incorporated, and there should also be attention paid to disposal of the asset at the end of its life.
- Life-cycle budgeting skills and planning at the macro level should be integrated – there should be planning first, followed by a budgeting process.
- In terms of macro-level planning, municipal engineers have the responsibility to look after water supply in the areas falling in their jurisdiction. It is necessary to find a way to look at the macro-level planning of these interventions. DWAF may not have the capacity to address issues of national importance.
- The status of titles in the engineering profession should be regulated and protected. Legislation to regulate the specifications of engineering work is underway, and should be promulgated in the near future. Currently non-engineers are signing off on work that a professional engineer should sign off.
- Quality of education and accreditation processes should aim to protect the engineering profession. School pupils should be exposed to the profession to grow an interest and desire to study in the field.
- Political appointments in government resulted in a situation that many departments do not have the capacity to assimilate and apply engineering advice.
- Who are the bodies that ECSA speak to, and have they got any real influence to bring about change? Regionalisation, consistency of pricing and the ability of municipalities to collect fees are further concerns. Plans are not integrated at the national, provincial and municipal levels; some plans may originate at the national level, but municipalities may not be adequately aware of these plans.
- Funding is often tied up by bureaucratic processes, and in some cases is misappropriated. The efficient and effective use of funds has to be ensured.

### **3. Education and training**

- Artisan development should commence at school level, and should ideally span a period of three years. Companies can contribute to the development of these persons.
- Training schemes should open up career pathways available to technicians and technologists. Many artisans and technologists who qualify are discouraged from pursuing a career as a professional engineer, because articulation opportunities are limited. Most people who are making initial career choices are limited in their choices by the availability of funds, but may later opt to further their studies in which case articulation possibilities will be helpful. ECSA does have mechanisms in place to allow for articulation from one qualification to another, for example from B Tech to B Sc. Eng.
- ECSA should encourage employers to offer registered in-house training schemes to help retain staff in the industry. SETAs could be brought on board to help subsidise training programmes.
- Artisan training pathways should be streamlined, incorporating schools, FET Colleges, UoTs and traditional universities.
- It was proposed that ECSA could introduce a compulsory skills transfer process, through coaching and mentoring, as a requirement for on-going professional registration. At present skills transfer is voluntary, but it may be helpful to make it compulsory and require evidence to prove that coaching and mentoring has taken place.
- How should universities ensure that they recruit experienced professionals to take up teaching positions, given the shortage of suitably skilled people? The structures within universities should make provision for the right number of relevant posts, as well as the systems to introduce particular projects.
- There are many private providers offering 'engineering' courses that are not accredited, meaning that students waste their money on a poor education and end up being disillusioned.



- There is a problem in terms of defining engineering work and making appointments using procurement policies in some local and provincial governments, because these structures do not have the capacity to define the quality of work that could be realistically expected. There is an ethical issue in terms of using consultants to appoint other consulting engineers. CIDB and National Treasury instituted an Infrastructure Development Programme for Public Works and other departments, which will cascade down to provincial and municipal level. Standardisation of these processes will be necessary to create consistency.
- Where will the capacity be sourced to take these processes forward? It will be necessary to find engineers who can do the work. It may be necessary to contract/second senior or retired engineers into positions to increase capacity. Strong control mechanisms must be implemented to ensure skills transfer.
- Skills transfer and capacitation will rely on people with a desire and interest to be capacitated, and allowing those people the necessary time to be trained.
- Government should understand that development plans are only as good as the people that make them a reality. An attitudinal change will be necessary on the part of the people to benefit from the training schemes.
- The private sector and government have different roles in terms of infrastructure development planning, and these planning skills have to be developed.

#### **4. Structures and Systems**

- Procurement and budgets;
- Macro level life cycle planning and budgeting;
- Standardisation;
- Capacity building;
- ECSA should address sub categories such as the OHS Act as part of the registration process;
- Awareness of the profession;
- Employment creation.

## **11. CONSOLIDATED FEEDBACK**

### **11.1 Agricultural Engineering:**

- Water – the lifeblood of agriculture, is affected by climate change;
- Water demand management and saving water should receive priority attention;
- Quality of water, and trade-offs with mining and industry;
- Water usage – human use, industrial and mining;
- Pricing of water and the multiplier effect;
- Soils and the importance of erosion control and prevention of contamination;
- Reduction in prime agricultural land;
- Research and standards are needed to rehabilitate land;
- Agricultural carbon footprint and energy conservation;
- Unlocking energy from bio-resources to contribute to the economy, and alternative energy sources;
- Productivity and international competitiveness;
- Education – the quality of school education and the availability of institutions where agricultural engineering can be taught;
- The message: a contextual understanding of agricultural engineering in the conservation of natural resources, rural development and food security.

- Target audiences: General public, educational institutions, the media and the public, government, commerce and industry, and other engineering disciplines.
- Multi-disciplinary impact must be researched, and communicated through mechanisms such as conferences, etc. Engineers have to be involved in policy discussions and decision-making.
- ECSA should take the lead, along with the Agricultural Engineering Institute.

### **11.2 Chemical Engineering:**

- Energy and water are inter-related; lots of water are used to generate energy;
- We are not producing enough engineers at undergraduate level to look at these issues who have the ability to design energy-efficient systems;
- ECSA has the mandate to accredit engineering programmes, but there is a gap in terms of the graduation of students and registration as a professional. This commitment should be revived and strengthened.
- The registration of professional engineers should be strengthened through incentives; once the identification of engineering work is completed, people should be encouraged to register with ECSA.
- The training of engineering graduates should be more effectively done; expecting students to learn what they need during the December holidays is misguided. The option of training during June/July holidays should be explored.
- The labour environment was also discussed; safety issues require a lot of attention which could be done through automation and accelerated development;
- Key research areas include the core curriculum; the industrial area has evolved over the years but engineers are still trained the same way.
- Identify key experts in relevant areas to run programmes.
- HEIs, ECSA and government departments should work closely together to discuss issues of concern.

### **11.3 Electrical Engineering:**

- Energy – how do we make ourselves relevant in decision-making processes; electrical engineers should assist government to create public awareness of alternative energy sources and come up with different strategies in this regard;
- The energy mix itself should be revisited and the timing of interventions should be researched to determine cost-effectiveness and appropriateness;
- Looking at different forms of energy, which are best suited to the South African context;
- Research cannot be left to government; ECSA, VA's and other stakeholders should be involved;
- In terms of telecommunications, some investment strategies and research will be required to increase distribution networks in rural areas;
- Uptake of e-services should be promoted through government interventions to improve telecommunications;
- There is a global migration from IPV 4 to IPV 6 – government should be proactively managing this transition;
- Existing policies have to be implemented, and government may need assistance in the rollout of this strategy;
- The lack of infrastructure capacity to provide electricity and telecoms should be addressed through partnership with government;
- There is a shortage of testing facilities for biometrics and smart-cards;
- Increased public awareness and involvement on energy issues should be created;
- Statutory processes should be integrated and communicated at all levels;

- A framework should be created to facilitate interaction between ECSA and government role-players to address lack of skills and capacity and limit bureaucracy. ECSA should be the vehicle to facilitate this interaction on behalf of the engineering fraternity.

#### **11.4 Civil Engineering:**

- The most important priority was education and training, both in terms of quality and quantity.
- A large number of technicians and technologists qualify, and the path to progress towards professional engineer should be clarified;
- There should be subsidies in place to capture more of the training schemes and increase effective skills development;
- A compulsory mentoring and skills transfer scheme should be instituted in the workplace to support tertiary institutions;
- In terms of structures and systems, IDIP and similar structures should be rolled out more proactively and in a more focused manner. Support by senior engineers will ensure quicker rollout of these programmes. Responsibilities and processes should be clarified upfront.
- Corruption, financial mismanagement and procurement strategies must be addressed to speed up programmes;
- Macro-level and long-term planning, and planning in an integrated manner, must be facilitated. Regional integration should receive attention.
- In terms of funding and financing, there should be processes to unlock budgets; alternate systems with appropriate risk allocation must be researched.
- In terms of asset management, a task team should be requested by ECSA to look at planning, execution and sustainability of projects.
- Promote a positive and healthy lifestyle for all South Africans through the trusted advice of the engineering profession. ECSA should forge these partnerships with government to support the development of suitable structures, and ensure efficient and effective use of public funds.

#### **11.5 Industrial Engineering:**

- Public sector service delivery and supply chain capability as a supporting mechanism for industry were identified as areas where the engineering profession can make a valuable contribution;
- A number of cross-cutting issues were identified, namely the skills pipeline. There is a certain level of dispersion of industrial engineers into other disciplines and a certain loss of identity, which brings its own challenges. The liability of industrial engineers further deters cohesion in the fraternity. In order to improve service delivery, there has to be a concerted effort to focus on increased accountability, which the profession could play an important role in achieving.
- There are statistics to demonstrate that the cost of delivering medical and educational supplies is mostly taken up by the costs of transportation and delivery. Modular construction could be used to great effect to ease bottlenecks in housing, and ensure service delivery. All partners in the value chain have to be equally competent and aligned to the same outcomes.
- Moving to the messages, industrial engineers bring a scientific approach to optimisation of the output chain and resources in a holistic way, looking at people and environmental constraints.
- The target audience has to be government, provincial and local authorities. There is a voluntary association for industrial engineers, but it does not have the resources that ECSA has. A multi-disciplinary approach will have to be followed.
- A lot of research has been done in the public arena; the issue would be to consolidate this research and come up with solutions. If ECSA should be willing, the industrial engineering fraternity would gladly participate in a process of engagement.

### **11.6 Mechanical Engineering:**

- The group was well represented, covering practitioners from parastatals, private, consulting and higher education institutions.
- The public service has made a commitment to spend R 800 billion over 3 years on infrastructure development. If one takes the public service engineering component of this amount, this amounts to about 2 000 top-end professional engineering and project management resources that would be needed. Where will the government find 2 000 of these experienced, well-trained people to spend R 800 billion over 3 years? How can ECSA and the engineering profession help to address this issue?
- If the engineering community had 0.1% of that money, it could put together a team of people through ECSA and the VA's to find a way to build the owner's team capacity that will be needed. If we do not develop the infrastructure that is needed, we will continue to have angry members of the public in South Africa.
- A research and development team has to be funded to look at the longer term education strategy at schools and universities. The constraints are not only at the level of schools, but across the education system.
- Private industry partners should be incentivised to train people. Industry should be incentivised through long-term contracts to invest in training. We also need to focus on mentoring – there are many accelerated career pathways, but not enough accelerated training programmes.

### **11.7 Metallurgical Engineering:**

- The group identified a number of main areas in metallurgical engineering.
- The first is the perceived need for increased beneficiation and associated with it, nationalisation. Beneficiation should really not be the problem of the mining industry; if there is an economic need for beneficiation, this should be part of the labour debate.
- Exporting materials that have been beneficiated is generally raised as a concern, but this is simply not true – what is exported is surplus to what the local market needs. Stainless steel is an example; there is no need to import steel. Zink has to be imported because of high power costs. Coal is fully beneficiated and used in South Africa, and surpluses are exported.
- The driver for all of this is economic analysis; we produce far more minerals than we actually need, which end up being exported which brings in billions of Rands.
- Secondly, import substitution was highlighted as a concern – many factories have gone bust because of import substitution.
- There are many environmental issues in the mining and metallurgical industry; water use and acid mine drainage have to be managed, but issues like coal discards that can be used to generate power should be considered.
- The skills gap is an area that should be addressed – the gap is particularly evident in the age group from 35 to 45. Lots can be done to stimulate the youth's interest in the engineering profession.
- The provision of basic issues like labour, power and water. Labour has been particularly newsworthy in the recent past, but other issues like power and water also have to be addressed.

### **11.8 Mining Engineering:**

- This group had an extensive discussion of the issues and how they could be addressed.
- Infrastructure – roads and railroads, the damage to the road system because of the lack of a suitable railroad system to move bulk;
- The 'rape and pillage' of resources attributed to the mining industry;
- Education and training, competency and accountability, skills shortages;
- Expectation that labour has in terms of career pathways and remuneration;
- Coaching and mentorship;

- Need to align legislation governing the mining industry; and lack of capacity at government level;
- Research and development capacity should be strengthened. The technology and will to apply best practices have to be strengthened.
- Strengthen the drive to buy South African;
- Industry coordination is necessary in terms of environmental standards and responsibilities.
- Priority messages: there is a shortage of skills and competent engineers and a misalignment of expectations in the workplace – industry and education structures should address this issue.
- Engineering should contribute to infrastructure improvements; get heavy loads off the roads and onto the rail system, and fix the roads;
- Government, industry and ECSA should coordinate their efforts. Industry should work with ECSA to share best engineering practices, and in-depth research should be done into each of these areas to understand problems and determine what can be done by the engineering sector to fix problems.

## **12. WAY FORWARD AND CLOSURE**

It was noted that the inputs of the various groups at this event will be consolidated into a single document that will be published on the ECSA website. ECSA will work with the VA's to take the work identified during the conference forward.

Mr Peters highlighted the importance of responding to the problems identified as a collective; ECSA will identify those areas where the available skills and capacity could have the most impact. On behalf of ECSA, each attendee was thanked for taking the time to attend the conference and for the valuable inputs that they made. ECSA's team was thanked for making the event a success, and the facilitators of each of the discussion groups were thanked for their assistance.