

Abridged Version of  
**THE PROCEEDINGS OF THE SAAE INTERNATIONAL WORKSHOP ON  
CHALLENGES OF THE ENGINEERING SKILLS SHORTAGE**

## **INTRODUCTORY REMARKS**

Faculty of Engineering of University of Pretoria provided support for the Workshop as part of the Centenary Celebration Programme. Financial sponsorship was kindly provided by Anglo American PLC

1. Current status of the work force of the nation reviewed against backdrop of the global scenario
2. Representatives from Academies of Engineering of UK, India and Australia provided invaluable perspectives
3. Stakeholders from different sectors of the nation such as academia, business, trade unions, industry, the professions, the natural sciences and government (JIPSA, and depts) deliberated on factors that needed to be considered. Deputy president tendered apologies and delegated staff to attend.
4. A framework for the proposed *Master Plan* was structured with the formulation of an implementation strategy.
5. Essence of the discussions has been prepared for presentation to the Deputy-President and representatives of JIPSA, at a post-workshop session.

## **SYNTHESIS OF THE DISCUSSIONS**

1. Changes in the economies of the world have impacted on skills needs and international competition for skills
2. Quality of education is a pre-requisite for being or becoming a "*Winning Nation*"
3. Proper management and governance generally is a necessity for success – but strong evidence that it is not the case in many spheres of the nation
4. South Africa is slipping in the global economic scene. It would be difficult to regain its former status in the *Premier League once lost!*
5. Crime and violence is at an unacceptable level in South Africa - jeopardizing efforts critical to the success of the skills enhancement initiative
6. Industry and tertiary education are taking steps to bridge mismatches between the two with more emphasis on practical work
7. New technologies - need for new skills
8. Career mobility is global and must be accepted
9. Engineering service disasters with even worse implications than the present ESKOM power failures can be expected if warning signals are not heeded

Questions that were considered:

1. how to develop and implement a workplace strategy?

2. how to ensure that the new workforce is ready for evolving organizational needs?
3. how to develop and improve tertiary programmes for specific or specialty areas?
4. how to improve the skills for managing our technology assets?

### **The Context within which the Engineering Skills Shortage needs to be Considered**

#### Craftsmen – builders of the nation's infrastructure

1. Focus on meeting urgent needs for skills in the short term
2. *Picking the low – hanging fruit, as well as building on sustainable engineering skills resources for the long term!*
3. Refocus on the quality mix of skills and optimal deployment of existing skill
4. Use all available highly educated and trained people to carry out appropriately demanding functions
5. Craftsmen – builders of the nation's infrastructure unavailable
6. Rebuild a national system for training and testing artisans
7. Unleash the wealth of financial resources (in the SETA's) and physical facilities
8. Provide free/affordable training to all those who qualify for at least the next four years
9. Train at least 50 000 artisans over the next five years

#### Engineering technicians and technologists – the engine room

1. Re-establish respect for technicians and technologists
2. Redefine the role of Universities of Technology
3. The output of this important stream of the pipeline should be about three times that of engineering graduates
4. Adjust the remuneration of professional staff at Universities of Technology to a market related level
5. Provide free bursaries for a period of at least four years to all South African's who qualify to study

#### Graduate professional engineers – playmakers for wealth creation

1. Focus on qualitative as well as quantitative needs for professional engineers
2. Supplement from outside sources with due regard to ensuring compatible competency
3. Adjust remuneration of professional staff at Universities to a market related level
4. Provide bursaries for a period of at least four years to all South African's who qualify

#### Career Guidance

1. Establish how to identify Engineers at an early age
2. Recognize differences in potential between school learners
3. *Reading, Writing and Arithmetic* prerequisite to continue with studies

4. Use systems such as *TRAC and its trainers to identify potential of learners and enhance teacher training!*
5. Provide bursaries automatically for at least the next four years to competent persons wishing to study SET
6. Options to develop affinity for trades and professional staff needed by industry:

- *“Influence the influencers!” – Teachers, parents, provincial education department district officials*
- Enhance the *Image of the Engineer*
- Take maths and science teachers to upgrade their knowledge on Science, Technology, Engineering and related Management (STEM) fields
- Bring message to schools in person with passion and support

Re-educating Teachers of Science and Mathematics and/or bringing them back into the System

- Retention of Tertiary Science Technology and Engineering Students should be a high priority and comprise interalia
- Structured workplace training and development:

Career paths

1. Toolbox of training courses and development initiation
2. Learnership programmes - unit standards must be competency driven
3. Mentorship
4. Regular performance counseling

Creating a better working environment

1. Safer Schools
2. Less administrative load
3. Restore the “image” of the teacher. Teaching is a profession!!!

Policy Issues that Need to be Addressed to Improve the Environment.

1. Numbers are important but *not at the expense of quality!* We need to ensure that efforts are aligned towards well defined goals with well managed coordination
2. Create a national training environment
3. Tertiary and FET institutions must be assessed for their output of graduates and diplomats against the national need
4. Technology – based departments in all three spheres of government must be headed by competent engineering practitioners well versed in management
5. Technology – based organizations must be transformed but *without losing essential competence in engineering.*
6. Sufficient funding to ensure implementation of the full extent of the *MP*
7. Consider a suggestion that funding be made available for a *major infrastructure and skills development programme* over the next decade
8. Little doubt that a nation can only be successful in a technologically intensive era such as the present if it possesses

an adequately sourced and trained engineering and technological workforce

9. Proposed *MP* can come together if responsibility for skills development at all levels in *Science, Technology and Engineering* are unified at *Executive level* under the jurisdiction of the presidency
10. After acceptance, a task team should be established to formalize the framework and a coherent strategy for execution of the *MP according to an agreed implementation schedule and specific benchmarks.*

**A MASTER PLAN TOWARDS  
ENGINEERING WORKFORCE RECOVERY AND DEVELOPMENT  
FOR SOUTH AFRICA**

**EXECUTIVE SUMMARY**

**OVERALL OBJECTIVES FOR THE MASTER PLAN (MP)**

- ❖ *Setting achievable goals in a systemic manner*
- ❖ *Working towards the set goals through partnerships*
- ❖ *Sustainability*

**ELEMENTS OF THE PROPOSED MP**

Eight primary elements were identified during the workshop as important components for the successful formulation and implementation of a framework for the *MP*. Some specific ideas for populating the framework emanated (emerged) from presentations and subsequent workshop group discussions. These provided valuable content for the draft *MP*. As greater clarity is reached, the *MP* will be further developed, populated and prepared for consideration by the various stakeholders. It is anticipated that the initial draft will generate vigorous discussion and gain enrichment in the process. Each of the elements is discussed hereinafter. The drafting of the *MP* was designed to allow subsequent insertions, deletions and text changes to be done with ease and without fear of addressing controversial issues.

1. Establish feasible short-term interventions

It was clear that a wide range of short-term interventions would have to be considered and implemented as quickly as possible. This would have to be done with due regard to the three primary objectives of the *MP*.

Details of proposed possible short-term interventions, together with some other options are contained in the synthesis of the discussions during the workshop. These should serve as potential elements for the development and implementation of the *MP*. A selection is mentioned below in abridged terms only.

- Launch a massive development programme for artisans using existing state, State Corporation and major industry training resources. This should comprise inter alia the following:
  - Fast-tracking trade apprenticeships
  - Training and re-training of craftsmen and women to suit both new and current needs of the industry
  - Establishing or re-establishing a database of qualified artisans to recover and manage this invaluable resource of industry.

*It is apparent that the number of qualified artisans currently falls far short of the needs of industry. Hence this action should have a very high priority.*

- Re-educate teachers of Science and Maths and/or bring them back into the system. Utilize successful intervention programmes, such as *TRAC*, on a national basis, to empower teachers by means of teacher training programmes
- Rationalise and promote STEM education and training. Differentiate where necessary and recognize and reward excellence
- Retain tertiary Science, Technology and Engineering students and practitioners

*There is extensive evidence that the fore mentioned activities are probably the ones that will render the most rapid improvement of the poor status quo. In particular it has been found that the quality of education has not advanced apace with the quantity of education enjoyed by learners in the country during the past two decades. This necessitates focused intervention towards improved quality, which requires an attractive and safe science, engineering and technology environment with awareness and buy-in of the nation. This will only be achieved through the systemic approach proposed in the *MP*.*

## 2. Initiate long-term action/programmes

- Raise visibility of *science, technology, engineering and management (STEM) careers* by
  - Enhancing the *Image of the Engineer*
  - Having industries adopting schools.
  - Taking maths and science teachers to upgrade their knowledge on STEM fields of activity including site visits
  - Introducing *all levels* of personnel activity in Engineering to school learners, FET Colleges and Technical High Schools

## 3. Treat the workforce pipeline from schools through into tertiary education or into skilled trades as a continuum

- Market and treat engineering as a whole as a career throughout the education and training system
- Re-establish the meaning of and respect for technicians and technologists in engineering by clarifying the space between craftsmen and professional engineers while stressing the need for all levels of competency

4. Maximise partnerships between role-players
  - Improve the match between the needs of industry and the products of tertiary institutions through partnerships focusing on trades as well as professional staff
  - Establish atmosphere/culture in organizations conducive to learning, training and development
5. Create opportunities and align interventions
  - Adapt the traditional business model of planning, programming and budgeting for the assessed skills requirements of an organization, to address present circumstances
  - Focus on short-term needs and build sustainable skills resources for long term needs concurrently
6. Activate and build community awareness towards STEM recruitment
  - Drive *Engineering Workforce Development* from the highest level of government
  - Publicize the poor statistics of the nation with respect to STEM more widely and vividly
  - Publicize the wide scope of current interventions and those that will be activated as part of the *MP* widely
7. Retain corporate STEM capacity within academic, government, industry and business sectors
  - Develop and implement a workplace strategy for South Africa.
  - Ensure that the new workforce is ready for evolving organizational needs.
  - Develop and improve tertiary programmes for specific or specialty areas.
  - Improve the skills for managing our technology assets.
8. Effective financial planning and scheduling of activities

It is apparent that each of the fore mentioned elements of the *MP* have to be considered in their own right. This will require the establishment of a system for structuring and managing each element. The attention should be focused on the short-term interventions in the first place. Some items are already up and running and it is appropriate that these be nurtured and expanded. Others are ready to launch and this should be done with haste. The following discussion focuses on these elements:

- *TRAC* has reported reaching approximately 125 000 school learners and 2800 teachers in Maths and Science in 2007. Their annual budget as non-profit entity is about R6,5m per annum. That amounts to some R60 per school learner. If this output had to be increased five fold that would require in the order of R30m per annum.

- The *TRAC* process could also be utilized to train and/or retrain Maths and Science teachers. This would require careful planning and management to ensure that the school system is not affected negatively by absence of teachers. It is however possible to achieve this by utilizing some of the ideas presented in the *MP*. A budget of R75m would be needed to train 15 000 teachers per annum. These *TRAC* initiatives would underpin the more extensive efforts that are being initiated by the Department of Education.
- Immediate attention is needed to address the artisan crisis. It is currently estimated that 50 000 artisans are needed. It would require R1 billion per year over the next five years to reach this goal. Several aspects of such a process and appropriate methods were presented in the workshop for consideration.
- The training /retraining of tertiary Science Technology and Engineering students would require strong partnering with industry. Feasible methods were debated in the workshop and the funds could be sourced from the SETA pool. The exact number of candidates is not fully known nor is the capacity of the industry to undertake the task known. However, if a target of 2000 per annum is set for five years it is estimated that it would cost R200m per annum.

If the above four activities were to be launched by January 2009 or earlier if feasible, it would lend credibility to the efforts of JIPSA and set precedents for the expansion of the plan to full maturity. It would also provide opportunity for investigation of the feasibility of implementing the bold *skills and infrastructure plan* that was proposed in the workshop!

### **IMPLEMENTATION OF THE *MASTER PLAN TOWARDS ENGINEERING WORKFORCE RECOVERY AND DEVELOPMENT FOR SOUTH AFRICA***

Conditions for successful unwrapping and implementation of the *MP* will require a concerted effort of all involved. This will of course be a topic that will be debated during the proposed post workshop feedback to JIPSA. Details will have to be carefully planned. In the debates during the workshop it was widely recognized and agreed that the success of the proposed *MP* was inter- dependent upon successful handling of the following three areas requiring skilful maneuvering and decision taking by government.

1. A safe and secure environment
2. Revision of government policies
3. Adoption of the *Master Plan towards Engineering Workforce Recovery and Development for South Africa* as a national strategy

If this is not taken care of in a spirit of harmony and goodwill, the *MP* will not be successful and the results are likely to bear little fruit. Some details and proposals are presented in the proceedings of the international workshop.

Drafted by Fred Hugo from the proceedings of the International Workshop, presentations, submissions, and reviews by SAAE Fellows, notes and observations. Input from all contributors is acknowledged with appreciation. Revised June 5, 2008 to reflect Master Plan in lieu of Marshall Plan.