Developing a National Skills Forecasting Tool for South Africa

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Preface and Acknowledgements

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Executive Summary and Key Recommendations

In 2003, the South African Department of Labour, supported by the European Union, commissioned research to investigate the feasibility of developing quantitative forecasting models to help identify future skill needs in South Africa.

The aims of the project were manifold. They included an in-depth review of forecasting models used in other countries, as well as an assessment of the suitability of existing South African forecasting models for identifying future skill needs/requirements. They also included an appraisal of the validity and reliability of data for use in developing a skills forecasting model in South Africa.

The project involved desktop research, reviewing previous work and data availability, as well as fieldwork in South Africa. The latter involved an assessment of the perceptions of a number of key experts in South Africa about the position there.

A consensus emerged that South Africa should adopt international best practice in anticipating changing skill requirements. The review of similar work across the world suggests that best practice, worldwide, usually involves the development of quantitative, national level employment projections. Although other methods and approaches are often adopted, these are generally regarded as complementary rather than substitutes for such projections, which are a cornerstone of most countries' efforts to provide useful labour market information to the various actors and stakeholders in the labour market. This usually entails the use of a multi-sectoral macroeconomic modelling approach, with all the advantages that this brings. While this is not the sole tool required to anticipate future skill needs, it is regarded as an essential part of the armoury in most countries that undertake this kind of activity.

The review suggests that there is modelling capacity in South Africa, upon which a robust, national, multi-sectoral forecasting system for occupational employment forecasting can be developed. Moreover there are some useful data to build such models, although these are not without their limitations. The review suggests that there are very real concerns about the quality of some of the data. However, it is argued that such concerns help to make a case for improvement in the latter rather than pre-empting the development of a new national level employment-forecasting tool.

Specific recommendations as to how to move forward, including the institutional arrangements required to facilitate such an approach are also made here. South Africa already has in place many of the building blocks required to carry out such a project. A number of macroeconomic models exist, some of which have detailed multi-sectoral capabilities. The key data sets providing information on occupational and qualification employment structures exist, although these do have their limitations and need to be further developed and improved if the reliability of this kind of exercise is to match that in other countries.

It is therefore proposed that a regular system for making quantitative employment projections, at national level, be set in place. This should include detailed sectoral, occupational and qualification elements, including estimates of replacement demands. A modular structure is proposed, which can facilitate further development and keep costs down.

The key modules are:

- Module 1: a multi-sectoral macroeconomic model, based around one of the existing models available in South Africa;
- Module 2: an occupational model, building upon previous work undertaken in South Africa, but making full use of the latest data available;
- Module 3: a replacement demand module, recognising the crucial importance of considering not just changing occupational employment levels but also the need to replace those leaving the workforce because of retirement, migration and mortality;
- Module 4: a qualifications module, focusing on the implications for qualification intensities within occupations (demand) rather than the supply side.

While all 4 modules could be developed independently, in practice the data and issues involved in Modules 2-4 are closely inter-related and are probably best undertaken by a single research team.

It is argued that, while there may be some benefits in improving and enhancing the existing data, new primary data collection is not a necessary condition to undertake some useful benchmark projections. These can be produced using existing data. Based on the assumption that no new primary data collection is required, the basic costs of such an exercise are estimated at around R1m. Updating costs, which might be incurred on a 1 or 2 year cycle, could be slightly less. However, there would undoubtedly be considerable scope for continuing development work, so it would be more realistic to regard this as the likely costs of a typical

update.

This should be sufficient to:

- “Buy in” a good set of multi-sectoral projections from an existing model;
- Develop a robust and consistent occupational database and related projection models, including implications for replacement demands and qualifications intensities;
- Produce a good quality report, including methodological details, software and data to enable easy updating

1. INTRODUCTION

1.1 Background

As part of its National Skills Development Strategy, the Department of Labour commissioned this research project to investigate the feasibility of developing forecasting models and tools, in order to help identify future skill needs in South Africa.

The first phase of the project involved two main elements:

- A review of international best practice, including an assessment of the strengths and weaknesses of different approaches;
- A review of existing data and previous approaches to this topic in South Africa.

In conjunction, these two elements allow an assessment of both what is desirable and feasible in a South African context. The report concludes with some detailed recommendations regarding a methodology for future skills forecasting in South Africa.

1.2 Aims and objectives

The detailed aims and objectives of the project were set out in the Terms of Reference as follows:

1. To assess the validity and reliability of data for use in a skills forecasting model in South Africa;
2. To identify and assess the suitability of existing South African forecasting models for identifying future skill needs/requirements;
3. To review forecasting models used in other countries and identify their applicability for use in South Africa;
4. To develop and pilot a forecasting model for use in the South African context;
5. To incorporate the forecasting model into the Skills Planning Tool Kit (SPTK);
6. To improve the capacity of the Skills Development Planning Unit (SDPU) to identify future skill needs;
7. To identify what future activities should be undertaken to identify future skill needs.

Anticipating the conclusions of this review, it is clear that “best practice” worldwide, involves the use of large scale, multi-sectoral models to produce a comprehensive overview of how structural economic and technological changes are affecting the demand for skills. The development and use of such models is a very resource intensive process, and it is apparent that this is not a practical objective of the present exercise.

What the present project can do is:

1. Assess the feasibility of using existing macro and sectoral models, already available in South Africa, to drive an overarching set of projections covering all sectors;

2. Explore the strengths and weakness of previous attempts within South Africa to forecast skill needs, including work by:
   - Human Sciences Research Council (HSRC);
   - Bureau of Market Research (BMR);
   - Individual sectoral studies by the SETAs.

3. Assess the availability and reliability of currently available data in South Africa on occupational employment structure by industry;

4. Explore the feasibility of addressing key issues such as the development of estimates of "replacement" demand by occupation, including elements such as:
   - voluntary retirements from the work force;
   - mortality (including the effects of AIDS);
   - migration (including the reliability of official data on emigration rates).

5. Examine the feasibility of extending some of this work to include other aspects/dimensions of skill such as formal educational and training qualifications and key/generic skills.

6. Make recommendations on possible models/approaches for undertaking this work, as well as possible institutional arrangements for carrying out such work.

1.3 Structure of the report

Section 2 begins with a summary of the various methods used across the world to anticipate changing skill needs, with particular emphasis on quantitative occupational employment forecasting. This draws upon an in-depth review, which is contained in two separate Annexures (A and B). All the key approaches are considered, including the national, multi-sectoral, macro-modelling approach. The reasons for favouring the latter approach are set out in detail, along with some of the problems and pitfalls associated with it.

Section 3 reviews previous work on occupational employment forecasting in South Africa. This includes previous work by the Human Sciences Research Council (HSRC) and the Bureau of Market Research (BMR). The discussion provides a critical but constructive review of previous studies, their limitations and scope for improvement.

Section 4 assesses relevant data sources in South Africa, focussing upon their strengths and weaknesses from the point of view of developing a systematic and comprehensive quantitative forecasting tool. This includes issues such as the quality of sectoral employment data (output and productivity, as well as employment) and the problems of mapping between the standard Industrial Classification (SIC) which is used to classify most official data and the "footprints" of the Sector Education and Training Authorities (SETAs), which have been charged with assessing sector skill needs in South Africa. Other issues covered include the availability of occupational employment data (especially industry by occupation employment matrices), the consistency of data over time and the merits of official and alternative / unofficial sources. Data on "replacement demands" by occupation, including rates of outflow due to normal retirement, mortality (including AIDS) and net migration are also assessed. Finally, data on qualifications and key/generic skills by occupation are also considered.

Section 5 begins with an overall assessment of modelling capacity in South Africa, including the availability of macro-modelling capacity. It draws together the key findings from Sections 3 and 4, outlining what types of modelling are feasible given current data and modelling capacity. In the light of all this, it then goes on to draw together the key conclusions from Section 2 and makes detailed recommendations about the best way forward in a South African context. This includes recommendations on the best ways of exploiting existing modelling capacity and data, including how existing models and data can best be adapted and used, providing some examples. This section also includes some recommendations for changes to institutional responsibilities and related arrangements to achieve such ends. Possible longer-term developments involving development of new data sets and/or modelling capacity, as well as the integration of outputs from such an exercise within the SDIS and SPTK, are also covered.

Finally Section 6 concludes, by summarising the key recommendations.

Full details of the various sources and references covered are given in the bibliographies contained in the separate Annexures, which also include details of the key data sources.

2. AN OVERVIEW OF OCCUPATIONAL FORECASTING WORLDWIDE

2.1 Key approaches: an assessment of international best practice

There have been a large variety of approaches to anticipating changing skill needs worldwide. These have tended to reflect perceptions of both what is desirable, as well as the practical limitations of what is feasible. Both of these have changed substantially over the past 50 years. From the earliest attempts, those engaged in such work have adopted model based, quantitative methods wherever possible, simply because quantitative results have been seen as a key output required by potential users of the results. The use of formal models has been advocated on various grounds, as detailed below. However, the merit of alternative, more qualitative methods has also been recognised.

Current work in this area is still very much constrained by data limitations. What is feasible in different countries is limited by their "statistical infrastructure". Some countries, such as the USA, have been engaged in this kind of work for over 50 years. The sophisticated analysis conducted there has been based upon very substantial prior investments in statistical surveys and datasets as well as modelling capacity. In contrast, in some other countries, where the same levels of investment have not been undertaken, the data to develop such quantitative models simply do not exist. In such cases alternative approaches have been developed. While these approaches can provide some useful insights, they are generally regarded as useful complements to the more fully-fledged, model based projections, rather than a substitute for them.

Based on an extensive review, covering most of the countries in the world which have undertaken work of this nature, the main approaches adopted include:

- Formal, national level, quantitative, model based projections;
- *Ad hoc* sectoral or occupational studies;
- Surveys of employers or other groups;
- Focus groups/round tables and other Delphi style methods, including setting up "observatories" (these may include some quantitative aspects but are generally more qualitative).

Each of these approaches has its own strengths and weaknesses. These have been compared and contrasted in Annex A, the results of which are summarised in Table 1. This includes the multi-sectoral macro modelling approach, although the pros and cons of this method are discussed in greater detail in the next sub-section.

Even where forecasting is carried out using hard-nosed, quantitative methods, those involved usually stress that such projections should be seen as part of an ongoing process rather than the final word and recognising the importance of incorporating more qualitative insights. None of today's forecasters claim that they can predict the detailed skill needs in different sectors with great quantitative precision. Rather, they suggest that they can provide the various participants in the labour market, as well a policy maker, with useful insights into how labour markets are developing in response to various external influences. It is important to recognise that accurate and precise forecasts are a chimera. The key question to ask is not whether or not such projections are **accurate**, but whether or not they are **useful**. The revealed preferences of national governments from all over the world, who support such activity with substantial funding, suggest that they are regarded as of considerable value. It is also clear that such work is seen as having a wide variety of different audiences and users, including careers guidance, as well as general labour market policy formation and planning education and training programmes. Few, if any, countries now regard such work as resulting in information that can be used to plan the scale and pattern of education and training provision with any precision. Rather it can help to inform all those involved about how economic and other forces are shaping the labour markets and the general implications for those skills that will be required.

Table 1: Comparison of the Pros and Cons of Alternative Approaches to Anticipating Skill Requirements

Alternative approaches	Advantages	Disadvantages
Formal, national level, quantitative, model based projections	Comprehensive Consistent Transparent Quantitative	Data hungry Costly Not everything can be quantified May give a misleading impression of precision
Ad hoc sectoral or occupational studies (using a variety of quantitative (model based) and qualitative tools)	Strong on sectoral specifics	Partial Can be inconsistent across sectors
Surveys of employers or other groups, asking about skill deficiencies and skill gaps	Direct "user/customer" involvement	May be very subjective Inconsistent Can too easily focus on the margins (i.e. current vacancies) rather than skill gaps within the current workforce
Focus groups/round tables and other Delphi style methods	Holistic Direct "user/customer" involvement	Non-systematic Can be inconsistent Can be subjective

2.2 Typical quantitative modelling approaches

The typical quantitative modelling approach involves two key elements. The first key component is a multi-sectoral macroeconomic model of some kind, usually built around a Leontief input-output table, which takes into account the inter-linkages between sectors. Such models are usually estimated using complex and sophisticated econometric methods, although computable general equilibrium models (where parameters are imposed rather than estimated) are also used in a number of countries. The key outcomes as far as the present project is concerned are consistent projections of employment levels by sector. Of course, in addition to providing projections of sectoral employment, such models are used for a wide variety of other purposes. Details of a typical multi-sectoral macroeconomic model are provided in Annex A.

The second key component is a module or set of modules, which translate the outcomes from the multi-sectoral models into implications for the demand for skills. These elements vary considerably across countries. Most commonly, this aspect is much less sophisticated, mainly due to the more limited nature of data available on skills. In most cases, the focus of attention is limited to occupational employment structures within sectors. The trends in such structures are analysed, normally using very simple techniques rather than sophisticated econometric methods. Again the typical approaches used are discussed in more detail in Annexes A and B.

2.3 Reasons for favouring a quantitative modelling approach

The review of international best practice in skills forecasting suggests that this generally involves the use of a multi-sectoral macroeconomic model. Such models are regarded as essential in order to obtain a robust and consistent sectoral employment scenario, which is the starting point for any comprehensive assessment of changing skill needs.

The advantages of such an approach include:

- The sectoral and other detail it provides;
- The fact that it is typically comprehensive, covering the whole economy;
- Logical consistency;
- Imposition of accounting constraints;
- Recognition of economic constraints and influences;
- The fact that it helps make underlying assumptions explicit;
- Consistent scenarios across all sectors.

2.4 Problems and pitfalls in using a modelling approach

Such methods do, of course have some disadvantages and problems. These relate to:

- Data limitations (often data were not collected with modelling in mind);
- Technical limitations within fixed resource limits;
- Resource costs of development and maintenance;
- Limits to current understanding of the way labour markets work;
- The possibly limited relevance of the past (such models being based on an assumption of a continued of past patterns of behaviour).

Quantitative models should not, therefore be seen as a panacea. Nevertheless, in most of the countries that do conduct regular national assessments of future occupational and skill requirements, such models are regarded as an essential cornerstone. Such models are increasingly being adopted in developing, as well as developed, countries as the availability of data and the capacity for model building improves.

3. OCCUPATIONAL EMPLOYMENT FORECASTING IN SOUTH AFRICA

3.1 A critical assessment of modelling capacity and data availability in South Africa

The initial phase of this project involved fieldwork in South Africa. The aim of this phase of work was to assess the perceptions of a number of key experts about the situation in South Africa. Those experts were interviewed to obtain their views on the list of topics set out in Section 1.2.

Although there were many different views, a broad consensus emerged along the following lines:

1) If possible, South Africa should adopt international best practice (i.e. develop national level, quantitative, employment projections, using a multi-sectoral macroeconomic modelling approach, with all the advantages that this brings);
2) There is existing capacity in the area of multi-sectoral forecasting in South Africa which could be used to underlie a skills forecasting model (the use thereof would avoid the need to make substantial investments in building such capacity from scratch);
3) There are various data sources available which would enable occupational projections to be developed, driven by such sectoral forecasts, and it is possible these could build upon earlier work (notably that carried out by HSRC for 1998-2003);
4) However, there are very real concerns about the quality of the data on occupational employment currently available and these need to be carefully addressed in any attempt to produce a national level set of projections;
5) Data concerns are even stronger in relation to issues such as replacement demands and other dimensions of skill, but some data do exist which can be used to highlight the significance of the key issues;
6) Data concerns also exist about alignment between SIC and SETA demarcation, which needs to be carefully sorted out.

Issues relating to data are dealt with in the following section. The remainder of this section focuses upon two issues. Section 3.2 reviews previous attempts to anticipate changing skill need in South Africa. Section 3.3 deals with the availability of multi-sectoral macro modelling capacity needed to drive a typical set of occupational employment projections.

3.2 Previous attempts to anticipate changing skill needs in South Africa

Previous work in this area in South Africa has tended to focus on the second of the two components identified in the previous section, although the discussion in Section 3.3 below, suggests that recent developments in macro modelling mean that this emphasis might now be changing. As far as analysing the implications for trends in occupational employment structures is concerned, there has been one nationwide study in recent years, plus a number of more partial exercises. Together, these various studies provide a useful foundation upon which to build a new and more comprehensive analysis of changing skill needs in the South African economy.

In a review of earlier work, Barker (1999, p 232) states: “Forecasts of expected broad trends, to provide guidelines for education, training and labour market planners, have in the past been made by the National Manpower Commission, … the Institute for Futures Research, ... and the Department of National Education. However, these forecasts were not found to be very helpful.” Barker was the Chairperson of the National Manpower Commission during the late 1980s, and this criticism perhaps reflects a view that such projections should deliver precise answers about where investment in education and training provision needs to be made. It is now recognised in most countries that this is not possible in a market economy, where labour market outcomes reflect the combinations of huge numbers of individual decisions. Nevertheless, such information can provide useful information to all these involved, even if it cannot be used to plan as in a command economy.

HSRC (1999)

In 1999 the HSRC undertook a study of South African labour market trends and workforce needs in respect of formal employment for the period 1998 to 2003 (Whiteford, *et al*. 1999). The study was fairly comprehensive, covering eight of the nine economic sectors of the South African economy. (The agricultural sector was excluded.) Detailed forecasts of future demand were made at sub-sector level of the 68 professional and 10 artisan occupational categories.

The 1999 study commenced with a survey of employers. Information was gathered on current as well as expected employment, skill shortages and possible changes in future skills needs by means of structured questionnaires from 273 randomly selected companies. An integrated

demand forecasting model for 1998 to 2003 was then developed. The model provided highly disaggregated estimates: demand forecasts were made for the total number of persons employed in each of 81 occupational categories in 36 sectors.

Changes in total employment arise from two major contributors: changes in output and changes in labour productivity. Estimates of the change in these two factors and the derived change in total employment in each sub-sector were based on the expectations of persons active in each sector together with the results from independent multi-sectoral macroeconomic forecasts available at the time. In the survey, respondents were asked to estimate the change in output and the change in employment within their sector. From this it was possible to calculate the change in employment relative to the change in output or, more technically, the elasticity of labour demand relative to sector growth.

The 1999 HSRC study concluded that fewer than 50 000 jobs would be created over the period 1998 to 2003, despite an estimated growth in output of 2.7%. The trade sector was expected to be the largest creator of employment, followed by the finance and construction sectors. In terms of occupational demand, the highest growth was expected to be in the IT field. Commercial occupations such as accounting and financial professions were also expected to show strong growth. Demand for engineers – especially electrical and chemical – was expected to be robust.

The study estimated replacement demand in a fairly crude fashion. For example, the number of deaths was assumed to be 6.5 per thousand for all occupations. (This was based on mortality rates derived from the 1995 October Household Survey for all persons with degrees, diplomas and certificates.) In the case of migration, it was assumed that the official data from Stats SA underestimated true emigration for 1998 by 50% and that emigration rates remained flat over the forecast period.

BMR (2001)

In 2001, the European Union, the Department of Labour and the Department of Trade and Industry commissioned Carel van Aardt from the Bureau of Market Research to investigate key skills shortages and the fast tracking of skills development (BMR, 2001). The study used a mixture of qualitative (interviews and workshops), quantitative (questionnaire and demographic analysis) and meta-analytical (secondary data) methodologies. This study showed that the

pool of people in the South African labour market appointed in High-Level Human Resource (HLHR) occupations increased dramatically from 296,000 in 1965 to 1,110,000 in 1994. The faster growth in demand over this period was for engineers and engineering technologists, engineering technicians, accountants and auditors, specialist managers, computer programmers, systems analysts and software engineers.

Van Aardt's study concluded that the South African higher education sector needs to produce more IT specialists, electronic engineers and specialist managers. The study also argued that the educational system needs to be more closely aligned to the needs of employers, i.e. greater emphasis should be placed on teaching the specific skills that industry requires.

HSRC (2003)

Woolard, Kneebone & Lee (2003) updated the earlier work by Whiteford *et al.* (1999) to provide employment forecasts for specific high-skill occupations over the period 2001-2006. They used a labour demand model to estimate the number of new positions that will arise as the result of sectoral growth and a separate "replacement demand" model to determine demand arising from retirements, emigration and inter-occupational mobility. They find that even in those occupations where employment levels are expected to decline substantially, there is likely to be a need to train new individuals simply to maintain the existing stock of skills at the required level.

The first step was to estimate employment by occupation and sector for 2001. The previous HSRC study had relied on the *Manpower Survey* to obtain the occupational structure of employment within each sector. Unfortunately, the most recent available *Manpower Survey* is for 1995. Consequently, the 2003 study elected to use the data sets from the *Labour Force Surveys* conducted in February and September 2001. These two surveys were based on independent cross-sections, making it possible to pool the two data sets in order to obtain a reasonable sample size.

The second step was to obtain sectoral growth forecasts for the period 2001-2006. These sectoral growth rates are important exogenous variables as they play a large role in driving the model. They relied heavily on ABSA's growth predictions for the forecast period (ABSA, 2001). ABSA forecasts the performance of 37 sectors of the South African economy. The approach used is "top down", meaning that the analysis begins at the macroeconomic level. The various

components of demand are forecast using a Keynesian demand model with a supply-side element that relies in turn on a variety of international and domestic assumptions. The projections of the components of demand then serve as inputs into an input-output based sectoral model. ABSA's sectoral forecasts are thus grounded on a set of consistent underlying assumptions about the macro environment for the next few years.

These sectoral forecasts were then fed through a matrix of elasticity's to obtain the changes in occupational demand within each sector. The change in demand for a particular occupation was obtained by multiplying the sectoral forecasts by the elasticity's and then adding up the occupational demand across all sectors. This then gave an estimate of the increase in the number of positions available for each occupation.

The elasticity's used in the previous HSRC study had been estimated through a complex process that was heavily reliant on the information provided through interviews with companies and industry experts. A repetition of this survey process was beyond the scope and budget of the update, thus the elasticity's obtained in the previous study were assumed to still hold for all sectors, with the important exception of IT. In the case of IT, however, the authors were of the opinion that domestic and global circumstances had changed sufficiently to require a re-assessment of the elasticity's used in the 1999 study. Interviews were conducted with several of the major IT companies and this information was used to re-calibrate the elasticity's for computer-related professionals. In general, it was found that IT companies were far more cautious in their predictions about the demand for IT professionals than they had been three years previously. IT companies indicated that they did not expect their workforce to grow by more than 1% or 2% per annum over the next five years. In addition, they indicated that very few "entry-level" positions were being created. If new positions were being created, these were for experienced staff or specialised programmers.

In addition to the additional ("new") demand for labour, the authors also considered replacement demand arising from retirements, net migration, movement into other occupations and in-service mortality. Indeed, given the relatively low rate of economic growth in South Africa coupled with high mortality, it can be expected that replacement demand will exceed the creation of new positions. Because the data for the model were obtained from a household survey, the authors had the distinct advantage of having detailed information about the demographics of each occupation. This made it possible to estimate specific rates of retirement and mortality for each occupational class.

SETA Studies

In addition to these general studies, a number of the recently formed SETAs have also undertaken work in this area. These inevitably tend to be partial, focusing upon the areas of concern to a particular SETA. Nevertheless they provide some useful insights. The work done for three of the Sector Education and Training Authorities (SETAs) by the HSRC is discussed here by way of example.

Financial and Accounting Services (FASSET)

The financial and accounting services sector has in recent years been an area of high economic and employment growth, and projections of the future demand for labour in the sector are based on the assumption that it will remain so in the near future. A very crude demand projection model was developed in this study (van Zyl, du Toit and Fourie, 2003). The model takes into account possible scenarios of economic growth, the employment-output elasticity, and mortality in the sector, retirement, emigration and people leaving the sector. Four projection scenarios were developed, ranging from a relatively pessimistic to a very optimistic scenario. All four scenarios, however, assume positive economic growth. The demand projections indicate that under positive economic conditions a total of between 11,000 and 25,000 new employment opportunities may be created in the sector over the period 2002 to 2008. This represents growth in total employment of between 2 % and 4.1 % per annum. This growth is, however, not only dependent on conditions in the rest of the economy, but also on the availability of professionals and skilled workers as job creation in this sector is particularly dependent on their skills.

Chemical Industries Education and Training Authority (CHIETA)

In 2003 the Department of Trade and Industry and the Chemical Industries Education and Training Authority (CHIETA) commissioned the HSRC to conduct a study on skills needs in the chemical industries sector (Erasmus, personal communication).

The findings are summarised in a sector report and nine sub-sector reports. These are the outcome of an analytical study that drew on secondary data sources and also data from surveys. The surveys included a broad telephone survey of employers, in-depth personal interviews with employers, a survey of accredited training providers, and a survey of universities and technikons.

Owing to low response rates, the authors caution that the results of the study should be viewed with circumspection and regard them as qualitative rather than quantitative. No attempt was made to quantify future labour demand. Instead, demand was described in broad terms.

Forest Industries Sector Education and Training Authority

The HSRC was commissioned in 2004 to develop a profile of the forest industries sector in South Africa. This report provides an overview of the quantitative and qualitative data collected on the forest industries sector. This includes a description of the workforce in terms of geographical distribution and company size; the distribution of occupations; and the population group and gender distribution. Training infrastructure, training provision, skills shortages and skills gaps, and drivers of training are discussed. No attempt was made to quantify future labour demand.

3.3 The availability of multi-sectoral macro modelling capacity in South Africa

A wide variety of economic actors have a strong need for information about the future macroeconomic environment and the consequences for production and demand in specific sectors or sub-sectors. Consequently, a large number of macroeconomic and sectoral models already exist in South Africa. The existing South African models can be broadly divided into "econometric" and "general equilibrium" approaches and these are discussed here in turn.

Econometric models have a much richer tradition in South Africa than general equilibrium modelling (van Seventer, 2003). For ease of exposition, within the rubric "econometric models", it is possible to distinguish between two approaches, namely partial equilibrium time series analysis and economy-wide modelling.

- Partial equilibrium models focus on a particular issue, such as economic growth or investment behaviour or money supply, without worrying much about other aspects of economy-wide adjustment. Based on time series data, past behaviour is analysed and policy conclusions are drawn. Single equation econometric modelling is very much complementary to general equilibrium analysis in that the estimated parameters of this kind of analysis provide the necessary elasticity's and coefficients needed for successful economy-wide policy modelling.
- Economy-wide econometric modelling entails the comprehensive representation of an economy in which the behavioural relationships are all fully estimated and then often (but not always) re-estimated on a regular basis.

The South African Reserve Bank (SARB) and the National Treasury (NT) both run quarterly economy-wide models that focus on the aggregate macroeconomic variables without going into much sectoral (industrial) detail. The focus of the SARB's model is on forecasting the typical macroeconomic variables (such as output and productivity) as well as the monetary policy variables that the SARB is obviously most interested in. The Treasury on the other hand focuses on the broad macro variables needed for medium-term fiscal budgeting. While these macroeconomic forecasts are published regularly, the detailed specifications of the SARB and NT models are not in the public domain.

Some aspects of the SARB macro econometric model have been made public sporadically. Both the SARB and NT models can be summarized as conventional Keynesian demand-oriented models with explicit supply elements (van Seventer, 2003).

The Bureau for Economic Research (BER) at the University of Stellenbosch has arguably the longest history of econometric forecasting outside of the SARB. Indeed, early versions of the National Treasury model were based loosely on the BER macro model (although the two models have since developed quite separately).

In addition, a range of private sector research companies also maintain large economy-wide models. The best known of these is the Global Insight econometric model, which is used by *inter alia*, ABSA Bank (ABSA, 2003). The Global Insight macro econometric model is not disaggregated to a sectoral level but rather feeds down into a detailed computable general equilibrium model (as discussed below). This is similar to the methodology used by Monash in Australia (as discussed in more detail in Annex B).

Computable General equilibrium (CGE) models are economy-wide models based on a Social Accounting Matrix (SAM). General equilibrium modelling makes it possible to step away from the traditional "holding everything else constant" (*ceteris paribus*) assumptions that are inherent in partial equilibrium models. By doing so, a general equilibrium model helps to represent a much more real world situation, where almost all critical macroeconomic variables have many interactions and feedback cycles in their determination. This ability to model the second round effects and interrelations between different markets greatly enhances the predictive capability of the forecasts.

There is now a well-established tradition of using CGE models in South Africa (see Annex C).

There are several CGE models currently in use – and regularly maintained – in South Africa. Most notably, James Thurlow at the International Food Policy Research Institute (IFPRI) and Dirk van Seventer at Trade and Industry Policy Strategies (TIPS) have carefully documented a standardised CGE model for South Africa and the model is in the public domain (Thurlow and van Seventer, 2002). Adaptations of this model are in use by a variety of organisations, including the HSRC and the Department of Agriculture. A similar model is in use by National Treasury, who collaborated with the World Bank to extend the standard model to include specific fiscal variables. In the private sector, Global Insight maintains a 36 (industrial) sector CGE model.

From the above it is evident that the capacity exists in South Africa to undertake the multi-sectoral modelling required in adopting the approach outlined in Section 2.2 above. It would not be necessary to build a new multi-sectoral model from scratch as one of the existing models could be used to provide the necessary sectoral employment forecasts.

4. DATA SOURCES IN SOUTH AFRICA: STRENGTHS AND WEAKNESSES

4.1 A critical assessment of data availability in South Africa

4.1.1 General Labour Market Information

The previous studies, which have attempted to anticipate changing skill needs in South Africa, have highlighted a number of areas of concern regarding data availability and data quality. These concerns are echoed in the present report. There can be considerable confusion when employment sources are directly compared and found to be widely divergent. However, this is due to the fact that different surveys measure different things and are thus useful for different purposes They are not necessarily interchangeable as sources of information about different aspects of employment levels and employment structure. This section reviews the data available from a variety of different sources.

Enterprise Based Surveys

The **Survey of Employment and Earnings (*SEE*)** is a quarterly survey covering a sample of 10,183 private and public enterprises in the formal non-agricultural business sector (those with a VAT turnover exceeding R300,000 per annum). It does, however, exclude certain industries and these are listed in Annex D. Stats SA, in collaboration with the South African Revenue Services and the Departments of Trade and Industry and Labour, have now re-engineered the register of businesses and this now serves as the sampling frame (Stats SA, 2003- See Annex D). This new sample covers all the industries in the formal non-agricultural business sectors as well as those previously excluded. Agriculture, domestic services and firms with a turnover of less than R300,000 (which would include most of the informal sector) remain outside the ambit of the *SEE*.

The **Survey of Average Monthly Earnings (*AME*)** is also a firm based survey and is run in conjunction with the Survey of Earnings and Employment (as discussed above). Its sample frame is similar to that of the *SEE* (prior to 2002) in that it only collects information from businesses in the formal non-agricultural business sector. This survey does not therefore collect any information from those industries mentioned above, (i.e. it excludes the same industries that the *SEE* disregards prior to 2002). In this regard, it would appear that any overall employment estimates from the *AME* would underestimate the true total including those sectors not covered by the survey.

From 1987, Stats SA conducted the **Manpower Survey** on an annual basis. In 1996, the name of this survey changed to the Occupational Survey, which ran through to 1997. In 1998, it was replaced by the Survey of Occupations by Race and Gender, but this survey did not move beyond the initial piloting stage and was discontinued in 1998. The Manpower Survey (*MS*) was an enterprise-based survey covering private and public enterprises in the formal non-agricultural business sector. It was conducted by mail and based on a sample of approximately 8 500 businesses/organizations. Agriculture, private households and the informal sector were excluded from the survey. The *MS* covered enterprises in all eight non-agricultural major industrial groups and could be subdivided into further groups and sub groups according to the Standard Industrial Classification of all Economic Activities (SIC). This firm-based survey thus allowed, in principle, for detailed disaggregation by sector. However, accuracy and reliability of the data will drop as the 8 major industrial groups are examined in more detail. Occupational employment estimates are also available for these industries and are classified according to the International Standard Classification of Occupations (ISCO). This also allows for the desegregation of occupational employment by sector. Again, the more disaggregated the analysis, the more unreliable the data become.

SARS refers to a database collected by the South African Revenue Service (SARS), and it consists of enterprises that are registered for tax purposes. This database is continually updated and downloads are created on a quarterly basis by SARS. This database collects information on both private and some public sector enterprises. The database supplied by SARS, as at February 2003 (the most recent readily available dataset available to the authors at the time of writing), consisted of 274,183 establishments. It can be noted that this database is considered to be the most reliable indicator of the potential sampling frame of businesses that any other firm-level survey should attempt to cover.

Household surveys

As a result of the unemployment debate of the mid-1970s, the Department of Statistics (which later became the Central Statistical Service and then Statistics SA) introduced the monthly Current Population Survey. For various reasons, not least the flaws in the sample design of the survey, this survey fell into disrepute and was abandoned in the late 1980s. After a gap of several years, the annual **October Household Survey (*OHS*)** came into existence in 1993, but excluded the TBVC states in the first year. The *OHS* had a detailed labour market module that covered a wide range of issues relating to formal and informal employment and unemployment. However, in order to fulfil the stringent reporting requirements of the IMF, in

February 2000 Stats SA introduced a twice-yearly **Labour Force Survey (*LFS*)**. For a more detailed description see Annex D.

There is some debate, however, on the employment figures that the *OHS* and *LFS* have reported. These relate to wide variations or sudden increases or decreases in labour force participation or economic activity. Since 1999, the household surveys (*LFS*) have tightened up methodologically in terms of taking a far broader view of what constitutes "employment" and the questionnaires have probed far more deeply for information on economic activity. As a result, the dramatic increases in measured employment between 1998 and 1999 and again between 1999 and 2000 are at least in part the result of methodological changes. This increase in measured employment also has an effect on the labour force participation rate since some people who would have described themselves as economically inactive in the *OHS* would be classified as working (and thus economically active) in the *LFS*. It cannot be sufficiently overemphasised that the *OHS* total employment figures should not be compared directly with the *LFS* figures.

To date, there have only been two full **Population Censuses** of the whole of South Africa - in 1996 and 2001. These censuses asked a few simple questions about work status. Because only a small number of questions are asked, it is not possible to probe deeply for information about activities that might be regarded as "work" but which the respondent does not regard as such. Consequently the population census might be expected to under estimate employment. Figure 2 in Annex D suggests that far fewer people are classified as employed in the Census compared to the *LFS*.

Private Data Houses

Private organisations such as Quantec and Global Insight produce their own employment series, which attempt to harmonise an array of labour market information sources. It would appear, however, that they rely most heavily on the *SEE* – largely because this is the data series consistent with the National Accounts (thereby avoiding internal inconsistencies with other series produced by these companies). These databases are produced for profit and are not "official" sources of data, but could be the best current time-series data for trend analysis.

Information from the SETAs

The SETAs collect limited information from employers, based on Workplace Skills Plans (WSPs). Only a small minority of employers have submitted WSPs to date. Consequently, this is not currently a useful source of employment information. In addition, some SETAs have conducted employer surveys. The sampling frame for these surveys is typically the SARS database of skills levy-paying firms. It is possible to map the sectoral categories and SETA classifications. (This mapping has been included as an addendum to Annex D.)

4.2 Sectoral data

In order to model labour demand at a sectoral level, adequate sectoral data on, *inter alia*, output, productivity and wages are needed. These data are all heavily dependent on the monthly economic statistics published by Stats SA. In 1996, Stats SA initiated a process of reviewing all its economic statistics. One of the outcomes of this process was a move to update the business register (as discussed above) on the basis of SARS records of VAT-registered businesses. Since the beginning of 2003, Stats SA has been conducting its monthly indicator surveys (manufacturing, wholesale trade, retail trade, motor trade and land freight) using fresh samples of businesses drawn from the new business register. This has, however, been done in parallel with surveys using the old sample. In this way, it should be possible to adjust historical figures in such a way that they can be comparable with the new series.

Results published from the surveys using the new business register as the sampling frame reflect higher levels of economic activity than those using the old register. This is not unexpected and is not in itself a cause for concern. In the case of manufacturing, wholesale and motor trade, the movements in the old and new series are quite similar and thus it is feasible to back cast the new series. In the case of retail trade, however, the old and new series do not track each other sufficiently well for Stats SA to be confident of the historical trend. One of the consequences of this is that Stats SA have opted to discontinue publishing a seasonally adjusted series until they have 36 months of data from which they can create new seasonal adjustment factors (because the old seasonal adjustments do not give a plausible picture).

The change in sampling frame poses a challenge for econometricians, as the time series data for employment (and thus productivity) are discontinuous. For example, total employment in

the third quarter of 2003 ostensibly jumped by 40% from the previous quarter (SARB, 2003, S-136) as a consequence of the broadened sample used for the **Survey of Employment and Earnings (*SEE*).** While adjustments can clearly be made to the data, it cannot be sufficiently emphasised that a great deal of attention will need to be given to data issues in this modelling exercise.

In order that the outputs from the model should be useful to the SETAs, attention will also need to be given to mapping the sectoral results onto the SETA classification. In Annex D a concordance table is provided which indicates how the 3 digit sector codes can be translated into the SETA classification. The modelling however will not be done at this level of desegregation, so a set of plausible assumptions will need to be made in order to translate sectoral projections onto SETA projections. This is not ideal, but in the absence of time series data defined according to the SETA footprints, there is currently no alternative. Only if efforts are made to collect data for such categories (as opposed to the more conventional SIC aggregate groups currently used in official data), will it be possible to resolve this situation. Even if a decision is made to do this it will take many years before a satisfactory time series database can be established, so some kind of mapping exercise from conventional SIC grouping to SETAs for the foreseeable future is likely to be required.

This situation is virtually identical to that in the UK, where the recently formed Sector Skills Councils have been defined with little regard for conventional SIC conventions. In trying to develop projections for such categories, UK analysts have to adopt analogous “maps” showing how SSCs are linked to SICs. In principle, such mappings (which are often based on proportions of employment in SIC categories being allocated to particular SSC categories) may vary across geography, across other dimensions of employment (gender, employment status, race) as well as over time (if such proportions change as time goes by). In the South African case, whole SIC 3 digit categories are allocated to SETAs. So, in principle, such problems need not arise and such “maps” could be relatively straightforward to produce and robust across categories and over time. In practice, things are not quite so simple. If robust data were available at SIC 3 digit level, robust SETA projections would be easy to produce from the SIC versions. If, as seems likely, robust analysis and projections are only possible at the 2 or 1 digit level, then South African analysts will face the same problems as those in the UK. In this case there is no ideal solution and fairly crude mappings based on 1 or 2 digit level SIC data will be the best that can be done. However, although this may affect the detailed employment estimates and projections, it is unlikely to change the general trends in occupational employment structure, which the analysis reveals.

4.2.1 Data Adequacy for Sectoral Forecasting

Sectoral employment data lie at the heart of any multi-sectoral modelling approach to assessing changing skill needs. There are still concerns on this front, with a number of private organisations spending considerable time and resource to develop consistent time series information based on the various official sources. The latter often display different patterns and further effort is needed to establish a set of sectoral data that all interested parties (Department of Labour, Stats SA, macro modellers, SETAs, etc) can agree upon.

For example, in a comparison between the **Survey of Employment and Earnings (*SEE*)** and the ***OHS/LFS*** surveys, the *SEE* shows a downward trend for formal employment, whereas the household surveys show on average an upward trend. As a result, the *SEE* does show lower levels of total formal employment (see Table 6 in Annex D). These lower levels do not necessarily imply an equivalent increase in unemployment, but rather indicate the limitations of the *SEE* survey, since these other employed individuals could be employed in industries or occupations not covered by the *SEE.* Thus, using the *SEE* survey as it stands up to now (1997 to 2002) to measure ***total employment*** is not a good idea. However, it can provide a useful measure of occupation structure ***within*** those industries that it does cover.

When considering a comparison between the **Manpower Survey (*MS*)** and the ***SEE***, it should be noted that they are not directly comparable. “The *MS* collects information from enterprises in all industrial groups. Therefore an enterprise may have one or more establishments, which may operate in different industries, e.g. mining and quarrying, manufacturing, agriculture and fishing.” (Stats SA, 1995).

The ***SARS*** database provides a comprehensive list of entities i.e. enterprises that are disaggregated by sector based on the 5 digit SIC sectoral codes. It does not, however, have any information regarding occupational desegregation with respect to the employees in these registered enterprises. The present analysis of the database indicates that 43% of the firms did not supply any information regarding their number of employees. The *SARS* database will therefore have limited use in verifying sectoral information obtained from the macro model, but might be useful in indicating sectoral *change* because the database is continuously updated.

A comparison between the **Census 2001** and the ***LFS*** for September 2001 reveals lower employment estimates for the Census (see Table 8 in Annex D). In all industries the *LFS* has

higher employment. The shares of different sectors are, however, broadly similar.

SASID, otherwise known as the South African Standard Industry Database, shows sector sizes broadly similar to the sizes obtained by the ***LFS*** data source. The only differences occur within the Trade, Transport, Finance Services and Community Services sectors, where the sectoral employment estimates are higher in the *LFS*. This is due to the fact that the *LFS* covers these sectors in more depth than *SASID* (*SASID* being based on the *SEE*). With regard to shares of total employment, these values are similar across sectors.

4.3 Occupational employment data

4.3.1 Labour Market Information

All the data sources have been discussed in Section 4.1.1, and this discussion will not be repeated here. The main issue addressed here is which of these data sources is the most reliable for occupational forecasting.

Enterprise Based Surveys

The **Survey of Employment and Earnings (*SEE*)** up until 2002, does not provide for an adequate estimate of occupational employment as many industries and thus occupations have been ignored. With the re-engineering of the registering processes for businesses and the creation of a new sample frame, all previously excluded industries have now been included, which allows for a much wider coverage of occupations within these industries. This of course implies a more detailed and reliable industry by occupation employment matrix, yet obtaining this level of detail prior to 2002 is not possible.

The **Survey of Average Monthly Earnings (*AME*)** is also discussed above as a possible source of labour market information. It is similar to the *SEE*, therefore provides more detail from 2002 onwards. It is important to note, however, that any overall occupational employment estimates from the *AME* would underestimate true employment levels.

The **Manpower Survey (*MS*)** became the Occupations Survey in 1996 and then was discontinued shortly after. This firm based survey allowed for desegregation by industries as well as occupations. These occupational groups are derived from these industries and are classified according to the International Standard Classification of Occupations (ISCO). This

also allows for the desegregation of occupational employment by sector, yet once again the more disaggregated the analysis, the more unreliable the data become.

The ***SARS*** as discussed above, does not have any information regarding occupational segregation with respect to the employees in registered enterprises. This is due to the fact that 43 percent of firms did not supply information regarding their number of employees (see Table 7 in Annex D).

Household Surveys

The ***OHS/LFS*** household surveys disaggregate by sector as well as occupation. There are question marks about their reliability and suitability for trend analysis. Annex D deals with these household surveys in detail and concludes that – since the *LFS* has a more in-depth approach to determining employment figures compared to the *OHS* - *OHS* total employment figures should not be compared directly with the *LFS* figures. This poses a problem with regard to analysing employment change over time, whether sectoral or occupational. One way of dealing with the problem of small sample size is to pool the data from more than one round of the survey. This can enable a more detailed occupation by industry employment matrix to be constructed than would otherwise be possible.

Analysis of data from the **Census,** as discussed above, leads to the conclusion that employment is underestimated compared to the *LFS*. There is possible underreporting of employment in the informal and subsistence agriculture sectors, particularly among those who work only a few hours per week. The *LFS* questionnaire includes more prompts to clarify these issues, which is not possible during census enumeration. The UN and ILO thus note that the *LFS* is expected to produce more reliable estimates of general labour market variables than censuses. However, the Census does have considerable advantages when it comes to measuring the structure of employment, not least because of its much large sample size. The concerns about the coverage of the Census in certain areas will obviously need to be taken into account in trying to develop a comprehensive overview of employment structure. Even then, it is clear that the coverage of the informal sector will remain poor for the foreseeable future and that any quantitative projections will be focused on the formal sector.

4.3.2 Data Adequacy for Occupational Forecasting

The ***LFS*** and the **Census data** were disaggregated by occupation in Table 10 in Annex D. These data were taken from 2001. The percentage shares of total employment in each occupation are also given. Employment levels for all occupations are higher within the *LFS* data set. Focusing on percentage shares of occupations in relation to the total, however, the patterns are broadly similar between these two data sources. Table 10 only shows desegregation by occupation. It is possible to disaggregate even further by looking at an occupation by industry employment matrix showing percentage shares (see Table 11 in Annex D). The data in Table 11 also throw light on whether or not the *LFS* data can be used in conjunction with the Census data in order to provide more accurate employment matrices. There are values within the existing employment matrix that are directly comparable, yet the majority are not. This does not necessarily imply that they are not consistent. Rather, it suggests that the data need cleaning and emphasises that they become more unreliable the greater the level of desegregation.

Another factor to consider with regard to whether or not the Census is the best option for sectoral and occupational forecasting, is what kind of changes have taken place over time within the Census and whether or not these changes are feasible given other time-series data.

Table 12 (Annex D) shows percentage shares of occupations within each sector for **Census 1996**. The values for **Census 2001** are given in Table 11 (Annex D). Over this 5-year period, most of the shedding of employment has occurred in the craft occupations as well as the skilled agricultural occupations. These occupations' shares of total employment by sector have dropped since 1996. The overall share of total employment by sector has stayed broadly similar over this 5-year period.

This discussion of the data available from the various sources leads to the conclusion that, broadly speaking, the Census data are the more robust and as a result, provide the more accurate portrayal of the South African labour market at that particular moment in time. The *LFS* could be used as not only a benchmark, but also as a means of filling in the blanks with regard to the interlinking years which are not covered by the Census. The emphasis, of course, is on occupational and qualification employment structures, in aggregate and within industries.

4.4 Data to Estimate Replacement Demands by Occupation

4.4.1 Replacement demand

In addition to changes in overall occupational employment levels it is important to consider replacement demand arising from retirements, net migration, movement into other occupations and in-service mortality. Estimating replacement demand is not straightforward, especially in a country like South Africa where the data on the mortality effects of HIV/AIDS remain uncertain and controversial.

Estimation of replacement demands requires the following information:

- Data on the age and gender structure of occupational employment;
- Data on the rates of outflow due to:
  - Retirement (and other reasons for leaving the workforce);
  - Emigration;
  - Inter-occupational mobility; and
  - Mortality.

Information on the age and gender structure is required because many of the flows, especially retirements and mortality, are age and gender specific. Age structures vary significantly by occupation – for example, a higher proportion of managers than IT professionals are likely to be nearing retirement age. Differences in age structure across occupations will clearly influence exits, with more, older people retiring, but more, younger people changing occupations. Age structure also affects mortality – while older people are more likely to die of non-AIDS causes, younger people are more likely to succumb to AIDS.

From the household survey/population census data, it is possible to analyse the demographic composition of each occupation. This makes it possible to estimate specific rates of retirement and mortality for each occupational class.

4.4.2 Retirements

For the purposes of modelling retirements, it may be helpful to consider the fraction of the occupational class that is aged 55 to 65 (say) in a given year and then to assume that some fraction of this group would retire each year. A fairly wide age category is needed if the occupational since the samples are quite small in most cases. It might also be possible to measure retirement flows over time, although this kind of approach could suffer because of the

sampling errors being too large.

4.4.3 Mortality

To estimate replacement demand arising from deaths in each occupation it is possible to use the race-, age- and gender-specific mortality rates contained in the Actuarial Society of South Africa's "AIDS demographic model 2000". The *ASSA* model was developed by the ASSA AIDS Committee, which was set up in 1987 "to assist the actuarial profession (and later the wider public) in estimating the impact of the AIDS epidemic in South Africa". As part of this work, the Committee has produced various papers and monographs on the epidemic and constructed models (the ASSA500 model released in 1996, the *ASSA600* model released in 1998 and most recently the *ASSA2000* suite of models) to predict the impact of the epidemic at both the national and regional level (ASSA, 2002). A new version of the *ASSA* model – based on the 2001 Census results - will be released in 2004 (Dorrington, personal communication).

Using the mortality assumptions of the *ASSA* model, one can calculate the risk of dying for each member of an occupational class in the survey data and use this to arrive at the number of people that will be required to replace those dying over the forecast period.

4.4.4 Migration and mobility

The migration of skilled professionals from the country has been an increasing source of concern over the past few years. Skills migration is clearly a reality and must also be taken into account in the modelling, as these losses also impact the supply and demand for higher-level human resources. The official source for skills migration data in South Africa is the annual reports published by Statistics South Africa. These sources are a result of a joint effort between the Department of Home Affairs and Stats SA. It is the Department's responsibility to record who leaves and enters the country via any of the major airports in South Africa. When individuals leave they are required to fill in a departure form, in which they state their reasons for leaving. Stats SA then captures the relevant emigration information from the departure forms. Immigration data are also gathered from records of individuals who have been granted permanent residence in the country (Bailey, 2003). These data are largely incomplete and inaccurate due to the following reasons outlined by Brown, Kaplan & Meyer (2001):

- The completion of departure forms is not always enforced and not all those individuals intending to emigrate permanently indicate as much (Stats SA, 2001);
- Only individuals leaving from the major South African airports are captured;

- Many South Africans leaving the country to travel, and who then stay abroad permanently are not captured;
- The system only recently started capturing disaggregated occupation data, therefore a trend analysis of skills leaving the country is limited at best;
- Stats SA categories have changed over the years, making it difficult to formulate trend analyses.

A study conducted by Meyer, Brown and Kaplan (2000 – See Annex D) illustrated that the receiving countries data reported around three times as many skilled South Africans entering their borders in the decade prior to 1997 than did the Stats SA data. This suggests that the official data are a severe undercount of emigration in South Africa.

4.5 Data on qualifications and key/generic skills by occupation

Occupational employment patterns are only one way of measuring skill. From the point of view of training and especially formal educational planning, the types of qualifications typically required are also important. Some (but not all) countries include a qualification dimension in their quantitative projections. The availability of suitable data in a South African context has therefore been explored.

Another aspect of skill that has received increasing attention in recent years in many countries, moves beyond occupational job titles and formal qualifications to examine the kinds of skills people actually require in order to undertake the main tasks in their work. These include physical skills such as manual dexterity and strength, general intellectual skills (including literacy and numeracy) as well as social skills such as communication, team-working, leadership, etc. These have been various termed key, core and generic skills. Generally attempts are not made to project such skill needs quantitatively, but many countries now devote considerable resource and effort to assessing how such skill needs are changing and their different patterns across sectors and occupations. The availability of such information in South Africa has also been assessed.

The review in Annex D, suggests that it is possible to create employment matrices by occupation cross-classified by qualification from the household / census data. This provides a measure of typical levels of educational attainment for all the different occupations, albeit rather crude. No such general information exists in South Africa for key/generic skills (although a few SETA's have begun to explore such issues. Without significant new data collection, it will

not be feasible to add such elements into the main forecasting model.

Even with only weak data for qualifications it is probably worth developing some extension to the “replacement demand” module, which allows some inferences to be made about implications for qualifications. Alternatively some supplementary information on “typical” qualification structures in particular occupation might be provided to enable users of such results to draw their own conclusions about what this might mean for the demand for formal qualifications.

5. THE WAY FORWARD

5.1 Overall Assessment of Existing Modelling Capacity in South Africa

This section draws together the key findings from the discussion in Sections 3 and 4, presenting a critical assessment of what has been done previously in South Africa and how this might be improved, given the data and capacity currently available.

Subsequent sub-sections then deal with the following:

- Recommendations on the best ways of exploiting existing modelling capacity and data;
- Complementary activities, providing some illustrative examples of how the outputs from such a process might be complemented and enhanced by other approaches to anticipating future skill needs;
- Recommendations for changes to institutional responsibilities and related arrangements;
- Possible longer-term developments, involving development of new data sets and/or modelling capacity;
- Integration of the outputs from such an exercise with the Skills Development Information System (SDIS) and the Skill Planning Tool Kit (SPTK).

Previous attempts to anticipate changing skill needs in South Africa have been heavily criticised but provide a useful starting point for developing new projections. Much of the criticism has been gratuitous, in the sense that those who undertook the work were themselves all too well aware of the problems with the data that they had to work with, as well as some of the more general limitations of this kind of exercise. In some respects things have not improved in recent years, with the demise of a number of key surveys. Nevertheless, some progress is possible given data currently available.

5.2 Recommendations on the best ways of exploiting existing modelling capacity and data

It is possible to provide a detailed “blueprint” or technical specification of how existing models and data can be exploited to provide the kind of forecasting tool required. It is also possible to illustrate examples of the kind of outputs that such a tool can deliver, based on:

- International best practice;
- Existing modelling capacity in South Africa;
- Availability of suitable data in South Africa.

A modular approach

Essentially, a modular approach is proposed with the following structure and broad elements (see Figure 1).

Module 1 requires a multi-sectoral macroeconomic model. Given the substantial investments required to develop such a model it is proposed that this should be based on one of the models already being used for such work in South Africa, rather than trying to develop something specifically for this purpose.

The present review suggests that the Global Insights and IFPRI/TIPS models (amongst others) would be suitable for this purpose.

Module 2 is a new occupational model, which would need to be to be developed as part of this new system. It would be based on various existing sources of data. This module will work out the implications for occupational employment of the projected sectoral employment levels developed from Module 1.

It is suggested that this module should, as far as possible, build on previous HSRC work (in order to take advantage of the substantial amount of work already done on historical trends). However, there are a number of ways in which any new module would need to diverge from the HSRC approach, given changes in data availability and the increased emphasis on the informal economy as a source of employment. The discussion in Section 4, as well as the more detailed reviews in the associated Annexes, presents various examples of the kinds of data that can be used, and their limitations. It also provides some suggestions as to how the latter might be addressed, including possible new data collection that would help to improve such analysis over the longer term.

Module 3 is another new module, to be developed based on a variety of existing data sources. It will be driven by the occupational employment levels projected from Module 2, in combination with information on expected outflows from employment due to retirements, mortality and migration. It is likely given existing data that this part of the exercise would be fairly crude but this is equally true of the position in most other countries. The important point is

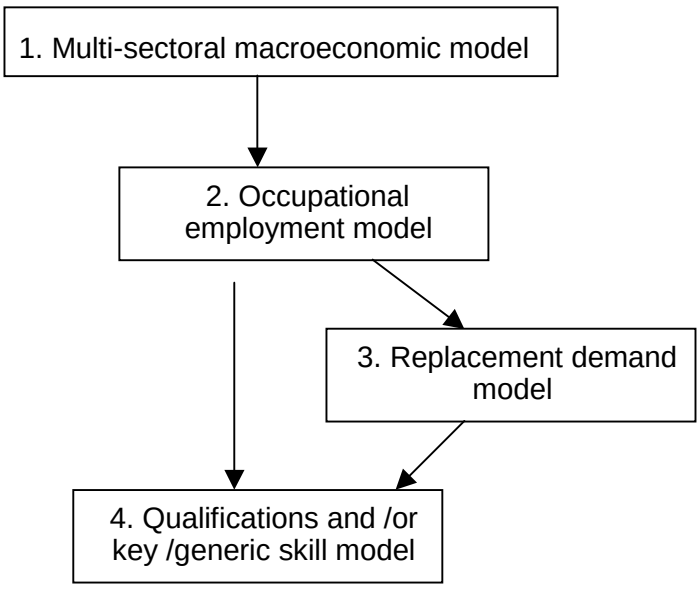
to recognise the importance of replacement demand issues and to take them into account in assessing likely future skill needs.

Module 4 is the most speculative because of concerns about data availability and quality. In principle, it could be driven either by the outputs from Modules 2 or 3 but it would require additional data on occupational employment cross-classified by qualification and/or key generic skills.

It seems likely that something on qualifications could be put in place immediately, based on existing data from the Census and/or the LFS on average qualifications levels by occupation. However the limitations of these data sets at a disaggregated sectoral level would need to be recognised. Such analysis could be improved by refining the data collected on these matters, possibly for specific sectors (although the advantages of a consistent treatment across all sectors should not be lightly dismissed).

With regard to key and generic skills, although some relevant data do exist, there are huge gaps. At present it is clear that the available data are not adequate to build such a model at a national level in South Africa. However, the examples identified for particular sectors (most notably the Financial and Accounting sector) suggest that, in the longer term, such modelling might be feasible if certain data gaps can be filled by new primary data collection.

Figure 1: Modular Approach to Skills Forecasting



5.3 The Value of Complementary activities

It is clear from the general review of methods of anticipating changing skill needs across the world, that formal, quantitative projections are just one amongst a number of important weapons in the armoury. The outputs from the kind of quantitative process described in Sections 5.1 and 5.2 can be complemented and enhanced by other approaches to anticipating future skill needs. Based on the experience and practices adopted in other countries, these can include:

- The use of detailed employer surveys;
- Scenario development;
- Other more qualitative methods.

A brief overview of the advantages and limitations of such approaches has already been given in Table 1 above. Suffice it to say here that, each approach has its strengths and weaknesses and that the ideal is to triangulate the problem by using a variety of methods and allowing them to inform and support each other, rather than seeing them as mutually exclusive alternatives. No approach has the monopoly on “truth” and no one approach on its own can provide a full and complete picture.

Large-scale employer skill surveys can provide very useful information. However, they should not be seen as a panacea. They do need to be quite large to provide detailed sectoral as well as occupational information. This means that they can be very costly. They also need careful design (both in terms of the sampling frame and the questionnaire) to ensure that the results produced are useful. Poorly designed employer skill surveys can be a very expensive and ineffective response to the demand for some way of anticipating changing skill needs. Effective prior consultation with both key stakeholders (customers), and survey companies and statistical experts (providers) is advisable before going down this route. Extensive piloting, including follow-ups to explore how fieldwork is conducted and how the respondents interpret questions, is also highly recommended.

5.4 Recommendations for changes to institutional responsibilities

What is proposed in Section 5.1 and 5.2 can be achieved using existing data and within the existing institutional framework. However, it is clear that there is scope for further extensions and improvements.

A major concern is the quality of information available on current occupational structure, and ongoing trends, within sectors. This could be improved by carrying out larger and more consistent surveys. Although there maybe some merit in getting SETAs involved in this process, there are substantial advantages in centralising this process. These advantages include economies of scale as well as consistency across sectors. Ways of expanding the coverage to include the informal sector, without sacrificing data quality also need to be found if a comprehensive picture is to be drawn.

Surveys of Employers (enterprises/establishments) and surveys of Households (Labour Force Surveys) both have their own advantages and disadvantages for this purpose. In most countries Household surveys have become the norm for obtaining overall measures of occupational employment structure. However, a substantial increase in sample size of the South African LFS would be needed to deliver robust statistics at a detailed sectoral and occupational level.

Information about generic /key skills is currently not generally available in South Africa. Obtaining such information in a robust manner is technically difficult and would require new surveys.

5.5 Possible longer-term developments involving development of new data sets and or modelling capacity

A number of general improvements can be envisaged in both the data on occupational employment and qualification levels and the methods used to analyse them. In addition there are two further areas where further development might take place. These involve extending and improving the treatment of the demand for and supply of qualifications (especially on the supply side) and the treatment of generic skills.

Regarding the basic databases and models discussed in Sections 5.1 and 5.2, the main improvements would relate to:

- Sectoral employment and related data, including extension to cover the informal sector;
- Data on occupational employment structure within sectors;
- Information required for estimating replacement demands (age structure, outflows from employment);
- Qualification structures within occupations;
- More sophisticated modelling, including incorporation of relative wage effects.

Such improvements are likely to be both expensive and long-term, involving detailed substantial input from other government agencies, especially Stats SA.

As far as modelling the demand for and supply of qualifications is concerned, this is likely to be an even longer-term project, requiring much improvement to existing data and the filling of many gaps, as well as substantial investments in modelling activity.

Much the same is true for the treatment of generic/key skills. Substantial investment in new primary data collection is the key requisite here.

In terms of modelling labour supply, existing demographic models would need to be applied to the specific issues pertaining to the growth in the size of the working age population and some new work would be required to investigate the trajectory of the labour force participation rates.

5.6 Integration of Outputs with the SDIS and SPTK

The Skills Development Information System (SDIS) is an overarching web-based portal designed to support the National Skills Development Strategy (NSDS). It is intended to provide a "one-stop" location for all those with an interest in skills, especially key stakeholders, including the SETAs.[1] Within the SDIS is the Skills Planning Tool Kit (SPTK). This sub-site provides a range of labour market information (LMI) relating to the South African labour market. It is currently organised into 4 modules:

1. The economy (economic trends and South Africa's position in the global economy);
2. The labour market (demographic, employment and unemployment trends);
3. Education and training supply; and
4. Scarce skills (priority areas for skills development).

[1] Full details of the SDIS can be found in Department of Labour (2004) Skills Development Information system: Overview and Documentation, Department of Labour Pretoria.

The first module includes historical, primarily macro level, information about global economic trends, foreign direct investment, gross domestic fixed capital formation, gross domestic product by sector, imports and exports, and labour productivity. These are of course the kind of indicators covered by most macroeconomic models. The use of such a model to generate projections of such indicators would therefore fall naturally into the SDIS/SPTK framework, providing a forward look to complement the current retrospective view of historical trends. In particular, it should deliver projections of output, productivity and employment by sector.

The second module concentrates upon demography, employment and unemployment. The supply of labour is covered by measures such as population by ethnic group, age and gender, as well as labour market participation rates. Employment is broken down by sector and occupation (broad groups). Indicators of market pressure (supply demand balance) such as pay and unemployment rates are also included. Again, at present this is retrospective, focussing on past developments. The kinds of projections produced by the typical modelling process proposed here would produce corresponding forward-looking trends for most of these indicators.[2] In particular, the projections would include forecasts of employment levels by occupation as well as replacement demands. The forecasting model could also be extended to cover some aspects of labour supply, although this might be best left for future developments.

The third module focuses upon education and training supply, including employment by highest qualification held, as well as various indicators of general education and training enrolment. The system of projections proposed here could produce some new forward-looking trends of the qualifications intensity of employment. In principle, it would also be possible to model and project future enrolments and flows of those obtaining qualifications by level and subject. However, such work is technically demanding, resource intensive and heavily reliant on good quality data. It is not recommended that this should be an immediate priority.

The final module of the SPTK relates to scarce skills. This includes information from a variety of sources, including work by the BMR (2001)[3], the Skills Development Planning Unit (2003)[4] and various SETA Sector Skills Plans. The information provided is of both a quantitative and qualitative nature, covering occupational trends as well as more generic skills. The proposed projections would provide a more systematic analysis of skill trends, including a forward view. This would however be at a fairly broad brush level, at least in the short-term, given concerns about the quality of some of the more detailed occupational data. It is also unlikely to include

[2] Few if any such models attempt to make predictions about pay levels.
[3] Bureau of Market Research, (2001) "Key skills Shortages and the fast Tracking of Skills Development", Bureau of Market Research, University of Southern Africa, December.
[4] Skills Development Planning Unit (2003) Survey of Public Sector Skill Needs.

implications for generic skills, given the lack of robust historical data. Such insights could be added at a later date given suitable investment (i.e. in new primary data collection to obtain a good historical benchmark of the importance of such skills).

5.7 Costs

The experience of other countries suggests that the development of such models and systems for anticipating skill needs at a national level is a major undertaking. Typically, it involves large investments in data, analysis and modelling of many person years of research.

By way of an example, the most recent exercise of this kind undertaken in the UK (Wilson *et al.*, 2004) cost over R2m, and this was based to a large extent on existing models and data bases). These models and datasets have taken many years to develop, involving similar costs in previous forecasting rounds stretching back over 25 years. The cost of the programme of forecasting work undertaken by the Bureau of Labour Statistics in the USA is measured in millions of dollars per annum. Other countries also invest similar substantial sums of money in these kinds of activities.

The overall costs of such work vary enormously depending upon:

- The level of sophistication of the modelling work;
- The level of detail (including the various dimensions of employment covered);
- The extent to which primary data collection is required.

However, it is possible to do something at a more modest level, building upon the lessons and experience of other countries. In particular, costs can be kept down by:

- Making maximum use of existing models and databases;
- By avoiding unnecessary detail (e.g. NOT adding a spatial dimension which multiplies the data required by the number of spatial areas to be covered, or including modules to deal with qualifications or key/generic skills as a prime focus of attention);
- Using existing data and not collecting new information specifically for the purpose.

Based on the assumption that no new primary data collection is required, and ignoring any costs of additional activity to disseminate and obtain feedback on the results, it is estimated that the basic costs could be restricted to a figure of around R1m.

This should be sufficient to:

- "Buy in" a good set of multi-sectoral employment projections from an existing model (Module 1);
- Develop a robust and consistent database of occupational employment across sectors, based on a variety of sources (Module 2);
- Develop a set of procedures to link such data to the multi-sectoral model outputs and produce projections of occupational employment levels (Module 2);
- Establish a robust set of data relating to replacements demands (Module 3);
- Develop a module to translate from the occupational employment projections to the implications for replacement demands (Module 3);
- Establish data and a modelling procedure to work out implications for qualifications requirements (Module 4);
- Produce a good quality *Results Report* presenting the main findings plus a *Technical Report* describing the data and models in sufficient detail to enable easy updating.

All data and any new models/ modules/ software developed should be the property of the Department of Labour.

6. CONCLUSIONS AND KEY RECOMMENDATIONS

Key Recommendations

Based upon the discussion above, a number of specific recommendations can be made. These include recommendations relating to the overall approach to be adopted as well as more specific thoughts regarding data sources and methods.

Overall Approach to anticipating future skill needs

The review of best practice worldwide suggests the following:

- The use of nationwide, multi-sectoral modelling methods, to provide a comprehensive, national overview of the changing demand for skills should be the cornerstone of the approach;
- More basic methods should be used for modelling occupational structure within sectors, recognising the limitations of existing data but making recommendations for further improvements in data collection;
- It is important to include an explicit treatment of replacement demands, although recognising the limitations of existing data;
- Some limited analysis of the implications for other aspects of skill such as qualifications might be undertaken;
- A satisfactory treatment of key/generic skills is best left to more qualitative approaches for the foreseeable future.

A modular approach is therefore proposed involving:

- **Module 1:** a multi-sectoral macroeconomic model;
- **Module 2:** an occupational model;
- **Module 3:** a replacement demand module;
- **Module 4:** a qualifications module, focussing on demand implications.

The advantages of a modular approach are that it facilitates the independent development and improvement of parts of the system. It is also a relatively low cost option.

Module 1 would be based around one of the existing multi-sectoral macroeconomic models available in South Africa. While there might be some advantages in building a new model specifically for his purpose, it is likely to be a costly exercise and the marginal benefits compared with using an existing model are likely to be modest. The important thing is to have a set of consistent sectoral projections, which are transparent in terms of the assumptions they are making about the external influences on the South African economy (including technological change and the impact of global competition). A range of alternative scenarios, to demonstrate the sensitivity of the outcomes to different assumptions would also be useful.

Module 2 would be new, although it could usefully build upon the previous work by HSRC, BMR and others. The relevant data sets have been reviewed in detail here. These have their limitations and inconsistencies. A key part of the work needed will be concerned with trying to reconcile these inconsistencies and reach a "consensus" view on current and likely future changes in occupational structures within sectors. This should also involve taking on board more qualitative as well as "hard" quantitative data.

Module 3 would again be new, but could build to some extent on previous efforts. Data on various aspects of replacement demands are in many respects even weaker than that on occupational employment structure. Nevertheless, the review of available data suggests that sufficient information exists to provide at least a broad indication of the likely scale of replacement demands as opposed to the projections of expansion or contraction in employment levels.

Finally **Module 4** would focus upon the implications for formal qualifications. As with replacement demands, the data review suggests that there are many gaps and problems with the existing data. Nevertheless it is felt that these are sufficiently robust to enable the production of useful benchmark projections of trends in qualifications intensities. It is not proposed that such work would focus upon the supply of qualifications at this stage.

In principle, all these modules could be undertaken independently. In practice, the data and issues involved in Modules 2-4 are closely inter-related and are probably best undertaken by a single research team.

Data sources and methods

The review of existing data suggests that although there are many problems, given some further work on data cleaning and refinement, the existing data are adequate to produce some benchmark projections of changing occupational structure, together with implications for replacement demands and qualifications.

However, if such analysis is to match the quality of those conducted elsewhere across the world- over the longer term, steps need to be taken to improve the quality of:

- Sectoral employment and related data, including extension to cover the informal sector;
- Data on occupational employment structure within sectors;
- Information required for estimating replacement demands.

Costs and resource implications

Assuming that no new primary data collection is required immediately, the costs of developing the basic projections could be restricted to a figure of around R1m.

This should be sufficient to:

- "Buy in" a good set of multi-sectoral projections from an existing model;
- Develop a robust and consistent occupational database based on existing data and to produce the related projection models;
- Produce a good quality report, including methodological details, software and data to enable easy updating.

Costs of updating are likely to be similar, since there is considerable scope for further development and improvement. An annual updating cycle is probably optimal although some countries have decided to update once every two years.

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Separate annexes

A: The Rationale for Conducting National Occupational Projections and how they are Typically Undertaken.

B: Labour Market Projections: A Review of International Best Practice (with complete Bibliography).

C: A Critical Review of Previous Work on Employment Projections in South Africa.

D: Data Sources for National Skills Forecasting in South Africa: Strengths and Weaknesses - A Critical Assessment of Data Availability.