What has been done and still needs to be done to skill South Africans to deliver infrastructure projects

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Abstract

The National Infrastructure Plan is made up of eighteen Strategic Integrated Projects (SIPs) each of which consists of a large number of projects drawn from a wide range of economic sectors and stretching across all nine provinces of South Africa. The Department of Higher Education and Training, was given the task of ensuring that the skills demands of these projects were realised both in advance of (**for**), and on the sites of (**through**), the development of the Strategic Integrated Projects. This paper presents the approach adopted to determine the occupations required and the interventions necessary to address the demand. Although focused on infrastructure skills, the approach can be generalised for skills planning in any field such as health, education, etc. The concept of determining which occupations are required is fundamental to the process. The aim is to increase the pool of those with the

requisite skills in the South African labour market – rather than seeking to map an individual to a job vacancy. Education and training providers have their own language, that of qualifications which does not speak to the language of occupation in a linear fashion. So the notion of a learning pathway was created to bridge the two. It commences with the underpinning knowledge or theory required, followed by simulated practice of some of the critical skills and procedures, followed by supervised practice in a real workplace and culminating in a formal assessment which might result in a professional designation, a trade certificate, a licence to practice or some other recognition that the practitioner is now competent to practice without supervision – with the qualification providers being equivalent to the first one or two steps of this pathway. A methodology was developed to determine the skills required for different types of projects. The methodology essentially consists of developing what are called skills prototypes for typical projects in each of the different sub-sectors. These prototypes are then used to estimate the skill requirements of similar projects by scaling the prototype up or down. In this way an estimation of the total skills required for all projects was developed.

International trends suggest that skills shortage is a global phenomenon. Employers worldwide express their unhappiness regarding a shortage of skilled professionals in various sectors of the economy. In Australia, skills shortage is faced in professional, skilled trades and service occupations (Mavromaras *et al*, 2013). In Europe, skills imbalances are a concern with respect to anticipated growth (CEDEFOP, 2012). In The United States it was found that there was a mismatch between the needs of industry and graduate attributes (ASCE, 2008). This view has been echoed in South Africa (Lawless 2005:125-129). The introduction of graduate attributes into the university curriculum is often suggested as a remedy to the problem (Tempone and Martin, 2003). But graduate attributes are not enough to work in the corporate world where the need to deliver actual projects does not allow for scenarios for young graduates to test their skills. Industries required more knowledge work, more teamwork and more use of technology than in the past. In Africa, HIV/AIDS is another contributor to the shortage of skilled professionals. Skills shortage in South Africa is due to an increasing demand which is driven by rapid growth combined with supply pressures (Mateus *et al*, 2014).

The South African government has adopted the National Development Plan (NDP) as its framework for addressing the three key ills in the country – high unemployment, high inequality and high levels of poverty. This paper outlines the SIPs Skills Plan that was developed from late 2012 to 2014 to address the skills dimension of the National Infrastructure Plan (NIP), one of the central pillars of the NDP. The NIP consists of 18 Strategic Integrated Projects (SIPs), each of which is essentially a portfolio of projects integrated through a common purpose. It provides an update on the progress achieved to date and outlines the next steps for its implementation. It concludes with a set of recommended measures that must be taken in support of this Plan.

The SIPs Skills Plan

From the outset it was envisaged that there would be a shortage of certain critical skills for the implementation of the NIP's Strategic Integrated Projects. Addressing this shortage is a key objective of the SIPs Skills Plan, and requires training in advance of the projects to ensure that skills are available when needed. It was also seen that the projects themselves would provide an ideal opportunity for workplace learning for thousands of citizens. This was therefore set as a complementary goal. The vision adopted was thus "Skilling South Africans **for** SIPs and **through** SIPs" with a core principle being "Building people is as critical as building physical assets". A phased approached to development was adopted as shown in Figure 1, with several focus areas to determine supply and demand and ensure that adequate support is in place to meet with demand.

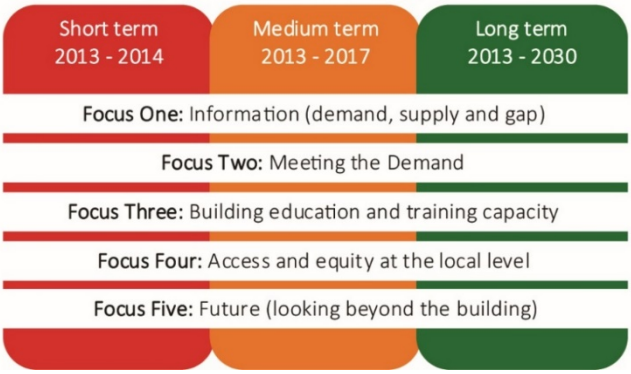

Figure 1: The SIPs Skills Plan

Focus One : Determining supply, demand and the gap

Establishing what skills would be in short supply for the roll-out of the NIP was a key priority. It proved to be challenging however as it soon became apparent that skills for the SIPs could not be seen in isolation from the broader demand for skills in society at large – as there was no guarantee that a person trained for a SIP project would not be attracted to work in the public or private sector somewhere else locally or internationally. The challenge did not stop there. Working out the nature and extent of the scarcity was also difficult given the current state of labour market information in the country.

Focus Two : Meeting the demand

Meeting the demand requires a multi-faceted response. In the **short term**, importation of skills or encouraging retirees to return to the workplace is considered necessary. In the **medium to longer term**, education, training and experience is the appropriate response. In general what has been developed is an understanding of the pathway that new entrants must follow to attain full competence – from school to a learning institution where theory is learnt, followed by or interspersed by time in a simulated workplace learning site where practical skills are acquired, followed by time in a workplace where the person moves from novice to competent worker under the mentorship of a qualified person. A point is reached where they can be formally assessed as being competent in their own right and capable of working independently – from which point they can proceed to enhance their expertise. This process is shown in figure 2.

Figure 2: The learning pathway

In the medium term, it is also possible for those who have travelled part of the way to be assisted to complete the journey – such as, for example, university graduates who require the requisite workplace learning to attain professional registration or college graduates who need workplace learning to take their trade tests. Those who have acquired skills informally can be evaluated and assisted to become competent. To increase the number achieving the competent level per occupation, increased enrolments, improved throughput, workplace opportunities and support must be in place as articulated in many research papers (Lawless and Kirsten, 2008; Fisher, 2011; ETDP SETA, 2012).

The need to capacitate the public sector with the requisite skills to plan, procure, oversee and sign off projects; and once infrastructure is built, to operate and maintain the assets, gives an indication of some of the many skills that must also be in place. Extensive

research has indicated a loss of technical skills in the public sector, which must be rebuilt. Furthermore, new skills for new technologies will also need consideration to accommodate innovative solutions being developed.

Focus Three : Building education and training capacity

To implement the strategies identified under Focus Two, it is necessary to simultaneously address the education and training capacity of those who must induct others. It is essential to ensure that the pathway from entry to competence (and on to expertise) is clearly translated into appropriate qualifications and/or designations, and that these are supported by quality curricula and materials, adequate facilities, competent lecturers and workplace support. Putting in place measures to enable implementers to ensure these things requires committed attention. In some areas dedicated training facilities have been built or are being planned to meet the needs of the SIP projects, new qualifications must be developed and lecturer training and tutoring systems must be initiated amongst other support measures.

Focus Four : Access and equity at the local level

To ensure that people are aware of employment and training opportunities in their area, extensive career guidance is essential, as is awareness of job opportunities. The National Career Advice Portal (NCAP) has been set up for this purpose (http://ncap.careerhelp.co.za). The Department of Labour has made its Employment Services South Africa (ESSA) system available (www.labour.gov.za), by facilitating the registering of SIP job opportunities and informing SIP Skills Coordinators of the number of people registered on their database claiming to have the skills in demand in required areas.

Focus Five : The future

Once the infrastructure projects are completed, there is a need to operate and maintain them; the skills required for this work also needs attention, particularly in the public sector. In addition, in the longer term it is also necessary to look at the skills required for up- and down-stream programmes – such as the design and manufacture of inputs for the infrastructure build or the initiatives that can flow on the back of the infrastructure once built.

The Language of the SIP Skills Plan

It is necessary to train for the labour market, so that learners can move from one project (or job in the public or private sectors) to another with as much flexibility as possible i.e. it is better to train people with portable skills than train them for a specific job only.

Occupations

Occupation provides a type of mobility identity which people can carry when seeking employment anywhere. 'I am a qualified plumber', 'I am a registered professional chemical engineer'. These identities must be known, trusted and recognised by employers. In South Africa, the Organising Framework for Occupations (OFO) is a coded occupation system which lists some 1500 occupations that are recognised in the labour market. The OFO is the Department of Higher Education and Training's (DHET's) key tool for identifying, reporting and monitoring skills demand and supply in the South African labour market and provides a common language when talking about occupations.

Specialisation

This does not mean that specialisation is not needed. Employment in one sector may require additional skills to those provided in a general foundational programme. For example, a plumber who installs solar water heaters may require some additional training as would a

plumber employed in local government where he or she will have to work on large water distribution systems.

Qualifications

In general, education and training providers do not use the term of occupation but rather qualification which is earned at universities or colleges. In some cases there is a one-on-one mapping between qualification and occupation while in others this is not the case. The NCAP system mentioned earlier outlines the different learning pathways that lead to a single occupation, allowing learners to determine what learning pathway they should follow to enter their chosen occupation. This information is vital if more and more people are to escape poverty and unemployment and find decent work that would benefit the economy.

The SIPs Skills Planning Methodology

The SIPs project list

First and foremost it was necessary to draw up a list of all projects to be developed including information such as scope, size, budget, start and end date.

Occupations in demand

Sectors and sub-sector. It was necessary to analyse the projects in the 18 SIPs to determine in which sectors they fell. This exercise can be understood by looking at a typical matrix in Table 1.

Table 1: A typical matrix of sectors per SIP

Road	Rail	Ports	Water	Energy	ICT	Ind	Social
SIP 1 Unlocking the Northern Mineral Belt							
Road projects in SIP 1	Rail projects in SIP 1	Ports projects in SIP 1	Water projects in SIP 1	Energy projects in SIP 1	ICT projects in SIP 1	Ind projects in SIP 1	Social projects in SIP 1
SIP 2 Gauteng to Durban Logistics and Industrial Corridor							
Road projects in SIP 2	Rail projects in SIP 2	Ports projects in SIP 2	Water projects in SIP 2	Energy projects in SIP 2	ICT projects in SIP 2	Ind projects in SIP 2	Social projects in SIP 2
SIP 3 South Eastern Node and Corridor etc.							
Road	Rail	Ports	Water	Energy	ICT	Ind	Social

Once the projects were categorised under sectoral headings, they were further grouped into sub-sectors and sub-sector types. It was recognised that a different range of occupations may be required per sector and in some instances per sub-sector. For instance the skills required to develop a coal-fired power station would be very different from the skills required to develop a wind farm, although both projects are categorised under energy as the sector and generation as the sub-sector. Conversely, the same profile may be used for developing and constructing a university, which falls under higher education as a sector, and a court, which falls under justice.

Prototypes for typical projects in sub-sectors. Expert project managers were asked to identify the typical size of a project per sub-sector, the duration for completing such a project and the occupations required using the OFO. These were known as prototypes. They were also asked to rate which of the occupations were scarce. Figure 3 is an example of an overview of a prototype in the energy generation sub-sector where the skills required from the planning to the construction and maintenance phase is determined. Detailed occupational breakdowns under each major category are embedded. This process was followed for each of the SIPs sub-sectors.

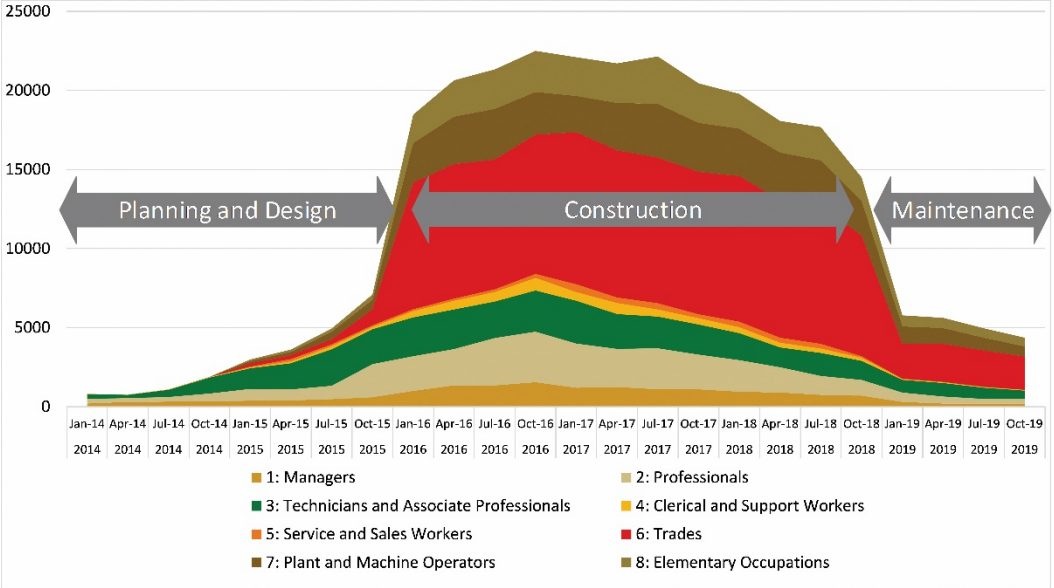

Figure 3: A typical sub-sector prototype

Skills required. Using the project list and prototypes and applying scaling factors to account for project sizes, commencement dates and durations, an overall list of occupations required for the SIPs could be determined. The model as generated in November 2014 is shown in Figure 4.

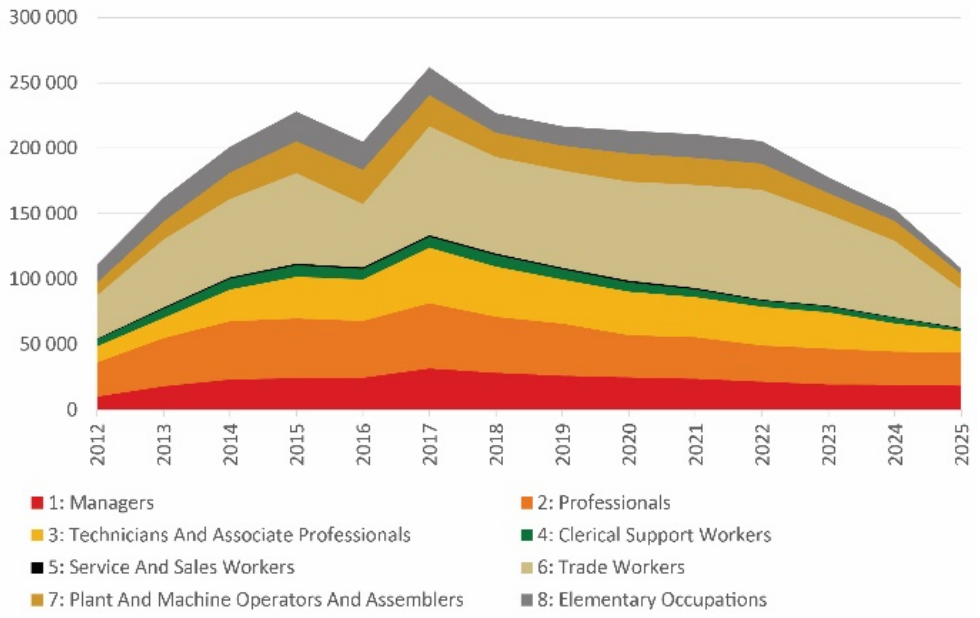

Figure 4: The SIPs skills demand

The projection required further adjustment for other projects to be carried out by the State which did not fall under the SIPs, and for private sector development. This then gave the overall demand. Where the factors relating to additional state and private sector demand were unknown, factors suggested by the Linked Macroeconomic Education Model (LM-EM) were used (Adelzadeh, 2013), or detailed research which had been carried out by interest groups representing certain occupations was adopted.

Occupational teams (OTs). To get input and advice on how to develop the occupations in demand, Occupational Teams were constituted. These teams were composed of theory and practical training providers, employers and those from registering or certifying bodies. They were able to draw on data from their communities of expert practice to refine the demand model and were able to offer insight with respect to the shortages and support required.

Supply

To determine the availability of skills, it was necessary to determine the size of the existing workforce and those available to return to the workforce from the ranks of the retired or unemployed, and to determine the inflows from education and training, plus immigration. This information was available in varying degrees of accuracy from the Quarterly Labour Force Survey – averaged from 2009 to 2013 for improved consistency (StatsSA), Employment Services South Africa (ESSA), professional bodies, DHET and the Department of Home Affairs. Since it was necessary to consider a 20 year horizon, losses such a mobility, mortality and retirement needed to be factored in, to ensure that adequate numbers were developed. Figure 5, a model created by Lawless (2005: 226-240) demonstrates the impact of skills movement over a period. This approach was followed for each occupation with the help of OTs.

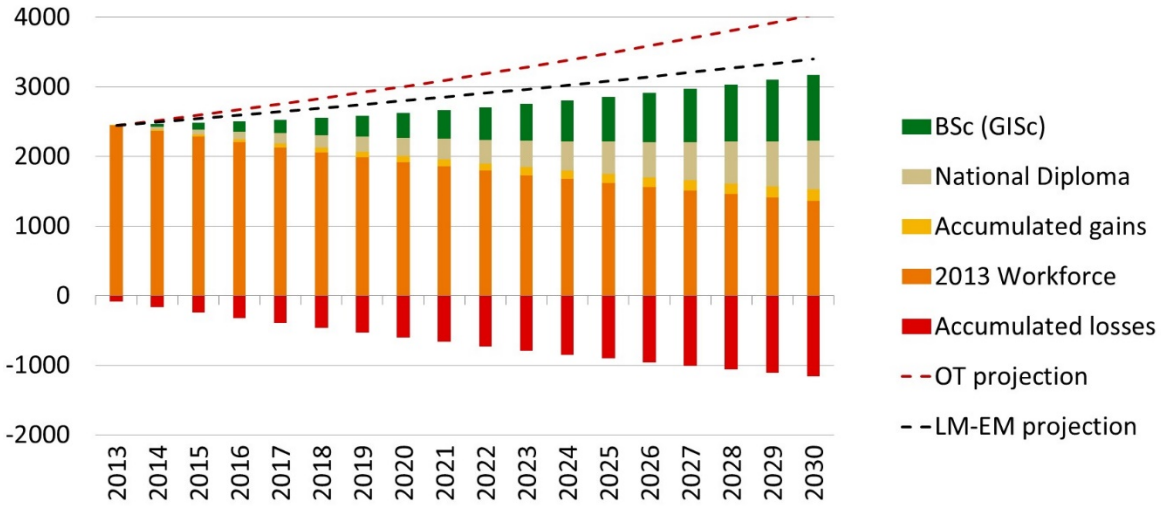

Figure 5: Supply and demand for Geographic Information Science Practitioners

The gaps

Where the demand (shown as dotted lines in figure 4) exceeded the projected growth, strategies needed to be developed to increase the supply. These could include immigration and the use of retirees in the short term, but in the medium to longer term, for most occupations there is a need to increase throughput at institutions providing theoretical and practical learning and to secure workplace-based learning to ultimately develop learners to the levels of competence required. The projections and interventions needed to be sensitive to the timeframe and locality at which these occupations were required.

What should be done?

To address the gaps, the support as outlined in focus areas three to five was considered to be critical. Funds were raised from the Sector Education and Training Authorities (SETAs), the National Skills Fund (NSF) and other agencies to support these focus areas, and it was decided to publish the detailed skills plan to get everyone on board.

The First SIPs Skills Plan Report

The first SIPs Skills Plan was launched by the Minister of Higher Education and Training on 2 September 2014 in the form of a report detailing all the occupations in demand and the support required to ensure their development was addressed. The report invited researchers and key partners to assist in improving the methodology that had been used to derive the list; to inform education and training planners of the occupations in demand in order to direct their attention to specific interventions required to address projected scarcities and to encourag all those with the resources to use them to support the interventions identified, to gain optimal benefits from the infrastructure investment in terms of generating South African jobs and South African skills. The response has been overwhelming, with provincial and regional bodies, employers and institutions committing to participate and address development at regional and local level. To ensure that all teams involved in planning and coordinating skills development initiatives followed the same process, a 21 STEP PROCESS has been developed, as shown in Table 2.

Table 2: The 21 STEP Methodology for developing scarce skills

What skills are needed?

1. Project list: Develop a list of projects planned and update the list at regular intervals
2. Skills prototype: Develop a prototype of occupations needed for a typical project in each identified sector/sub-sector and rate the scarcity of each occupation
3. Skills required: Estimate the total skills required for all projects over a timeline and produce a list of occupations in demand and a list of those that are scarce
4. National Demand – Determine the national demand for occupations identified as scarce

in STEP 3.
5. Occupational Teams: Set up occupational teams to act as expert advisers per occupation, to refine demand and supply models and give input on interventions required
6. Skills available: Determine the number in the workforce and the number unemployed with respect to each occupation in demand
7. Inflow of skills: Project inflow from those qualifying and consider immigration and use of retirees when demand requires additional short-term capacity
8. Where are the gaps?: Determine which occupations are not being developed at the required rate to meet demand
9. Where and when: Provide an indication of scale, place and timeframe of demand for each occupation

What should be done?

10. Training on project sites: Ensure tenders are issued including the cidb Training Standard calling for training on the site of projects (cidb, 2013)
11. School support: Consider schools in the area as feeders for skills and offer career guidance and support for gateway subjects such as maths and science
12. Centres of Specialisation: Identify Centres of Specialisation as near as possible to the source of demand
13. Delivery capacity: Occupational Team per occupation to visit Centres of Specialisation to determine their capacity, interventions required and develop a plan
14. Workplaces: Find workplace-based learning opportunities
15. Resources: Secure resources for the plan from SETAs, NSF, industry or other sources.
16. Implement, monitor and evaluate plans: Monitor and evaluate implementation

The special case of Government

17. Which departments: Determine which municipal, provincial or national departments have a central role to play in terms of planning, raising funds, procuring, overseeing and taking over operations and maintenance
18. What skills are needed: Define roles and skills required, match these against available skills and determine gaps
19. Planning and resourcing: Put together a plan and identify resources
20. Implement, monitor and evaluate plans: Monitor and evaluate implementation of capacity building

Governance

21. Governance: Establish robust structure to oversee implementation of plans.

Meeting resourcing challenges

In 1999 the Skills Development Levies Act was passed. It requires all employers (whose gross wage bill exceeds R500 000 per year) to pay a one per cent payroll levy to the

South African Revenue Service (SARS). Employers and educational institutions need to tap into this funding and create networks of training programmes around the skills required nationally. Scholarships have been offered by the SETAs and educational institutions are funded by DHET and incentives have been offered to employers to provide workplace learning. Although various bottlenecks have been identified, the SETAs and DHET are in the process of addressing these to create an enabling environment. Employers have also undertaken to work with government on this[1].

Conclusion and Recommendations

Implementation of the Skills Plan has commenced (DHET, 2015) however much work remains. It is now up to education and training providers together with employers to address the gaps that have been identified and to produce the next generation of skills to meet the demand of the SIPs. Going forward the implementation phase requires an efficient monitoring and evaluation tool to track the numbers entering and leaving the system because if there are shortages in any of the categories then the lack of a particular skill will affect the quality and period of completion of projects. The 21 STEP PROCESS can be adapted to any project to predict the occupational requirements and development processes in any sector or sub-sector. The SIP Skills Report is available on the following website: https://sip-skills.onlinecf.net.

[1] Organised business, as Business Unity South Africa and the Black Business Council, made this commitment to the President of South Africa under the President's Business Working Group on 24th October 2014.

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