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The shape of demand for high-level agricultural skills in the South African labour market

Nicci Earle & Andrew NM Paterson[1]

A supply of high-level agricultural skills is foundational to the South African agricultural sector's capacity to improve the quality and range of agricultural products and services so as to support small agricultural producers, meet domestic needs for food security and increase the competitiveness of local products on global agricultural markets. Concerns about the coexistence of graduate unemployment and skills shortages in the agricultural sector prompt the question: What is the shape of demand for high-level agricultural skills in the South African labour market? To answer this, the authors conducted 83 interviews with respondents in private, public and non-governmental organisations involved in agriculture. The findings reveal a rising demand for high-level agricultural skills among farmers, farm managers and foremen; in research and product development; in the sales and marketing functions of firms supplying primary agriculture; in government entities across a wide range of occupations; and in public and private sector R&D.

1. INTRODUCTION

Agriculture, agro-processing and related support activities in South Africa remain critical contributors to both national employment and export revenues (NDA, 2003; Bhorat, 2004), despite declines in the agricultural sector's contribution to GDP relative to the manufacturing and services sectors since 1970 (Bhorat, 2000). Because the attainment of high growth in all the various economic sectors of South Africa is felt to be intricately linked to the development and overall availability of high-level skills in the domestic labour market, understanding national demands for particular sets of these skills is becoming increasingly important (NDA, 2001; Mbeki, 2005). In the context of limited overall national availability of such skills, unemployed graduates represent a considerable waste of resources, not only at the individual but also at the national level (DoL, 2005; Miti, 2005). Understanding the shape of demand for high-level agricultural skills both within and across sectors provides the foundation for aligning supply with demand and thus ensuring the sector's sustainability into the future (Barry, 1995; Agriculture and Agro-Processing Working Group, 1998; DoL, 2005; Paterson et al., 2005).

Various activities across the South African economy that require high-level agricultural skills make up the total demand for such skills in the domestic labour market, not only from agriculture but also to a varying degree from other sectors that provide inputs to agriculture and with which agriculture has forward linkages. The demand for these skills across the various sectors is not static but dependent on the interplay of global, national and sectoral pressures (NDA, 2001; Groenewaldt, 2004).

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This article presents findings from research that sought to explore the shape of demand for high-level agricultural skills in the South African labour market. Underlying the exploration was a need to move beyond examining the aggregate size of demand for these skills to considering the internal and external forces that have either a positive or negative impact on demand, and to look systematically outside the immediate agricultural sector for signs of the demand. The article is based mainly on the findings from 83 interviews with firms, organisations and institutions involved either directly or indirectly in South African agriculture.

The article first examines the employment of high-level agricultural skills at a national level, providing contextual information about the overall size of the demand for these skills. Second, it presents and discusses a schematic model of agriculture-related activities in South Africa that was developed as a tool to guide the selection of key firms, organisations and institutions for further investigation and to provide possible explanations for the findings. Finally, it presents the most important research findings, providing shape to the total demand for high-level agricultural skills in the South African labour market.

2. THE DATA AND PROXY MEASURES

Analysis of the South African Labour Force Survey of 2004 (StatsSA, 2004) provides some information about the overall demand for people with high-level agricultural skills in the agricultural sector in South Africa.

In the case of both 'high-level agricultural skills' and 'demand', it is necessary to use proxy measures, i.e. measurable concepts that are used to represent non-measurable concepts. Thus qualifications[1] can be used as the proxy measure for 'high-level skills', despite weaknesses such as assuming that all have had equal training, and leaving out people without qualifications who have nevertheless acquired high-level skills through mentorship, self-study and work experience. A proxy for the 'demand' for a particular group of skilled individuals is the number who are employed. The larger this number, the greater will be the need for skilled individuals to replace losses from retirement, death and other factors. Such replacement demand may of course grow or shrink depending on the overall growth or decline of sectors using particular groups of occupations or skills.

It is possible to extract from the Labour Force Survey the number of 'workers with degrees, diplomas and certificates' in the field of study 'agriculture and nature conservation' (see Table 1). Another variable from the Labour Force Survey, 'monthly income', based on the general observation that in market economies higher levels of skills are associated with higher levels of income, provides a means of further isolating the targeted group (StatsSA, 2004; Paterson et al., 2005). This analysis reveals that a total of 33 000 (19 000 plus 14 000) workers with 'degrees, diplomas and certificates' in the study area of 'agriculture and nature conservation' in the South African economy earn a salary in excess of R2501 per month.

This is an approximate measure because this group contains individuals with high-level skills in nature conservation, so the overall demand for high-level agricultural skills in the South African labour market is likely to be somewhat lower than the figure of 33 000. On the other hand, certificates sometimes refer to qualifications that indicate intermediate-level skills (i.e. post-school certificates) rather than high-level skills

[1]These are referred to in this article as follows: NDip (National Diploma), BTech (Bachelor of Technology), BAgric (Bachelor of Agriculture), BSc (Bachelor of Science), MSc (Master of Science), PhD (Doctor of Philosophy).

Table 1: Number of workers with degrees diplomas and certificates by field of study (agriculture and nature conservation) and monthly income

Field of study			Number of workers by income categories			Total number of workers in employment*
			R2501–R8000	R8001 or more	Other*	
LFS 2004	All fields	N (000)	925	594	487	2006
		%	46.1	29.6	24.3	100
March	Agriculture and nature conservation	N (000)	19	14	9	42
		%	45.2	33.4	21.4	100

*Includes 'Don't know', 'Refused' and 'Unspecified income'.

Source: Labour Force Survey, March 2004 (StatsSA, 2004).

(i.e. postgraduate certificates), and the inclusion of intermediate certificate holders may slightly exaggerate the real numbers.

While there is some value in estimating the total size of the high-skilled workforce in agriculture, further analysis needs to be undertaken to reveal its distribution across agriculture and other sectors that may require high-level agricultural skills.

3. METHODOLOGY AND MODEL DEVELOPMENT

The data from the Labour Force Survey is at best able to indicate the size of demand for high-level agricultural skills in the South African labour market, but it provides no information about the specific skill requirements or the internal characteristics of demand for these skills. This study aimed to develop an understanding of the shape of high-level agricultural skills demand, as expressed by key firms, organisations and institutions associated with agricultural goods and services.

Given sufficient time and resources, the preferred method would be to survey all employers in agriculture and related sectors; however, the next best option, used for this study, was to target selected firms, organisations and institutions that represent the range of economic activities in South African agriculture. A schematic model of all agriculture-related activities (e.g. input, output, and governance and support) was developed to help target suitable informants and to ensure that all relevant areas of the agricultural economy were included. This model, which uses the principles of value chain analysis (Kaplinsky & Morris, 2001), is presented in Table 2. (It should be noted that, as with any attempt to simplify a large system characterised by multiple relationships and interrelationships between the various role players, this schematic model of agriculture and related activities is necessarily simplified. Although it presents all major links adequately, it cannot capture all possible relationships.)

In Table 2 agricultural activities are presented in columns A and B. The primary activities can be subdivided into plant and animal production, with each of these broad categories representing a range of more specific activities. Secondary or basic processing activities, which flow directly from the primary ones, can be broadly grouped into basic food and beverage processing, fibre processing and feed and supplement production. The sector-specific inputs for these activities are shown in column C: for primary agriculture, seeds, fertilisers and crop protection agents for plant production, and feeds and supplements, animal health products and veterinary services for animal

Table 2: A schematic model of the agriculture-related activities in South Africa

D. NON SECTOR-SPECIFIC INPUTS	**C.** SECTOR SPECIFIC INPUTS		
		A. PRIMARY AGRICULTURE (PRODUCTION)	
Specialist equipment, machinery & engineering services	Seeds Fertilizers Crop-Protection	Plant Production	Fruit & Nuts
			Grains & Oilseeds
			Vegetables & Herbs
			Tea & Coffee
			Ornamental Plants & Flowers
Water and Electricity			Tobacco
			Commercial Forestry
	Feeds Veterinary-Services Animal Health Products	Animal Production incl. Aquiculture	For Carcass & Meat
			For By-Product (feathers, eggs, milk, honey, wool etc)
Specialist packaging and labelling suppliers			For Conservation & Tourism
			Fish Hatcheries/Farms
		B. SECONDARY AGRICULTURE (PROCESSING)	
	Chemical preservatives, supplements, detergents	Basic Food & Beverage Processing	Fruit & Nuts
			Vegetables & Herbs
Specialist transportation, logistics & storage services			Grains and Oilseeds
			Red Meat, Poultry & Fish
			Dairy
			Tea & Coffee
Specialist software and technology			Wine
		Fibre Processing	Wool
			Cotton & Flax
			Leather
			Wood
		Feed & Supplement Production	For Animal Production & Pets
E. GOVERNANCE AND SUPPORT SERVICES			
National & Provincial Government Departments & Institutions Training & Skills Development Research & Development Specialist Financial Services Agricultural Product Sales and Marketing Organisations Retail Sector Private Consulting Companies Product & Industry Regulatory Boards and Quality Assurance Organisations Professional, Consumer and Producer Associations and Societies			

production, and for secondary agriculture, the production and supply of chemical preservatives, supplements and detergents. The non-sector-specific inputs are shown in column D: farm equipment, machinery and engineering services, water and electricity services, packaging and labelling services, transport, logistics and storage services, and information and communication technology services. While these non-sector-specific inputs do not exclusively target agriculture, they have in many instances developed areas of specialisation that focus on the needs of their agricultural clients. Columns A, B, C and D account for the provision and flow of physical products or inputs to the sector. Column E shows cross-cutting governance and support activities, involving a large number of stakeholders often with overlapping functions.

The schematic model presented in Table 2 informed the selection of the sample of informants for interviews, based on a combination of purposive and snowball techniques. Some organisations were selected as they were thought to typify a particular subsector, while others were identified by asking respondents for references to their customers, suppliers and competitors. In this way, coverage of agricultural value chains and forward and backward linkages was improved.

A total of 41 interviews were conducted with private companies, organisations and institutions relatively evenly distributed across the activity areas identified as A, B, C and E. The diversity and number of those organisations classified as falling into area D led the researchers to the conclusion that they could not cover this sector effectively in its own right. They elected to obtain information about this input group indirectly through the respondents (selected in groups A, B, C and E) and through secondary sources obtained from the National Agricultural Directory 2004/5 (Macaskill & Ashdown, 2004) and agricultural trade magazines and periodicals. Interviews were also conducted with state and parastatal organisations and institutions involved in governance and support activities in the agricultural sector: government departments of agriculture (10), parastatal organisations (6), colleges of agriculture (11), and universities and universities of technology offering agricultural qualifications (15). In all, 83 interviews were conducted for this research.

The interviews focused on three areas: first, the total size of employment and the proportion of employees who had agricultural qualifications at the level of the three-year national diploma or higher in each organisation (while qualifications are only a proxy for high-level skills in the field, this was considered by the researchers to be the easiest way for interviewees to identify people in their organisations with these skills, or vacant positions requiring such skills); second, the changes in the organisation's demand for such qualifications over the past decade, and anticipated future change; and, third, the factors that had either a positive or negative impact on the organisation's ability to recruit and retain people with the targeted skills.

4. KEY ELEMENTS OF THE DEMAND FOR HIGH-LEVEL AGRICULTURAL SKILLS IN THE SOUTH AFRICAN LABOUR MARKET

Analysis of the interview data reveals a number of characteristics of the demand for high-level agricultural skills in the South African labour market.[2] The main findings, which lend support to Bhorat's (2000, 2004) findings of increasing demand for high-skilled workers across the range of sectors in the South African economy, including the agricultural sector, are summarised below. Each finding is then discussed further in the sections that follow:

- At the level of primary agricultural activities, demand for high-level agricultural skills is relatively high and increasing.
- At the level of secondary agricultural activities, demand for high-level agricultural skills is relatively low.
- Among firms that provide sector-specific inputs to the primary agricultural sector, demand for high-level agricultural skills is generally high and increasing.
- Among firms that provide sector-specific inputs to the secondary agricultural sector there is virtually no demand for high-level agricultural skills.
- Among firms and organisations that provide non-sector-specific inputs to the broader agricultural sector, demand for high-level agricultural skills is difficult to quantify but probably variable.

[2]While food technology is typically taught in university faculties of science and agriculture and is therefore also strictly a high-level agricultural skill, interview respondents did not include it in the category of high-level agricultural qualifications but saw it rather as a separate high-level skill. The term 'high-level agricultural skills' in this article thus excludes skills in food technology, but makes separate mention of these as appropriate.

- Among the organisations and institutions providing governance and support to the agricultural sector, government and parastatal employment constitutes the single largest demand for high-level agricultural skills.
- Demand for high-level agricultural skills appears to be driven by vertical integration and horizontal coordination among individual role players.

4.1 Demand for high-level agricultural skills in primary agriculture relatively high and increasing

To match its diverse climate, South Africa's primary agricultural sector includes diverse types of farming: intensive and extensive, small subsistence and large commercial (Agriculture and Agro-Processing Working Group, 1998). Primary production of plants and animals takes place mainly on farms, overseen by owners, managers or foremen. The Census of Commercial Agriculture 2002 (StatsSA, 2005: 11) revealed that in the nine provinces of South Africa there were 35 538 active farmers (farm owners), and a further 23 744 farm managers and foremen.

The demand for, and distribution of, high-level agricultural skills in the groups of farmers and farm managers or foremen is difficult to ascertain because of the largely private nature of agricultural activities in South Africa and the lack of organisation among those involved in the sector. Furthermore, findings generated from interviews must necessarily be considered as anecdotal evidence. Nevertheless, this study's findings suggest that increasing skills requirements in the primary agricultural sector are contributing to the overall increase in skills demands in the agricultural sector as a whole. Bhorat's macro-level analyses also reveal this (2000: 441).

Respondents from higher education institutions offering agricultural qualifications (for the full list see Table 5), who were asked to outline their graduate employment trends and opportunities, indicated that the largest proportion of their total first-qualification graduates entered employment in the primary agricultural sector either as farmers or as farm managers or foremen. Agricultural colleges (with national certificate or diploma first-qualification graduates), however, noted larger proportions entering the primary agricultural sector than did the university departments of agriculture (with bachelor's degree first-qualification graduates). Furthermore, respondents were of the opinion that the requirement for high-level agricultural skills is likely to be proportionately higher for managers and foremen than for farmers, since farmers (who have often inherited the land) are more likely to have acquired the necessary skills from a parent mentor, while the formalised nature of the employment of farm managers and foremen is likely to require some form of accreditation in addition to farming-specific work experience.

Regardless of current levels, the demand for high-level agricultural skills is expected to increase in both groups into the future. Respondents in the agricultural colleges report a trend where more farmers are insisting that their 'inheriting children' receive some form of agricultural qualification. One of the reasons cited is the current uncertainty over the long-term prospects of the agricultural sector as a stable and desirable working environment. A second reason is rising demands on the efficiency of agricultural production, including increased mechanisation, due to global competition and market deregulation. For these same reasons, large commercial farmers are also indicating that their recruitment strategies have recently changed so that the minimum qualification level for manager and foremen positions will be the three-year NDip in Agriculture.

It is difficult to estimate the skills demand at privately owned commercial farms. Corporations owning these (Rainbow Chickens, McCain Vegetables, Tongaat Hulett Sugar and Dew Crisp), however, indicated that only about 20 to 50 per cent of foreman and manager positions are filled by people with appropriate formal high-level skills. And while the non-formal skills they have acquired through years of practical experience will continue to be considered critically important, the corporations indicated that recruitment strategies will focus on people with agricultural qualifications over and above relevant work experience. Thus, with a skills gap of between 50 and 80 per cent, the demand by corporately owned commercial farms for managers and foremen with high-level agricultural qualifications is likely to increase substantially over the short to medium term.

The interviews revealed that the rising demand for qualifications is also linked to a stronger emphasis on specialisation (e.g. plant or animal production) and even sub-specialisation (e.g. production of wine, sugarcane, poultry, etc.) within agricultural qualifications. Consequently, not all job applicants with agricultural qualifications at the same level are considered to be equally suitable. General agricultural qualifications carry less weight in particular fields where employers require a particular specialisation. This, ironically, leads to an effective reduction in the overall pool of properly qualified employees available to these subsectors.

4.2 Demand for high-level agricultural skills in secondary agriculture relatively low

Secondary agriculture is defined as the initial stage of processing agricultural products. While these activities can be distinguished from manufacturing, the division is often not precise. Interviews were conducted with a range of firms that process basic food and beverages (SAD Foods, Ceres – fruit and vegetables; Ina Paarman Foods, Robertson Spices – herbs and spices; Bull Brands Foods, Karan Beef, Rainbow Chickens – meat and poultry; Clover, Parmalat – dairy products; South African Honeybush Tea Association – tea; Tongaat Hulett Sugar – sugar). None of these reported any demand for high-level agricultural skills. Instead, their skills demands and shortages were observed predominantly in the food technology and process/industrial engineering fields.

Similarly, firms that process basic fibre (Stucken Group, Cape of Good Hope Wool Combers – wool; Clark Cotton – cotton; Bader SA, EAC Tannery, Hidskin – leather; Sappi – wood), reported that they did not require high-level agricultural skills. All four subsectors reported a shortage of specific industry process skills or industrial engineering skills. The leather industry reported additional shortages of people with the niche qualification 'Higher National Certificate in Leather Technology', developed specifically for the industry and offered only at Grahamstown's International School of Tanning Technology. The paper and pulp industry reported shortages of people with the Bachelor of Technology in Pulp and Paper Technology (a specialisation within chemical engineering). The wool and cotton industries on the other hand still largely considered on-the-job training and experience to be preferable to any available agricultural qualification.

The only exceptions to the above trend were found in the production of animal feeds and supplements, and in wine production. The schematic model in Table 2 explains these findings. Feed and supplement production is not only a secondary agricultural activity but simultaneously a primary sector-specific input activity. As such, it is engaged in agricultural

sector activities in which the demand for agricultural qualifications is relatively high and increasing. In the case of wine production, the demand for agricultural skills is due to the vertical integration between the primary agricultural activity of wine grape production and the secondary one of wine production. The specialised agricultural qualification in oenology (wine making) includes viticulture (grape growing) as a core subject.

4.3 Demand for high-level agricultural skills among firms providing sector-specific inputs to primary agriculture relatively high and increasing

Among firms providing sector-specific inputs for primary agricultural activities (e.g. Pannar Seed, Syngenta – seed production; Foskor, Sasol Nitro, Omnia, Kynnoch, Profert – fertilisers: Syngenta, Beyer Crop Sciences – crop protection products; Afrivet, Beyer Animal Health – animal health products; Epol, Bokomo Feeds, Meadow Feeds – animal feed and supplement products), overall demand was reported to be relatively high and increasing for two important categories of employee: research and product development (R&D) personnel, and sales and marketing personnel.

In the case of R&D personnel, there is general demand for relatively advanced qualifications, with firms most commonly citing the minimum requirement as an MSc degree in a relevant specialisation. And while qualifications in plant pathology, microbiology, entomology and zoology are not strictly defined as agricultural, firms nevertheless considered these to be part of the 'basket' of critical R&D skills. Notably, the size of demand for R&D personnel within firms varied considerably depending on whether they were domestic or multinational. While domestic firms generally house their R&D departments in South Africa regardless of their national and/or global sales and distribution focus, multinational firms generally house them in their country of origin. An exception to the latter appears to be in the development of crop protection products, where the specificity of local conditions necessitates local R&D activities, even among multinational organisations. Overall, the increasing demand for high-level agricultural skills in the area of R&D is considered to be the result of increasing global competition for market share in the context of rapid and widespread technological advancements and increasingly demanding customers.

The second common area of strong demand for agricultural qualifications was found in respect of sales and marketing personnel. Respondents argued that the qualification levels are being raised for these personnel so that they can provide high-quality, scientifically grounded information and advice about increasingly advanced products to increasingly educated farm owners, managers and foremen. Some firms employ their own sales agents, while others use a common network of sales agents in their particular subsector. All firms, with the exception of those involved in animal health products, reported that – regardless of the current proportion of high-level agricultural qualifications among their sales agents (which ranged from a high of almost 100 per cent to a low of 20 per cent) – their intention for the future was to recruit only agricultural graduates into sales and marketing positions.

The animal health products firms are an exception because, despite a similar trend towards increasing qualification demands for sales agent positions, they are willing to accept a range of qualifications outside agriculture (including zoology, biology, veterinary nursing and veterinary technology). Commonality of subsector-specific knowledge among sales agents is achieved in the animal health products sector through the compulsory AVCASA (Association of Veterinary and Crop Associations of South Africa) Animal

Health Course, and in the fertiliser industry through the compulsory Fertiliser Advisor's Training Course, both developed relatively recently through cooperation between the Tshwane University of Technology (TUT) and the respective industry associations.

Veterinary services as a sector-specific input to the primary agricultural sector can only be provided by people who have the necessary qualifications. As such this group is worth specific mention. Veterinarians in South Africa can be employed either in direct animal health services (providing animal production support and quality control, or domestic animal health services) or in R&D activities. Both the government and the private sector have demands for qualified veterinarians, veterinary nurses and technicians. However, the focus of demand in these two sectors appears to be slightly different. While in the public sector veterinary skills are used mainly for disease control, meat quality control and R&D activities, in the private sector they are used predominantly for animal production support, domestic animal health services, and the development and production of animal health products. Private sector demand is difficult to ascertain, particularly as the majority of veterinarians in this sector are self-employed. The government's demand for veterinarians is discussed in Section 4.6.1 below.

4.4 Minimal demand for high-level agricultural skills among firms providing sector-specific inputs to the secondary agricultural sector

In contrast to the relatively high level of demand for agricultural qualifications from firms providing sector-specific inputs to the primary agricultural sector, there is minimal requirement for these qualifications from those providing specific inputs, such as chemical preservatives, supplements and detergents, to the secondary agricultural sector. The qualifications required here are predominantly organic chemistry, inorganic chemistry and biochemistry, chemical engineering, biotechnology and food technology. This finding is unsurprising, given that the secondary agricultural sector itself has virtually no requirement for high-level agricultural skills.

4.5 Demand for high-level agricultural skills among firms and organisations providing non-sector-specific inputs to the agricultural sector difficult to quantify but probably variable

Enterprises that provide non-sector-specific inputs to agriculture generally produce goods and services that are consumed across all economic sectors. In this sense, it is not the agricultural sector that primarily drives the skills needs of these producers. However, in many instances suppliers have developed specialised capabilities to meet the needs of agricultural sector clients. This category covers a very wide range of inputs, but can be classified into three main groups supplying 1) equipment, services and information that relate to resource use and management, 2) machinery and vehicles, and 3) infrastructure, tools and technology.

The National Agriculture Directory 2004/5 (Macaskill & Ashdown, 2004) indicates that the diversity and scope of the firms that fall into these groups is large. It is, however, possible to make tentative deductions about their high skills requirements in agriculture. Demand for high-level agricultural skills is likely to be found in design of agricultural products and services and such demand is likely to be strong in locally owned firms that have a strong agricultural market focus and/or local manufacturing facilities. It is also likely to be found in sales and marketing of agricultural products and services

and will probably be strong in firms that are involved in, or have divisions dedicated to, direct agriculture end-user sales or services, where a professional and knowledgeable interface with farmers and farm managers is essential.

4.6 Strong demand for high-level agricultural skills among the organisations and firms providing governance and support to the agricultural sector

Among organisations providing governance and support services in agriculture, there is clearly a strong high-skills demand from government entities. The government constitutes the largest employer in this group and the level of demand from government entities can be accessed through information on public sector employment. On the other hand, it is difficult to obtain a clear picture of the size or the high-skills needs of firms and NGOs providing legal, financial, consulting or skills development services in agriculture. Consequently, this section is able to reflect more accurately on government needs but, where possible, refers to broader private sector needs.

Demand for high-level agricultural skills in government can be divided into three principal areas: the national and provincial departments of agriculture; the various institutions offering agricultural education – schools, agricultural colleges and universities; and the various agriculturally focused parastatal organisations, whose functions cover agricultural R&D, product quality control, financial services and marketing.

4.6.1 National and provincial government departments

The National Department of Agriculture and the nine provincial departments are collectively large employers of people with high-level agricultural skills. Available data on the employment and demand for agricultural qualifications in the provincial departments is presented in Table 3. The largest requirement for agricultural skills is in the line function directorates, which provide direct support to the agricultural sector (see 'Job descriptions' in Table 3). High-level agricultural skills are also found in the various management structures of the departments. As people with these skills are promoted to more senior management positions, demand at lower levels is fuelled through the creation of vacancies.

Scarcity of high-level agricultural skills in the provincial departments of agriculture presents in two main ways. Firstly, skills appear to be scarce in certain knowledge areas. Scarcity was noted for the following qualification types: agricultural economics, agricultural engineering, hydrology, aquaculture, horticulture, soil science, agronomy, animal science, veterinary science and crop protection (Miti, 2005). Secondly, there appears to be greater scarcity of the higher-level qualifications in each knowledge area. For example, the proportion of vacancies to overall posts is much lower for positions requiring the NDip in Agriculture than for those requiring a BSc in Agriculture.

Outside the general demand discussed above, it is worth noting the demand for veterinary and veterinary related skills in government. Table 4 shows that the supply of required skills in this field is substantially below the levels demanded by the national government, provincial governments and state supported laboratories. For example, of all the government veterinary posts only 59 per cent are currently filled (185 out of 314). Similarly, only 74 per cent of government posts for animal health technicians (1055 out of 1423) are currently filled (NDA, 2005).

Table 3: Demand for agricultural qualifications in the provincial departments of agriculture (September 2005)

		Staff with agricultural qualifications			
Province	**Total staff**	**Total demand**	**% filled**	**% vacant**	**Job descriptions**
Gauteng	83	45	44.5	55.5	Agricultural scientists Agricultural technicians
Western Cape	812	135	68.1	31.9	Industrial technicians
Eastern Cape	*	*	*	*	Animal health technicians State veterinarians
Northern Cape	315	**13	*	*	Veterinary technologists
Mpumalanga	1861	221	83.3	16.7	Agricultural economists Soil scientists
Free State	1260	109	88.1	11.9	Farm managers
KwaZulu-Natal	3798	***(738)	*	*	Environmentalists Biometricians
North West	2019	390	80.0	20.0	Laboratory managers
Limpopo	5614	983	83.8	16.2	Rural development practitioners

*Information not available.

**Total number of people with agricultural qualifications employed at present. Data on vacancies was unavailable and thus it was not possible to calculate total demand for such skills.

***Total number of people with intermediate to high-level qualifications as defined by the Skills Plan, including all agricultural qualifications.

4.6.2 Education and skills development

The institutions and organisations that provide agricultural education and skills development are key to the supply side of any skills analysis, and their staffing requirements make them also an important source of demand for high-level skills. In the government sector, people with high-level agricultural skills are required as educators in schools offering the subjects agricultural science, animal husbandry, field husbandry and farm mechanics, in Further Education and Training (FET) and agricultural colleges offering agricultural courses and qualifications, and in universities offering agricultural qualifications.

In South Africa a large number of ordinary high schools offer agricultural science as a subject. In 2003 approximately 60 660 pupils took it as a subject in Grade 12 in 2645 high schools. On the assumption that, ideally, every high school offering agricultural science should have at least one qualified teacher to teach it, the minimum demand for agriculturally qualified teaching staff would be 2645. The actual situation is of course far from ideal – it is well known that not all teachers (including those of agricultural science) in South African high schools are qualified to teach their subject, or to teach it at the level at which they are teaching it (Paterson et al., 2005).

In higher education institutions that offer agricultural training it was possible to obtain exact data for the staffing requirements at these institutions. The findings are presented in Table 5, which shows a current total demand figure of 866 appropriately qualified people in academic and technical posts. The unmet portion of this demand amounts to 14.5 per cent.

Table 4: Government demand for animal health personnel

	Veterinary posts			Technical posts			Border and redline posts		
Service	**Filled**	**Vacant**	**Total**	**Filled**	**Vacant**	**Total**	**Filled**	**Vacant**	**Total**
National	17	32	49	23	22	45	0	0	0
Provincial	148	80	228	951	308	1259	248	0	248
Laboratory	20	17	37	81	38	119	0	0	0
Total	185	129	314	1055	368	1423	248	0	248
Percentage	59%	41%	100%	74%	26%	100%	100%	0%	100%

Source: NDA, 2005.

4.6.3 Parastatal demand

It is important to understand the demand for high-level agricultural skills in parastatal institutions because it reveals three key areas of demand not only in these institutions but also in private sector enterprises: the national R&D stock, the pool of agricultural economists, and local capacity to meet South Africa's need to assure the quality of agricultural products crossing its borders inwards and outwards. The discussion here thus refers to parastatal and broader market demand for skills in these strategic fields.

In South Africa six national parastatal organisations support the agricultural sector. There are also various provincial ones, such as finance institutions and development corporations,[3] a number of which support and develop agricultural activities at the emerging farmer level. Table 6 summarises high-level agricultural skills demand in the national parastatals. The SAVC employs only six administrators, OBP employs people with agricultural qualifications in Animal Health only because the supply of veterinary technicians is insufficient, and the NAMC employs only five agriculturally qualified staff. The demand for agricultural qualifications is relatively high at the ARC, the SALB, and the PPECB. These needs are discussed in more detail below.

The Agricultural Research Council (ARC): While the national and provincial departments of agriculture and private research organisations also undertake agricultural R&D activities, the parastatal ARC remains the largest and most significant national agricultural R&D institution. Table 7 profiles the large number of employees at the organisation who have high-level agricultural skills.

As a means of contextualising the size and importance of the ARC to the domestic agriculture R&D sector, Table 8 provides comparative numbers of people with agricultural qualifications employed in eight private organisations that are engaged exclusively in R&D or have a dedicated R&D section. While the overall extent of private R&D employment is uncertain, the capacity of each of the largest of these private organisations – the South African Sugarcane Research Institute and Pannar Seed's R&D division – is only about 8 per cent of the ARC's total employment of people with high-level agricultural skills.

The ARC is concerned that its R&D capacity is currently in decline. Certain of the 12 research institutes in the organisation are struggling to source the MSc and PhD level

[3]For example, Mpumalanga Agricultural Development Corporation (MADC), Eastern Cape Development Corporation (ECDC), Free State Development Corporation (FDC), KwaZulu-Natal's Ithala and Limpopo Economic Development Enterprise (LimDev).

Table 5: Demand for agricultural qualifications among staff at agricultural colleges and universities with departments of agriculture (September 2005)

		Staff with agricultural qualifications		Vacancies for staff with agricultural qualifications	
Tertiary education institution	**Province**	**Teaching**	**Management**	**Funded**	**Unfunded**
Elsenburg College	Western Cape	24	5	0	5
University of Stellenbosch		54	0	0	0
Cape Peninsular University of Technology		6	0	2	0
Fort Cox College		16	6	2	0
Nelson Mandela Metropolitan University	Eastern Cape	9	0	0	0
University of Fort Hare		17	1	0	12
Grootfontein College	Northern Cape	57	6	3	30
Cedara College		16	2	3	0
Owen Sithole College		18	2	3	0
University of KwaZulu-Natal	KwaZulu-Natal	60	0	1	2
Mangosuthu Technikon		10	1	1	0
University of Zululand		10	0	0	5
Glen College		13	1	2	2
University of the Free State		62	1	0	0
Central University of Technology	Free State	5	1	0	0
Potchefstroom College		20	4	4	0
Taung College	North West	11	3	2	1
North West University		50	0	9	10
Tshwane University of Technology		44	1	0	0
University of Pretoria	Gauteng	48	0	0	0
University of South Africa		12	0	0	2
Lowveld College	Mpumalanga	17	3	2	3
Madzivhandila College		23	3	4	0
Tompi Seleka College		20	1	17	0
University of Limpopo	Limpopo	37	1	0	0
University of Venda		42	0	0	0
		701	**38**	**55**	**72**
		739		**127**	
Totals		**866**			

skills required in their areas of speciality. Respondents report that increased pressure for self-funding of the organisation has resulted in higher workloads and stresses on individual researchers, with concomitant migration of skilled people to private sector R&D institutions. However, the private sector, whose R&D capacity appears to be growing, only funds research that is in its own interests. There is thus a need to continue the public good agricultural research that is critical to the sector, and to sustain the skills base in the ARC.

Table 6: Requirements for agricultural qualifications in national parastatal organisations

Parastatal organisation	Total permanent employment	Employees with agricultural qualifications	Vacancies for agricultural qualifications	
			Funded	Unfunded
Agricultural Research Council (ARC)	2670	734	20	0
South African Land Bank (SALB)	650	35	3	0
National Agricultural Marketing Council (NAMC)	21	5	0	0
Perishable Products Export Control Board (PPECB)	332	257	2	0
Onderstepoort Biological Products (OBP)	206	*	0	0
South African Veterinary Council (SAVC)	6	0	0	0
Totals	**3885**	**1031**	**25**	**0**

*Specific information unavailable. However, individuals with agricultural qualifications are used only as a substitute for the demand for veterinary technicians.

The Land Bank (SALB): Unlike the commercial banks, cooperatives, development financing institutions and NGOs, which cater for the financial needs of specific groups of agricultural clients, the mandate of the Land Bank is to support the entire agricultural sector. The demand for high-level agricultural skills at this institution is qualitatively comparable to the demand for such skills at the large South African commercial banks (see Table 9). An interesting feature of the Land Bank, however, is that it employs a higher proportion of people with NDip or BTech degrees, while the commercial banks employ a higher proportion of people with Honours and MSc degrees. This qualitative difference, which makes comparison difficult, is considered to be largely because those with higher level skills prefer the working conditions and remuneration offered by the private sector.

When it comes to obtaining people with the necessary qualifications in agricultural economics (or a basic agricultural qualification plus an economics or commerce qualification), the various financial institutions, as well as the South African Sugar Association (SASA), which also employs agricultural economists, have difficulty recruiting candi-

Table 7: Employment of agricultural qualifications at the ARC

Positions requiring agricultural qualifications	Numbers employed	Qualification range
Research technicians	244	NDip (Agric)
	129	BAgric/BSc (Agric)
	79	BSc (Hons) (Agric)
Researcher	137	MSc Agric
Senior researcher and specialists	145	PhD
Total agric skills employed	**734**	
Total ARC employment	**2670**	

Table 8: Examples of employment of persons with agricultural qualifications at R&D departments, entities affiliated to industry associations or NGOs

Research body	Numbers of people with agricultural qualifications	Range of qualifications
Pannar Seed (R&D Division)	60	While research technicians may have qualifications in the BSc/BTech range, the majority of researchers are at MSc, PhD or postdoctoral levels.
SA Sugarcane Research Institute (SASRI)	59	
Citrus Research Institute	21	
Syngenta SA (Seed and Crop Protection R&D Division)	16	
Capespan-Experico	15	
Beyer Crop Science (R&D Division)	15	
Deciduous Fruit Producers' Trust (R&D Arm)	9	
ASNAPP (Agribusiness in Sustainable Natural African Plant Products)	5	

dates with sufficiently high-quality passes combined with the language and communication skills they need if they are to deal with a range of clients from varied cultural and educational backgrounds.

The Perishable Products Export Control Board (PPECB): As a large proportion of agricultural products become food for humans, quality assurance in support of public health is critical to the success of the industry. International markets increasingly demand that specific quality standards be met by South African suppliers of agricultural products. The PPECB oversees the controls required for the successful export of South African agricultural food products. Of its total staff of 332 people, the PPECB employs 257 with high-level agricultural skills as quality inspectors based throughout the country.

4.7 Demand for high-level agricultural skills apparently driven by vertical integration and horizontal coordination among role players

An interesting observation emerging from this research is that vertical integration and horizontal coordination among organisations are contributing to increased demand for high-level agricultural skills. Examples were cited of the vertical integration of wine

Table 9: Numbers of agricultural economists in four large banking institutions

Banking institution	Total number of agricultural qualifications	Positions occupied	Range of qualifications
Standard Bank	52	Agricultural Advisors, Trainees, Relationship Managers, Provincial Managers, Head Office	Agricultural Economic plus a range from NDip Agric to MSc Agric with additional finance/commerce qualifications
ABSA	37		
Land Bank	35		
First National Bank	31		

grape and wine production and the horizontal coordination of fertiliser and animal health products firms. Further examples are presented in more detail in this section.

The demand for agricultural graduates and diplomates in large South African retailers provides an example of how vertical value chain integration increases the requirement for high-level skills. Retail corporations establish preferred- or sole-provider agreements with their suppliers of fresh produce as a means of improving and standardising product quality. A portion of the demand for high-level agricultural skills comes from the retail function of general fresh produce procurement. Greater demand, however, comes from these organisations' need to develop their suppliers by providing farmer support in matters of crop production, the use of fertilisers and international best practice benchmarking. Table 10 shows the high-level agricultural skill requirements of the four largest South African retailers.

Recruiting the appropriate candidate, however, depends on a combination of the retailer's requirement for work experience and the specific agricultural qualification. For instance, one retailer stated that it demands ten years of work experience on top of an appropriate qualification to appoint employees in positions which focus on farmer support.

Producer associations, formed to improve the sustainability of particular product subsectors, provide an example of horizontal coordination between role players as a driving force behind increasing skills demand. This is because they meet their mission of improved subsector sustainability in various ways, including networking, marketing, scientific and technical R&D and support, and human resources development (including strategic training). The range of their activities determines to a large extent the demand for high-level agricultural skills in a particular association, while the work undertaken by an association not only helps develop high-level agricultural skills but stimulates demand by promoting recognition of the value of these skills in the subsector. Table 11 provides examples of the extent and variation in demand for agricultural qualifications in producer associations and organisations.

SASA, as one of the most highly organised and widely active producer associations in the national agricultural sector, provides a concrete example of the way horizontal role player coordination stimulates increasing skills demand. This association manages all sugarcane transactions in South Africa, with core funding being obtained from the levies generated per ton of produce sold. In addition to this, funding is obtained from the various user-pay services it offers. SASA provides its subsector with industry production and marketing statistics, markets the nutritional and health benefits of the product to general consumers, undertakes and publishes scientific research through its R&D division SASRI, organises industry-specific networking events, provides quality

Table 10: Employees with agricultural and horticultural qualifications at four large South African retailers

Retail organisation	Agricultural qualifications	Qualifications required
Woolworths	19	BTech/BSc Agric (Plant Production)
Shoprite-Checkers	10	BSc Horticulture
Spar	7	
Pick'n Pay	5	

Table 11: Demand for agricultural qualifications in producer associations and organisations

Organisation or association	Total permanent employment	Agricultural qualifications
Capespan	315	95
South African Sugar Association	1000	82
National Wool Growers Association of SA	32	25
South African Cane Growers Association	42	14
Grain SA	25	9
Deciduous Fruit Producers Trust	22	6
National Emergent Red Meat Producers Organisation	10	4
Cape Wools	6	2
Dry Bean Producers Organisation	6	1
Feed Manufacturers Association of SA	2	0
SA Plant Breeders Association	0	0

assurance testing services, and promotes the development of human resources in the industry through extension services, bursaries for education at tertiary training institutions and industry-specific short courses and learnerships. This association's large overall employment figures and its strong demands for high-level agricultural skills are thus in line with the range and scope of governance and support services it provides to the sugar industry in South Africa.

5. CONCLUSION

The key features of demand for high-level agricultural skills in the South African labour market identified by this study are as follows.

- There is a strong demand for high-level agricultural qualifications for farmers, farm managers and foremen.
- Among firms supplying products and services to primary agriculture, the demand for high-level agricultural skills is concentrated in R&D and sales and marketing functions.
- The government and parastatal sectors have wide-ranging high-level agricultural skills requirements in the areas of education, extension, R&D, engineering, marketing and economics.
- NGOs and private sector institutions involved in governance (e.g. producer associations) and support services (e.g. consulting firms) in the agricultural sector reflect the demand for high-level agricultural skills.
- In addition to a rising overall demand for high-level agricultural skills, there is increased demand for particular fields of specialisation and for the more advanced levels of qualification.

It is necessary to qualify these observations in two ways. First, our claim that general demand for high-level skills is increasing is based on qualitative evidence. Further research which quantifies the demand in particular subsectors or occupations will be important for planning purposes. Second, it is not possible to tell from this analysis whether the increased demand for high-level agricultural skills observed by the respon-

dents reflects an overall increased demand in the sector for skills or the replacement of low- to intermediate-skilled workers with high-skilled ones, as Bhorat's analyses (2000, 2004) suggest is the case.

The areas of the most critical unmet demand include agricultural engineering and agricultural economics, and R&D capacity at the MSc and PhD levels. This is of serious concern if a sufficient supply of these skills is foundational to South African agriculture's capacity to improve the quality and range of agricultural products and services to meet domestic needs for food security, the sustainability of small agricultural producers and its competitiveness on global agricultural markets.

Finally, this article has focused mainly on occupation-specific and sector-specific demand for high-level agricultural skills and consequently has not addressed the demand for high-level management skills in the sector. This task needs to be undertaken in a study of its own that can examine the way the ideal combination of sector-specific skills, work experience, strategic management, financial management and people skills for managers will differ by sectoral classification, firm size and other factors.

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