STAFF AGING AND TURNOVER IN AFRICAN AGRICULTURAL RESEARCH

A Case Study on the Agricultural Research Council and the Faculties of Natural and Agricultural Sciences and Veterinary Sciences of the University of Pretoria

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Analyzing Trends, Challenges, and Opportunities

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Acronyms and Abbreviations

ARC	Agricultural Research Council
ASTI	Agricultural Science and Technology Indicators
FNAS&FVS	Faculty of Natural and Agricultural Sciences (of the University of Pretoria)
FTE(s)	full-time equivalent(s)
FVS	Faculty of Veterinary Sciences (of the University of Pretoria)
HC(s)	headcounts
UP	University of Pretoria

Abstract

As part of a series of case studies (including Burkina Faso, Kenya, Senegal, South Africa, and Zambia) that assessed the status of and trends in human resource capacity, this study focused on staffing at the South African Agricultural Research Council (ARC) and the Faculty of Natural and Agricultural Sciences (FNAS&FVS) and Faculty of Veterinary Sciences (FVS) of the University of Pretoria (UP) during 2001–10. The specific characteristics studies were (1) the capacity of both research and support staff by gender, qualification level, and discipline; (2) the age profile of scientists; and (3) trends in staff recruitment and staff turnover. The results show that both the ARC and FNAS&FVS&FVS experienced an increase in the age of staff, although much more so at ARC than at FNAS&FVS. Unlike ARC, where research staff numbers have declined significantly over the past decade, FNAS&FVS recorded growth in researcher/lecturer capacity, although there has been a growing reliance on part-time appointments. Female participation in research has grown significantly at both the ARC and FNAS&FVS, albeit it in the junior (BSc-qualified) staff category at FNAS&FVS. In both cases it appears that the ability to compete with the private sector—and even the public sector in terms remuneration levels and the ability to attract and retain young researchers—is thus a constraint. Given the greater flexibility at universities in allowing staff to augment their income through consultancies, universities seems to be gaining ground over ARC, but this may not be sustainable in the long run.

1. INTRODUCTION

Recent case studies on the agricultural R&D capacity in South Africa have shown that research staffing levels at the primary public research agency, the Agricultural Research Council (ARC), have declined since 2000. By 2004, ARC had lost about a third of its 2000 research capacity, whereas staffing levels in the higher education sector grew (Liebenberg, Beintema, and Kirsten 2004). More recently it was determined that the reduced staffing levels at ARC were mostly limited to attrition of BSc-qualified researchers, and that levels had stabilized at slightly above 400 between 2004 and 2008 (Flaherty Liebenberg, and Kirsten 2010). Over the same period, staffing levels grew at the universities, albeit at a much slower rate than in the previous decade. No doubt stagnant levels of core funding to ARC contributed to its lack of capacity expansion. A recent, more detailed, analysis on gender demographics revealed that—even though female participation in national agricultural research system is the highest in Africa, at 41 percent—female participation at senior levels of management is surprisingly low, at just 15 percent (ASTI—AWARD 2008). That study only counted permanent staffing and follow-up interviews at the time revealed that the role of part-time and temporary staff had become increasingly important at South African universities. It is hoped that the present study will be able to shed more light on this and other human resource capacity issues, given its inclusion of detailed data on both part-time and temporary staff employed at ARC and the University of Pretoria (UP).

Both ARC and the UP (and universities in general for that matter) implemented substantial restructuring initiatives after 2000. After receiving a scathing review of the performance of the council in 1997 restructuring of the ARC began in 2000–01 with efforts to consolidate the Council's administrative functions (Financial Management, Human Resource Management, and Administration), which also involved the merger of some of its institutes. In 2005 the Council's governance and management structures were revised, and more recently in 2008 staff placements were reassessed based on competency tests. A salient feature of each of the restructuring initiatives at the ARC is the occurrence in an environment of stagnant core funding levels (Liebenberg, Pardey and Kahn 2011b). In terms of the higher education sector, a number of universities were consolidated through mergers from 2004 to 2005 for the purpose of increasing efficiency in the use of available resources. At that time, the Mamelodi campus of Vista University was merged with UP, and UP's Faculty of Agriculture and the Faculty of Natural Sciences were merged to form the Faculty of Agricultural and Natural Sciences (FNAS).

This paper is part of a series of case studies (Burkina Faso, Kenya, Senegal, South Africa, and Zambia), [1] which carried out an assessment of the status of and trends in human resource capacity, given the critical impact of human resources in R&D institutions. The objectives of this study were to assess the characteristics of staff employed at ARC and UP during 2001–10 in terms of (1) the capacity of both research and support staff by gender, qualification level, and discipline; (2) the age profile of scientists; and (3) trends in the recruitment of new staff and staff turnover.

2. STAFFING LEVELS

Overall, average yearly staffing at ARC fell from a total of 3,240 individuals or headcounts (HCs) in 2000 to 2,250 in 2010, representing a decrease of 3.9 percent per year (based on the number of staff employed as at March 31 each year). Refining data to reflect only the months staff were employed each year yields a 3.8 percent decrease per year, from 3,176 full-time equivalent staff members (FTEs) to 2,166 (Table 1). The drop in staff numbers reflects two distinct events between 2000 and 2010. The first

[1] The case studies were commissioned by the Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI) and formed the basis of a synthesis paper for the conference "Agricultural R&D: Investing in Africa's Future–Analyzing Trends, Challenges, and Opportunities" which is being organized by ASTI/IFPRI and the Forum for Agricultural Research in Africa (FARA).

event involved restructuring at ARC, with resulting decreases in total staffing of 5.3 percent per year during 2000–04. Staffing levels remained relatively stable between 2004 and 2007, thereafter decreasing by 5.2 percent per year until 2010.

Table 1. Composition of staff employed at the Agricultural Research Council and University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences, 2000–10

Institution/category of staff	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
a. Agricultural Research Council (ARC)											
All researchers (HCs)	648	622	580	541	519	493	531	524	517	498	474
Researchers	*511*	*492*	*462*	*434*	*417*	*394*	*428*	*425*	*425*	*427*	*405*
Research management	*137*	*130*	*118*	*107*	*102*	*99*	*103*	*99*	*92*	*71*	*69*
Technical staff (HCs)	2,203	2,063	1,924	1,813	1,775	1,679	1,682	1,661	1,592	1,536	1,385
Administrative staff (HCs)	471	436	399	372	389	454	479	445	426	410	391
Total (HCs)	**3,322**	**3,121**	**2,903**	**2,726**	**2,683**	**2,626**	**2,692**	**2,630**	**2,535**	**2,444**	**2,250**
All researchers (FTEs)	613.2	576.3	535.8	494.8	486.2	465.5	505.4	514.8	490.3	459.1	454.9
Researchers	*479.4*	*452.4*	*422.8*	*392.6*	*389.7*	*372.2*	*406.9*	*417.9*	*402.9*	*395.6*	*386.3*
Research management	*133.8*	*123.9*	*113.0*	*102.2*	*96.5*	*93.4*	*98.5*	*96.8*	*87.4*	*63.4*	*68.7*
Technical staff (FTEs)	2,117.8	1,988.9	1,856.4	1,741.8	1,718.9	1,636.7	1,636.0	1,620.9	1,524.0	1,475.4	1,341.2
Administrative staff (FTEs)	444.6	408.3	377.6	348.8	371.4	430.9	447.0	420.8	392.1	373.9	369.4
Total (FTEs)	**3,175.6**	**2,973.5**	**2,769.8**	**2,585.4**	**2,576.5**	**2,533.1**	**2,588.4**	**2,556.4**	**2,406.4**	**2,308.4**	**2,165.5**
b. University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences (FNAS&FVS)											
All researchers/lecturers (HCs)	359	342	342	336	343	392	405	435	433	556	621
Permanent share (%)	*57.7*	*59.4*	*57.6*	*61.9*	*59.8*	*55.4*	*51.1*	*46.0*	*41.8*	*36.2*	*33.7*
Part-time share (%)	*30.6*	*28.9*	*27.8*	*26.8*	*29.2*	*34.4*	*39.5*	*43.2*	*44.6*	*52.9*	*55.2*
Temporary share (%)	*11.7*	*11.7*	*14.6*	*11.3*	*11.1*	*10.2*	*9.4*	*10.8*	*13.6*	*11.0*	*11.1*
Technical staff (HCs)	524	401	373	398	392	394	402	438	455	595	608
Administrative staff (HCs)	157	155	154	161	147	162	151	168	175	169	169
Total (HCs)	**1,040**	**898**	**869**	**895**	**882**	**948**	**958**	**1,041**	**1,063**	**1,320**	**1,398**
All researchers/lecturers (FTEs)	280.7	278.8	281.5	290.8	300.1	334.6	340.8	357.8	254.3	329.5	336.7
Permanent share (%)	*71.7*	*70.5*	*68.3*	*68.1*	*67.9*	*64.0*	*59.1*	*54.1*	*70.0*	*57.6*	*58.3*
Part-time share (%)	*17.0*	*17.9*	*15.9*	*21.0*	*21.9*	*26.3*	*32.7*	*35.8*	*8.4*	*25.7*	*25.9*
Temporary share (%)	*11.3*	*11.7*	*15.7*	*10.8*	*10.2*	*9.7*	*8.2*	*10.1*	*21.6*	*16.6*	*15.8*
Technical staff (FTEs)	335.4	302.3	305.9	327.7	339.2	338.9	338.2	361.0	377.2	478.3	479.0
Administrative staff (FTEs)	116.5	129.9	132.7	135.3	129.9	136.7	131.7	139.8	156.3	148.3	149.0
Total (FTEs)	**582.7**	**556.0**	**561.3**	**583.5**	**588.2**	**606.0**	**599.8**	**644.3**	**682.3**	**804.7**	**821.2**

Source: Compiled by author from ARC (2000–11) and FNAS&FVS (2011).
Notes: Prior to 2005, the Faculty of Natural and Agricultural Sciences existed as the Faculty of Agriculture and the Faculty of Natural Sciences. HCs indicates headcounts; FTEs indicates full-time equivalents. ARC data are reported based on staffing levels for the year ending March 31 of the following year quoted; hence, 2000 data are for April 1, 2000, to March 31, 2001, and so on. Note also that FTE calculations of research staff numbers take into account the number of months an individual was employed. For example, in a given year an individual researcher may have been employed for 8 months, this person would count as 1 HC but only 0.66 FTEs, having spent only 8 of the 12 months actually working for the organization.

The rates of decline differ markedly at ARC when data are disaggregated by general categories of employment. The overall number of researchers fell by 5.2 percent per year during 2000–05—from 511 to 394 HCs. Numbers then returned to 428 HCs in 2006, before returning to 405 HCs in 2010, which represents just under 80 percent of the 2000 level. However, the number of senior (that is, management level) researchers decreased throughout the study period, from an initial 137 HCs in 2000 to only 69 HCs

in 2010. Technical support staff decreased by 3.9 percent per year during this decade, from 2,203 to 1,385 HCs, representing the highest category of decline both in absolute and percentage terms. Of all categories, ARC's administrative staffing declined the least during this timeframe, averaging a rate of 1.9 percent per year.

Due to restructuring, total staffing at FNAS&FVS for the period 2000–02 fell from 1,040 to 869 HCs, thereafter increasing to 1,398 HCs in 2010. Similar to the trend observed at ARC, the number of researchers/lecturers fell from 359 to 336 HCs between 2000 and 2003, growing consistently thereafter to reach 621 HCs in 2010, which represents yearly growth of 9.9 percent from 2004 to 2010. It should be noted, however, that—given the large number of part-time staff employed at FNAS&FVS—the impact on research time is much lower, as is reflected by the more modest growth in the number of FTE researchers at FNAS&FVS. Beginning at 188 FTEs in 2000, numbers fell to 170 FTEs in 2004, before increasing to 198 in 2010; this represents an average increase of 0.5 percent per year for the period under study or, for the purposes of comparison with the headcount data, 2.6 percent year during 2004–10.

Based on headcounts the share of permanent staff changed significantly over the study period; 62 percent of all researchers/lecturers had permanent full-time appointments in 2003[2]. This share fell to slightly below 60 percent in 2004, then fell precipitously to reach only 34 percent in 2010. By comparison, the share of part-time researchers/lecturers grew from 28 percent in 2003 to 55 percent in 2010, whereas the share of researchers/lecturers with temporary appointments remained relatively stable, averaging around 12 percent for the decade. The trend in FTEs once again differs somewhat. The share of permanent researchers/lecturers over the period under study fell from 72 percent to about 58 percent; part-time employment within this category grew from 17 to 26 percent; and temporary employment grew from 11 to 16 percent. Combined, researchers/lecturers employed under part-time or temporary appointments constituted about 42 percent of FTE staff in this category employed at FNAS&FVS as of 2010.

The number of technical staff employed at FNAS&FVS remained more stable in contrast with comparable numbers at ARC. The headcount initially fell from 524 in 2000 to 373 in 2001, then fluctuated slightly below 400 until 2006, before increasing to 608 in 2010. In FTEs numbers they actually increased from 2001 at a rate of 5.1 percent per year. At FNAS&FVS, administrative staff numbers fluctuated between 150 and 170 HCs throughout the decade under study, although slightly more staff were employed on a full-time basis in 2010.

In terms of support staff, data for FNAS&FVS indicate that the ratio of administrative support staff to researchers/lecturers decreased twice as fast as it did at ARC during 2000–10, but the ratio of technical staff to researchers/lecturers at FNAS&FVS decreased slightly less per year than at ARC during this timeframe. The distinction, however, is that at FNAS&FVS administrative support staff numbers stagnated as researcher/lecturer and technician numbers grew, whereas at ARC staffing decreased across the board, but technical and administrative support staff numbers decreased the fastest. In both cases the trend is unlikely to be sustainable in the long run, indicating the likelihood of increased workloads all round.

3. AGE DISTRIBUTION

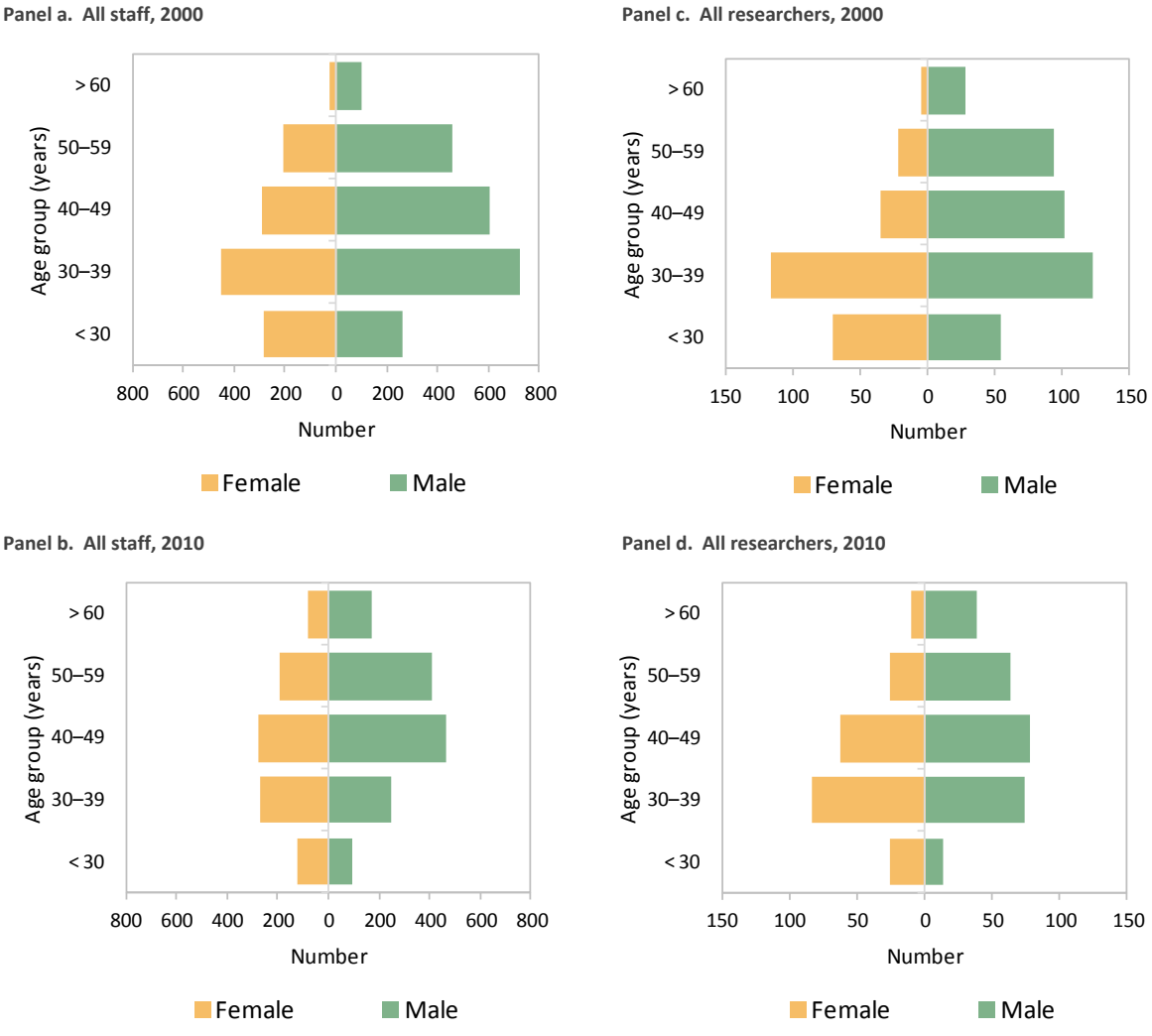
The average age of all staff employed by ARC increased from 41 to 46 years over the study period (Figures 1a and 1b). In 2000, 77 percent of staff was 49 years old or younger, compared with 63 percent

[2] Only senior lecturers and professors are classified as researchers, unless their position title specifically indicates that they lecture exclusively. Lecturers and junior lecturers are considered too inexperienced to conduct independent research. As the time actually spent on research is not specified in the university's human resources database, the proportion of the year worked was used to estimate FTEs. A comparison with previous ASTI studies indicates a good correlation in terms of total FTEs using this estimation method.

in 2010; the number of staff under 30 years of age fell to 215, slightly less than 40 percent of its 2000 level of 547; and the ratio of researchers aged 50 years and older increased from 23 percent in 2000 to 36 percent in 2010.

Based on headcounts, at ARC the number of researchers aged 20 to 29 years fell to slightly less than a third of the 2000 level; staffing in the 30 to 39 age group decreased to 66 percent of the 2000 level; and staff numbers in the 40–49 age bracket remained stable(Figures 1c and 1d). The number of researchers aged 50 to 59 decreased to 77 percent of the 2000 level, whereas the share of those older than 60 years increased by 40 percent. A few staff members even fell into the 70 plus age group, being retirees contracted to mentor younger scientists. Trends are similar for technicians in specialized or skilled positions, with numbers aged 50 years and over increasing by 61 percent. Among less skilled technical support staff (farm laborers and laboratory assistants), the age composition shifted significantly, no doubt correlating to some degree with the aging of these staff over the 10 year period. Two-thirds of these technicians were aged between 30 and 49 in 2000, whereas in 2010, 88 percent were over 39 years of age. The highest decrease occurred in 30 to 39 year old age bracket, whereas numbers over 59 years increased by 54 percent.

Figure 1. Age of staff employed at the Agricultural Research Council, 2000 and 2010



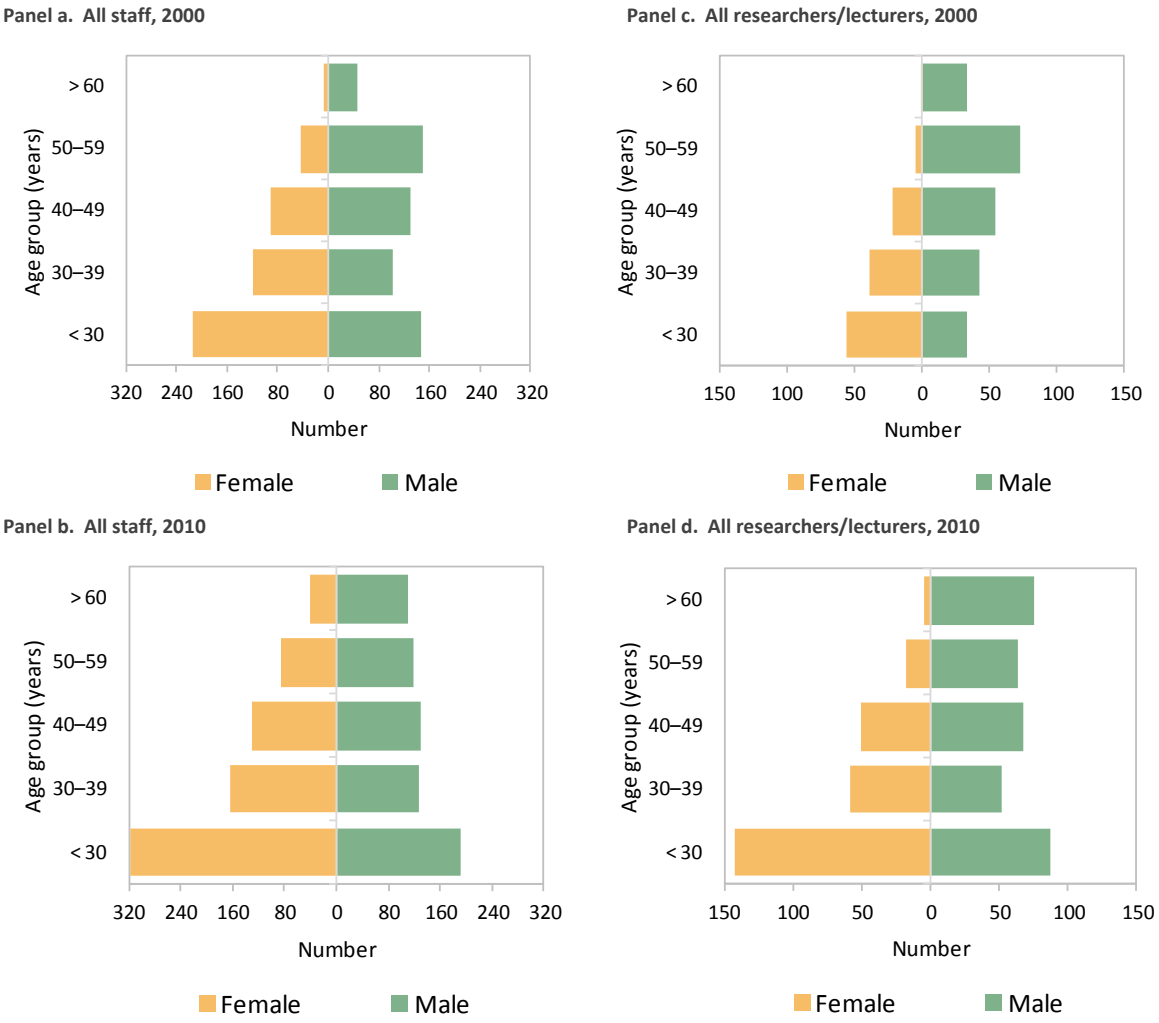
Source: Calculated by authors from ARC (2000–11).

One probable explanation for the higher number of older staff is that a large proportion of staff who worked for the ARC in 2000 has stayed in its employment. For those who were within 10 to 15 years of retirement in 2000 it would make more financial sense to remain at ARC as retirement approaches even in the face of low funding, salary increases that were below inflation and increasing workloads due to reduced staffing. This would explain the shift in the age profile of less skilled technical support staff. One possible reason for the huge decrease in staff aged less than 39 years may be changing personal preferences in career choice for young people as agricultural R&D is probably not seen as a sector of choice in career development. Alternatively it may simply be that in view of limited financial resources, ARC elects not to fill vacant positions in this staff category, as well as among administrative staff, in order to release funds to maintain capacity among skilled technicians and researchers. The combined effect is an aging staff corpse that through normal attrition would in the near future lead to a huge loss in institutional knowledge in the conduct of the business of agricultural research as experienced staff exits the ARC.

Bearing in mind that the total number of ARC staff decreased between 2000 and 2010, the gender composition of researchers also shifted (Figure 1a and 1b). The share of female researchers increased significantly across all age levels. In the 40 to 49 year old age bracket, female participation almost doubled during 2000–10. A similar comparison among technical staff reveals female staffing increased slightly in the age brackets of 20 through 39, but doubled in the 60 to 69 year old age bracket, from 22 to 42 percent.

At FNAS&FVS the shift in age composition is significantly different. The average age of all staff employed at FNAS&FVS increased from 34 to 39 years, with the highest increase being among administrative staff, who aged a little over 10 years—counter intuitively reflecting little actual staff movement within this category over the 10 year period under study (Figure 2a and 2b). The total number of female researchers/lecturers increased significantly at all age levels. Among female researchers/lecturers, however, the greatest increase occurred in the 20–29 year old age bracket (Figure 2c and 2d). The profile for male staff shifted from being predominantly centered around the 50 to 59 year old age bracket to being fairly evenly spread across all age groups up to 60 to 69 years, although numbers decreased slightly in the 50 to 59 year old age bracket. Male scientists, however, were more prevalent in research rather than lecturing positions. Whereas in 2000 female scientists were most commonly employed in lecturing positions, the situation is changing and their prevalence in research positions (more senior lecturing positions) has increased significantly.

Figure 2. Age of staff employed at the University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences, 2000 and 2010



Source: Calculated by authors from FNAS&FVS (2011).
Notes: Prior to 2005, the Faculty of Natural and Agricultural Sciences existed as the Faculty of Agriculture and the Faculty of Natural Sciences. In 2000, the 20–29 year old age bracket included seven staff members under 20 years of age; the age 70–79 year old age bracket includes one staff member older than 79 years of age.

The reason for the higher proportion of young female staff in lecturing positions is largely explained by the use of the senior lecturer position as the cut-off to classify lecturers as researchers, with those below this position falling into the category of lecturers. There is a strong preference for PhD-qualifications as a prerequisite for the position of senior lecturer. Most junior lecturing positions are part-time, funded through the projects/programs of senior staff. Such staff are often involved in furthering their studies toward attaining a PhD qualification, which part-time employment facilitates. This however, does not explain why young male scientists are much less prominent in these positions. Better salary levels of more permanent positions in the private sector, where a PhD is not a prerequisite for employment, serve as a strong incentive to draw staff away from a university career as a researcher/lecturer.

4. QUALIFICATIONS OF RESEARCHERS AND LECTURERS

During 2000–10, the number of researchers and technicians at ARC declined across all degree levels (Table 2). The net effect of the changes in degree composition was a contraction in the share of BSc-qualified researchers, from 21 percent to 14 percent in 2010; an increase in MSc-qualified researchers, from 44 to 50 percent; and increase in PhD-qualified researchers, from 32 to 34 percent. In 2010, ARC employed 131, or 33 percent, fewer male researchers than in 2000; this represents a decrease of 42 BSc, 41 MSc, and 44 PhD-qualified male researchers. The number of female researchers employed at ARC fell by 41 during 2000–10; of these, 29 were BSc-qualified, 5 MSc-qualified, and 6 PhD-qualified.

From 1998 to 2003, ARC's core funding was successively cut, creating immense pressure to generate income (Liebenberg, Pardey, and Kahn 2011b). In addition, salary levels were frozen, and performance assessment systems were dispensed with, leaving little scope for staff promotion. Coupled with protracted transformation processes, this situation negatively affected staff morale and led to a number of resignations. Interestingly, most of the staff that departed around that time were in the younger age brackets with lower levels of educational attainment. In 2000, the average age of resigning staff was 40.1 years, whereas by 2010 this average had risen to 45.2, with BSc- and MSc-qualified staff still representing the highest shares.

Table 2. Educational attainment of researchers/lecturers employed at the Agricultural Research Council and University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences, 2000–2010

	Highest qualification	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
a. Agricultural Research Council (ARC)												
Researchers (HCs)	BSc	137	133	124	119	109	88	102	88	92	82	66
	MSc	283	277	267	248	248	241	249	240	237	235	237
	PhD	209	198	176	161	149	155	171	184	176	171	159
	Other	17	12	11	11	11	8	12	15	15	13	12
Subtotal		*646*	*620*	*578*	*539*	*517*	*492*	*534*	*527*	*520*	*501*	*474*
Technical staff (HCs)	BSc	89	80	77	68	75	79	94	90	89	89	69
	MSc	15	13	9	10	13	11	9	15	14	17	16
	PhD				2	2		1	1	1		
	Other	847	793	747	705	687	791	793	777	759	731	699
Subtotal		*951*	*886*	*833*	*785*	*777*	*881*	*897*	*883*	*863*	*837*	*784*
Researchers (FTEs)	BSc	125.3	114.7	110.3	101.9	100.5	82.5	97.3	87.0	84.8	69.1	61.7
	MSc	268.3	264.5	244.6	229.3	237.5	227.7	237.4	237.5	224.1	222.1	228.7
	Phd	202.2	184.7	168.8	152.6	135.9	148.5	163.3	179.5	171.5	159.9	156.2
	Other	15.4	10.3	10.6	9.7	10.2	5.8	11.0	14.0	13.3	11.7	9.2
Subtotal		*611.2*	*574.3*	*534.3*	*493.5*	*484.2*	*464.5*	*508.9*	*517.9*	*493.7*	*462.8*	*455.8*
Technical staff (FTEs)	BSc	78.7	73.6	65.2	63.9	69.3	75.3	88.1	87.1	86.4	79.4	66.1
	MSc	14.3	11.2	8.8	8.6	12.4	11.0	8.8	15.0	13.0	13.9	15.2
	Phd				0.6	2.0		0.1	1.0	0.2		
	Other	429.4	395.3	366.1	339.1	359.8	404.9	408.7	393.0	369.8	355.3	355.3
Subtotal		*522.3*	*480.1*	*440.1*	*412.2*	*443.5*	*491.1*	*505.6*	*496.1*	*469.4*	*448.5*	*436.5*

Continued…

Table 2. Continued

	Highest qualification	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
b. University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences (FNAS&FVS)												
Researchers (HCs)	BSc	30	24	24	23	26	26	21	27	35	38	39
	MSc	57	50	47	50	43	47	44	49	45	46	43
	Phd	96	96	102	106	102	104	105	105	119	123	129
	Other	11	12	8	6	7	7	5	8	8	16	19
Subtotal		*194*	*182*	*181*	*185*	*178*	*184*	*175*	*189*	*207*	*223*	*230*
Lecturers (HCs)	BSc	28	33	41	39	48	46	55	50	68	101	106
	MSc	25	32	39	25	26	23	23	24	30	35	41
	Phd	39	42	38	44	43	61	71	71	66	68	78
	Other	77	57	43	32	33	62	63	100	62	129	166
Subtotal		*169*	*164*	*161*	*140*	*150*	*192*	*212*	*245*	*226*	*333*	*391*
Total researchers/lecturers		**363**	**346**	**342**	**325**	**328**	**376**	**387**	**434**	**433**	**556**	**621**
Technical staff (HCs)	BSc	45	41	53	55	53	52	48	55	53	60	57
	MSc	32	30	30	32	30	28	30	35	44	38	40
	Phd	10	7	8	9	5	6	4	6	7	9	9
	Other	219	202	185	201	186	189	188	220	208	214	224
Subtotal		*306*	*280*	*276*	*297*	*274*	*275*	*270*	*316*	*312*	*321*	*330*
Researchers (FTEs)	BSc	15.0	12.0	12.0	11.5	13.0	13.0	10.5	13.5	17.5	19.0	19.5
	MSc	28.5	25.0	23.5	25.0	21.5	23.5	22.0	24.5	22.5	23.0	21.5
	Phd	48.0	48.0	51.0	53.0	51.0	52.0	52.5	52.5	59.5	61.5	64.5
	Other	5.5	6.0	4.0	3.0	3.5	3.5	2.5	4.0	4.0	8.0	9.5
Subtotal		*97.0*	*91.0*	*90.5*	*92.5*	*89.0*	*92.0*	*87.5*	*94.5*	*103.5*	*111.5*	*115.0*
Lecturers (FTEs)	BSc	5.6	6.6	8.2	7.8	9.6	9.2	11.0	10.0	13.6	20.2	21.2
	MSc	5.0	6.4	7.8	5.0	5.2	4.6	4.6	4.8	6.0	7.0	8.2
	Phd	7.8	8.4	7.6	8.8	8.6	12.2	14.2	14.2	13.2	13.6	15.6
	Other	15.4	11.4	8.6	6.4	6.6	12.4	12.6	20.0	12.4	25.8	33.2
Subtotal		*33.8*	*32.8*	*32.2*	*28.0*	*30.0*	*38.4*	*42.4*	*49.0*	*45.2*	*66.6*	*78.2*
Total researchers/lecturers		**130.8**	**123.8**	**122.7**	**120.5**	**119.0**	**130.4**	**129.9**	**143.5**	**148.7**	**178.1**	**193.2**
Technical staff (FTEs)	BSc	28.7	24.4	33.7	35.1	43.2	39.8	33.7	41.2	38.3	40.7	39.5
	MSc	22.0	19.6	19.1	21.9	24.3	23.7	22.8	24.2	32.4	28.0	29.8
	Phd	6.2	4.9	4.5	5.4	4.0	4.4	2.8	3.3	5.8	5.5	4.5
	Other	176.8	168.2	160.0	174.0	169.1	168.9	169.4	186.5	172.9	177.4	183.0
Grand total		**233.6**	**217.0**	**217.3**	**236.3**	**240.6**	**236.8**	**228.7**	**255.2**	**249.4**	**251.7**	**256.7**

Sources: ARC (2000–11) and FNAS&FVS (2011).
Notes: Prior to 2005, the Faculty of Natural and Agricultural Sciences existed as the Faculty of Agriculture and the Faculty of Natural Sciences. HCs indicates headcounts; FTEs indicates full-time equivalent staffing. Data are reported based on staffing levels for the calendar year. Note also that FTE calculations of research staff numbers take into account the number of months an individual was employed. For example, in a given year an individual researcher may have been employed for 8 months, this person would count as 1 HC but only 0.66 FTEs, having spent only 8 of the 12 months actually working for the organization.

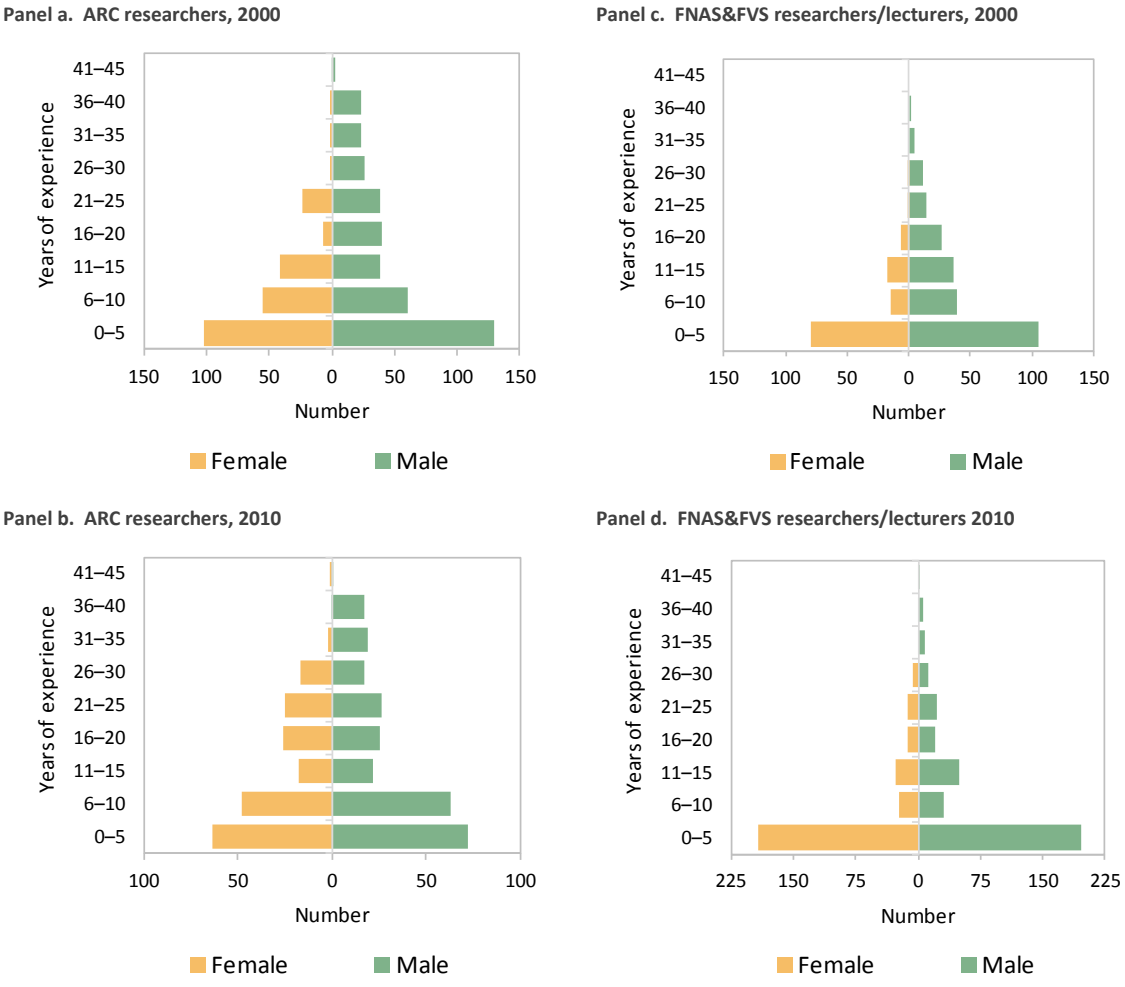
Of the researchers/lecturers employed at FNAS&FVS, those qualified to the BSc level more than doubled to reach 106, those with MSc degrees increased by 40 percent, and those with PhD qualifications increased by 47 percent. Staff employed primarily as lecturers show much higher rates of growth in qualification levels in pursuance of a PhD than do research staff who mostly already have obtained a PhD. As mentioned earlier the majority of lecturing responsibilities had shifted to part-time staff amongst which there has been a six-fold increase in the number of PhD-qualified staff, from 30 in 2000 to 195 in 2010. By comparison, BSc-qualified staffing in this category numbers increased from 12 to 103, and MSc-qualified staffing from 10 to 36.

The gender composition of researchers/lecturers has changed significantly. 49 percent of the growth in degree-qualified researchers employed at FNAS&FVS stems from an increase of 76 female researchers, who now have a more even representation across all qualification levels.

5. LENGTH OF SERVICE OF RESEARCHERS AND LECTURERS

At ARC, the distribution of the number of years of service accrued by researchers narrowed considerably for those with up to 15 years' service, although this trend is more prevalent among male researchers (Figure 3a and 3b). The share of ARC researchers with less than 16 years' service decreased from almost 69 percent in 2000 to 62 percent in 2010, and most of this change occurred after 2006. ARC's 80 researchers with 10 to 15 years' service represented 13 percent in 2000. At that time 10 to 15 years' service appeared to be the threshold for employment, especially for female researchers. By 2010, the number of researchers in this category represented 9 percent, and female researchers were better represented within this category and higher lengths of service. In 2010, staff fell into two categories of length of service: 0 to 5 years, and 16 through 25 years, indicating that more recently recruited staff remain in service for shorter periods of time.

Figure 3. Length of service of researchers/lecturers employed at the Agricultural Research Council and University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences, 2000 and 2010



Sources: Compiled by author from ARC (2000–11) and FNAS&FVS (2011).
Note: Prior to 2005, the Faculty of Natural and Agricultural Sciences existed as the Faculty of Agriculture and the Faculty of Natural Sciences.

Researchers/lecturers employed at the FNAS&FVS during 2000–10 increased their length of service on average, and female researchers/lecturers with longer periods of service became more prevalent (Figure 3c and 3d). The number of male and female researchers/lecturers employed for 0 to 5 years increased significantly, with the prominence of part-time appointments being a contributing factor.

It is estimated that ARC lost approximately 1,634 years of experience in research capacity, and a further 3,060 years of experience among its technical staff during 2000–10. This correlates with the high turnover of staff with less than 16 years of service among both researchers and technical support staff. At FNAS&FVS the situation is a little different. Among researchers/lecturers the faculty gained about 1,480 years of service, plus a further 473 years through technical staff, which correlates with increased staffing in the 0 to five years of service category.

6. STAFF SENIORITY

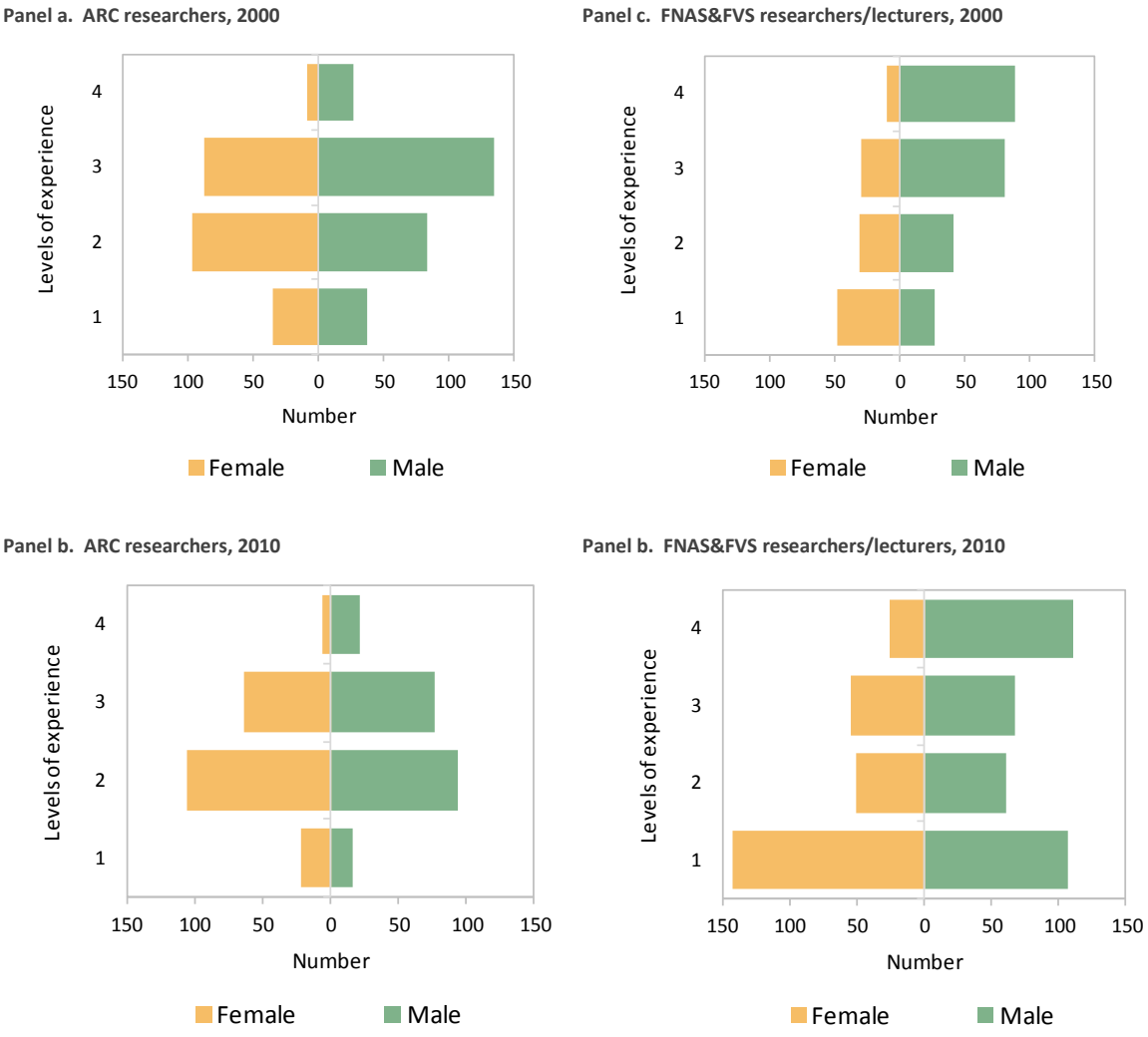
At both ARC and FNAS&FVS each classification of employment comprises four levels of seniority. In the case of ARC researchers, the levels are 1) junior researcher, 2) researcher, 3) senior researcher, and 4) chief researcher, whereas in the case of FNAS&FVS lecturers, the levels are 1) junior lecturer, 2) lecturer, 3) senior lecturer, and 4) professor. Seniority of staff were categorized according to these levels. At ARC, researchers that have reached the level of Chief Researcher have the option to pursue a career as a specialist researcher as an alternative to taking up a managerial position, but the same four levels of seniority apply, i.e. 1) junior specialist researcher, 2) specialist researcher, 3) senior specialist researcher, and 4) chief specialist researcher. This option was introduced to improve opportunities in terms of both the career path and remuneration.

At ARC the number of researchers below the level of management fell to 405 in 2010, 106 less than its level in 2000. The number of senior researchers decreased by 81 followed by a decrease of 36 amongst junior researchers. Scientists in the management positions (starting at the assistant director level) experienced a decrease in number from 137 in 2000 to 69 in 2010. The shedding of managerial positions were almost exclusively limited to the assistant and deputy director levels which decreased by 45 and 23 respectively.

The pattern of seniority at FNAS&FVS was completely different (Figure 4c and 4d). Male dominance at the higher levels of seniority was further reinforced during 2000–10. The number of women in senior positions did increase, however, although the greatest gains occurred at the first three tiers.

A comparison between the averages at the various levels of seniority at the FNAS&FVS and ARC clearly shows differences at the lower level. At FNAS&FVS the average age of junior lecturers is 27 years, increasing to 36 years at the lecturer level and 40 years at the senior lecturer/researcher level. Professors on average are 53 years old. At all seniority levels the average age has increased by 2 to 4 years since 2000. At the ARC the average ages of nonmanagement research staff at ARC for tiers 1 through 4 are, 34, 39, 48 and 55 years, respectively, and this has changed little over time. The age difference between staff at FNAS&FVS and ARC at the lower levels of seniority is explained by the fact that staff at FNAS&FVS are still building their careers as researchers in efforts to be promoted to senior lecturers. In so doing aspiring researchers are forced to “grow through the ranks,” gaining sufficient experience. From that point onward, promotion to a professorship is determined by set of internationally accepted criteria, which are based on research achievements and peer review. This is in contrast to ARC, where educational attainment is not as strict a prerequisite in determining promotion to the senior researcher position.

Figure 4. Seniority of researchers/lecturers employed at the Agricultural Research Council and University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences, 2000 and 2010



Sources: Compiled by author from ARC (2000–11) and FNAS&FVS (2011).
Note: Prior to 2005, the Faculty of Natural and Agricultural Sciences existed as the Faculty of Agriculture and the Faculty of Natural Sciences. For ARC, 1 stands for junior researcher, 2 for researcher, 3 for senior researcher, and 4 for chief researcher; for FNAS&FVS, 1 for junior lecturer, 2 for lecturer, 3 for senior lecturer, and 4 for professor.

7. DISCIPLINES OF RESEARCHERS AND LECTURERS

Records on the disciplines are not always accurate, and often change over time as scientists attain higher degrees. At ARC during 2000–10, the largest net decrease in absolute numbers of researchers was in the area plant health, with a decline of 67 HCs (Table 4). This was followed by declines in the number of researchers focusing on crop and animal breeding (–17 HCs each) and natural resource management, food sciences, and biotechnology (–16 HCs each). These disciplines typically represent areas with numerous private-sector opportunities. It is well known that South Africa has a shortage of crop breeders. An area that significantly expanded is horticulture, which gained 20 researchers, which is consistent with growth in the subsector in general. Most of the other disciplines recorded a net loss in researcher numbers.

Table 3. Disciplines of researchers employed at the Agricultural Research Council, 2000 and 2010

	2000		2010		
Discipline	**%**	**Rank**	**%**	**Rank**	**Change**
Agricultural economics	1.09	17	1.05	19	(2.00)
Agricultural engineering	3.44	9	3.16	10	(7.00)
Animal breeding	5.94	5	4.43	7	(17.00)
Animal nutrition and management	2.03	13	2.32	13	(2.00)
Anthropology		22	0.00	22	–
Biometrics and research methods	2.03	13	1.90	15	(4.00)
Biotechnology (crop and livestock)	5.16	8	3.59	9	(16.00)
Chemistry, biological sciences, and biochemistry	2.34	12	2.74	11	(2.00)
Crop breeding (food crops and horticulture and industrial crops)	7.03	4	5.91	5	(17.00)
Crop health (weed science, pathology, entomology)	28.44	1	24.26	1	(67.00)
Environment science and agroclimatology	1.09	17	1.90	15	2.00
Extension	0.31	20	1.27	17	4.00
Food crops agronomy (cereals, pulses, and roots and tubers)	5.94	5	5.91	5	(10.00)
Food science and postharvest technology	5.63	7	4.22	8	(16.00)
Forage agronomy	3.28	11	2.74	11	(8.00)
General agriculture	0.00	22	1.05	19	5.00
Geographic information systems	1.88	15	2.32	13	(1.00)
Horticulture and industrial crops agronomy (flowers, fruits, vegetables, nuts, pyrethrum, and fiber)	3.44	9	8.23	3	17.00
Information sciences	0.94	19	0.21	21	(5.00)
Natural resources management (soil science, water management, and land use planning)	8.59	3	8.23	3	(16.00)
Range ecology and management	1.56	16	1.27	17	(4.00)
Seed technology	0.16	21	0.00	22	(1.00)
Sociology and gender		22	0.00	22	–
Veterinary sciences	9.69	2	13.29	2	1.00

Source: Calculated by author from ARC 2000–11.
Note: Similar data for FNAS&FVS had not been recorded.

8. STAFF TURNOVER

Following a high resignation rate during 2000–05, ARC doubled its recruitment between 2004 and 2007 aided by an expansion in its core funding (Table 4). In 2008 and 2009, the number of resignations once again almost doubled, reflecting the reality that the rate of resignation generally is substantially higher at the time of, or immediately after, major staff restructuring initiatives undertaken by ARC. Restructuring often impacts negatively on staff morale, especially of it is of a recurring nature and extents over several years. This is born out by the differing trends in staff turnover at FNAS&FVS and at ARC during the past decade. At FNAS&FVS restructuring took place (and was completed) during 2004 to 2005. Hereafter both resignations and retirements declined and staff numbers increased. At the ARC restructuring initiatives were implemented during the years 2000 to 2001, 2005 to 2006 and again in 2008. With the exception of the latest changes the previous transformation initiatives followed on replace of the executive management corpse of the ARC. Throughout this period ARC scientists were under persistent pressure to raise the level of funding generated in addition to the core funding the council received.

Table 4. Staff recruitment and departures at the Agricultural Research Council and University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences, 2000 to 2010

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
a. Agricultural Research Council (ARC)											
Retirements	na	43	40	50	48	42	51	44	42	47	56
Resignation	na	240	268	341	219	218	112	121	217	215	160
Deaths	na	19	21	23	20	21	18	25	22	20	24
Total recruitments	**na**	**110**	**84**	**123**	**255**	**216**	**207**	**243**	**142**	**98**	**112**
Total departures	**na**	**302**	**329**	**414**	**287**	**281**	**181**	**190**	**281**	**282**	**240**
b. University of Pretoria Faculties of Natural and Agricultural Sciences and Veterinary Sciences (FNAS&FVS)											
Retirements	112	102	98	92	78	68	51	32	26	18	9
Completion of contracts	369	238	215	204	215	264	280	324	284	290	298
Medical reasons	6	4	5	4	3	3	2	2	2	1	1
Disciplinary reasons	18	17	16	13	11	10	10	7	5	3	1
Resignations	135	123	101	113	99	84	70	62	86	66	47
Unknown	18	17	13	16	10	6	6	4	6	3	5
Total recruitments	**925**	**777**	**739**	**775**	**763**	**814**	**820**	**875**	**1,016**	**1,070**	**1,157**
Total departures	**640**	**484**	**435**	**426**	**406**	**429**	**413**	**427**	**403**	**378**	**356**

Source: Calculated by author from ARC Annual Reports (2000–11) and FNAS&FVS (2011).
Note: Prior to 2005, the Faculty of Agricultural and Natural Sciences existed as the Faculty of Agriculture and the Faculty of Natural Sciences.

Unlike at FNAS&FVS the staff database of the ARC do not capture the reasons for staff terminations , but exit interviews are held with staff who resign from the ARC and the statistics for this is reported in ARC annual reports. These interviews are conducted with the staff member's supervisor (or with the head of human resources if requested), which may influence the responses given. In the most recent year, 44 percent of departing staff indicated that they were voluntarily resigning. Of this share, 38 percent indicated their reason for leaving as the pursuit of better salary/service conditions, and a further 16 percent indicated that ARC's working conditions/organizational culture was the cause of their departure. A significant 29 percent of departing staff gave no reason at all, however, which may be indicative of a different problem.

The trend in staff departures at FNAS&FVS is mostly driven by the completion of part-time contracts. Retirements and resignations played a decreasingly important role over the period under study. In contrast with ARC, and considering the differences in the nature of employment policies, trends in recruitment and terminations at FNAS&FVS have largely stabilized after the turbulent years of restructuring earlier in the decade.

9. STAFF INCENTIVES

Remuneration packages at both ARC and FNAS&FVS are largely the same in terms of basic content, including a base salary plus vacation, holidays, and pension, medical, and disability coverage. Until 1971 the then Department of Agricultural Technical Services was responsible for both the faculties of agriculture at the universities and institutes that now reside under ARC (which was established in 1992) and salary levels of scientists at both the faculties and institutes were on par with each other, both in terms of levels and structure. As of 1971, the faculties of agriculture were transferred to the Department of National Education and university staff were often reputed to receive lower salaries than their peers at the institutes. Scientists at the institutes generally received a slightly higher salary than similar disciplines employed in other divisions of the department, such as the regulatory services. Specific disciplines that were considered as scarce, such agricultural engineers and veterinarians

received a salary that was 10 percent higher than other scientists. Since the establishment of ARC efforts were made to maintain a remuneration dispensation for scientists that were at least equal to that of similar positions in the Department of Agriculture. With the change from a baseline formula funding to that of a competitively allocated parliamentary grant in 1998, however, the ARC was no longer able to always match this commitment (Liebenberg and Pardey 2011a).

Early in the decade under review, ARC introduced the total cost to company dispensation (an all inclusive package with no specification of the individual elements) to structuring salaries. This greatly reduces the administrative cost of structuring and negotiating remuneration packages as wage negotiations now only focus on the overall rate of increase. This, thus, obviates the costly and often time consuming process of negotiating over changes in benefits, such as the car allowances, housing allowances, etc. This approach, however, assumes a uniform level of inflation across all elements of the remuneration package of all employees, which is not entirely realistic in the long run. For example, car allowances paid to staff of whom work related travel are regularly expected would today (if calculated as a proportion of the total remuneration they now receive) be entirely insufficient to cover the monthly installment on a similar make and model as vehicle prices and insurance have increased precipitously over the past decade. The same situation exists with the other major expense item, that is, medical insurance.

ARC staff at times received no, or very limited, salary increases soon after the total cost to company dispensation were introduced. Subsequent increases to date were generally below the inflation rate. In addition, adjustments in subsistence and travel allowances often fell short of the rates applicable in the rest of the civil service. Collectively, these factors have led scientists at the ARC to perceive that their standard of living have eroded significantly since they joined the ARC. This may present the most compelling explanation for the sharp rise in the rate of resignations coinciding with each phase of restructuring as the resulting changes failed to meet expectations. And, unlike university staff, ARC scientists have little or no opportunity to engage in private consultancies to augment their income.

The use of the total cost to company dispensation has another unintended consequence in that it make salary comparisons between the ARC and the rest of the civil service very difficult. Parliamentarians and others often confuse the “high salaries” quoted for advertised positions at the ARC when comparing this with a similar positions at the Departments of Agriculture (both national and provincial), failing to realize that the positions at the Departments are exclusive off other benefits.

At FNAS&FVS salaries are often perceived to be lower—especially for part-time staff—compared with ARC,[3] and other government departments. University staff, benefit from having more freedom in terms of their time, the additional benefit of sabbatical, and even unpaid, leave, and their ability to earn additional income through consultancies. Too great an emphasis on consultancy work detracts from longer term capacity development at the universities, in so doing, places the standard of training under risk.

Constraints to work-related travel (administrative burden of motivating each trip and writing travel reports) are also far fewer at FNAS&FVS, as are constraints to pursuing opportunities for career development in line with one’s own interests. Prospects for funding are also greater at FNAS&FVS, including the National Research Foundation grant to A-rated scientists, and the publication subsidy scheme introduced by the National Department of Tertiary Education to stimulate the publication of research outputs at universities.

Yearly performance assessments conducted at FNAS&FVS determine the basis for promotion and, as such, ensure that any consultancies undertaken are tailored to academic prerequisites. ARC, in contrast, abandoned its performance assessment process in 2002, and only introduced a new

[3] This is in contrast with many other African countries where salaries at universities are often higher than those offered for government employees.

mechanism in 2009. Lack of financial resources, however, cast doubt on the prospect that the new mechanism can provide a vehicle for much-needed staff incentives.

However, universities being more exposed to job recruitment by the private sector find it difficult to retain promising candidates for career development as a researcher. This is especially true of staff below the level of senior lecturer. Senior lecturers, which represent the first level of experienced researchers, receive a total remuneration that is competitive with similar positions in the civil service and with a more established basis of consultancy can enjoy a relatively better standard of living than their junior colleagues. Professors and especially those in managerial positions again start to lag behind similar managerial positions in the civil service and especially the private sector. This leads one to conclude that the salary levels of scientists at both the ARC and the universities are generally not competitive.

10. CONCLUSION

The first of a succession of re-structuring initiatives followed a scathing review of ARC in 1997. These initiatives, implemented by a frequently changing executive management team, were drawn out over more than a decade. The first efforts at restructuring occurred amidst declining levels of core funding to ARC, and its restructuring initiatives. This in all likelihood provided the stimulus for younger scientists to leave ARC, and possibly the profession. The second round of restructuring at ARC was primarily aimed at senior and institute management and took place amid a climate of improved core funding. This would explain the relatively stable staff numbers during the period 2003–07. The most recent re-structuring interventions, coupled with stagnant core funding levels, appear to have resulted in a renewed exodus of staff with departures once again double levels five years ago.

FNAS&FVS, which also faced a re-structuring process around the same time as the second re-structuring initiative at ARC, seems to have recovered and grown from its new base. Not only have staff numbers increased in response to the steadily growing number of students, but its age structure and educational attainment levels have also increased remarkably compared with ARC. FNAS&FVS has also been able to attract younger staff, however, even here, warning signs are emerging, which call into question the faculty's future sustainability as a research-based training facility. If the decline in the ratios of technical and administrative support to scientists continues, the operating efficiency of the organization will suffer, having wider ramifications on its ability to provide quality training fed by ongoing research.

The strength of the universities lies in the incentive schemes available to research staff and its flexible working conditions. This assists in attracting both junior and experienced scientists, even on a part-time basis. In a competitive funding environment it should then not be a surprise that universities are recording growth in the provision of agricultural research services. The extent to which this is sustainable is uncertain. If the prevailing trends in staff capacity at the university are prevalent at other universities, it would be prudent for ARC and others to proactively engage with universities to develop a longer term strategy to ensure full coverage of the country's agricultural research needs and focus.

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The Agricultural Science and Technology Indicators (ASTI) initiative compiles, analyzes, and publishes data on levels and trends in agricultural R&D investments, capacities, and institutional arrangements in developing countries. ASTI is managed by the International Food Policy Research Institute (IFPRI) and involves collaborative alliances with many national and regional R&D agencies.

Jointly convened by ASTI/IFPRI and the Forum for Agricultural Research in Africa (FARA), the conference, "Agricultural R&D -- Investing in Africa's Future: Analyzing Trends, Challenges, and Opportunities," brought together experts and stakeholders from the region to contribute their expertise for the purpose of distilling new insights and creating synergies to expand the current knowledge base. The themes under focus were (1) Why African governments under invest in agricultural R&D; (2) How human resource capacity in agricultural R&D can be developed and sustained; (3) How institutional structures can be aligned and rationalized to support agricultural R&D; and (4) How the effectiveness of agricultural R&D systems can be measured and improved.

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