Survey report

Bioscientists in the 2008 Survey of New Zealand Scientists and Technologists

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Our paper explores differences and similarities of New Zealand bioscientists relative to the larger science community both in terms of their attributes and their opinions on some important issues. The most recent Survey of New Zealand Scientists and Technologists, from which data for this paper were extracted, will serve as a rough guide to a greater understanding of issues that engage the scientific community generally and bioscientists in particular (Sommer 2010). Such understanding will contribute to the advancement of a bio-based economy. The analysis demonstrates specialised capabilities of the New Zealand survey not previously developed.

We comment first on the origins and purpose of the 2008 Survey and then reveal some of the distinguishing attributes and opinions of bioscientists compared to all other scientists. There are some important messages in this analysis for both public policy and private action. There are also some conundrums to contemplate.

Origins

The 2008 Survey was organised and conducted by Sommer with invaluable support from a distinguished Technical Advisory Group made up of New Zealand scientists from universities, Crown research institutes, MoRST, and scientific societies. Principal sponsorship for the survey was provided by the New Zealand Association of Scientists and was supplemented by the Royal Society of New Zealand and MoRST. Although completed in late 2008, the report was released in early 2010 as a special issue of the *New Zealand Science Review* (Sommer 2010).

Sommer's direction of major surveys of US scientists in 1986 and1988 (Sommer & Seltzer 1988) laid the foundation for the 1996 Survey of New Zealand Scientists and Technologists (Sommer & Sommer 1997). A more limited survey of New Zealand scientists conducted by the NZAS in 1994 (Berridge 1995) provided valuable insights for the 1996 Survey. With this background, the 2008 Survey was developed and carried out via email in the last quarter of 2008. More than half of the 76 questions asked in 1996 were repeated in 2008, and 22 questions carried over from the 1988 survey serve as background for international comparison.

Fields of science

The 2008 survey is a 1 in 6 random sample of nearly six thousand New Zealand scientists, 80% of whom had attained a doctorate and 17% a masters-level degree in one of eight broad fields of science. The survey population was limited to this level of credentials and these broad fields of science to focus on the research scientist community and to permit comparison with elements of the 1988 and 1996 surveys mentioned above.

The survey sample was composed of 930 individuals for whom valid email addresses were available. The survey respondents numbered 361 after discarding several incomplete surveys. The response rate was just under 40%.

The bioscientist component of the survey sample was made up of those individuals whose highest degree was in Biological sciences and several others whose highest degree was in another field (e.g. Medical sciences and Agricultural sciences) but who identified Biological sciences as their principal employment over the five years leading up to the survey. These bioscientists made up 30% of the respondents, thereby providing a substantial basis for analysis. As shown in Figure 1, no other fields of science had as many respondents.

Sources of survey population

The survey population is composed of those employed by universities ($n=178$), Crown research institutes (CRIs, $n=142$), research associations, polytechnics, and museums, the last three of which have been grouped as 'Other' ($n=41$) (Figure 2). These are the research scientists most closely tied to public funding

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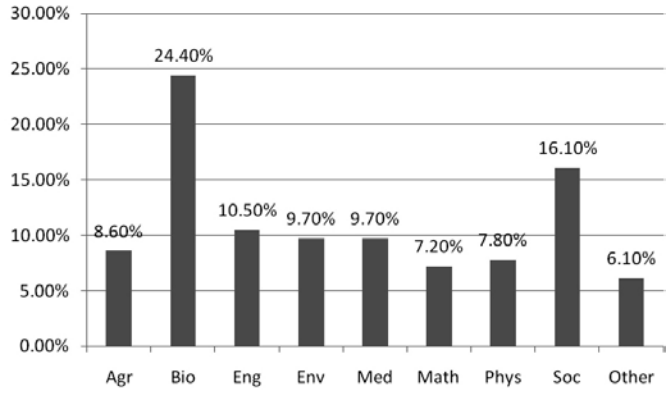

Figure 1. Primary field of scientific specialisation of survey sample. (Agr = Agriculture & Soil sciences; Bio =Biological sciences; Eng = Engineering sciences and Applied sciences & technologies; Env = Earth & Environmental sciences, and Natural Resources; Med = Medical & Health sciences; Math = Mathematics & Computer sciences; Phys = Physical sciences; Soc = Social & Behavioural)

sources. Regrettably, it does not include similarly qualified scientists in private firms who could have added as much as 10% to the existing database but who were difficult to recruit because demand for their services is market-driven.

Purpose

The functions of the survey are four-fold, and each is important.

- It provides an independent 'voice' for scientists not sifted, sorted or processed by institutional or organisational spokespersons in universities, CRIs, other government agencies, or scientific societies.
- It is a source of information for the development of science policy, public and private.
- It provides information that can be used to monitor the effectiveness of government science policy.
- It is a source for enhanced public understanding of science and technology.

A fifth function of the survey has emerged, that is as a source for hypothesising about the directions of New Zealand science. Our ability to distinguish responses of bioscientists from those of the rest of the science community supports each of these functions.

Voice

Scientists are highly independent and express concern that their views are not taken into consideration when science policy is formed. This point is backed up in the survey, where fewer than 1 in 7 scientists regard government science strategy development to be open and inclusive. Moreover, bioscientists were the ***least*** called upon among all fields to advise government during the five years preceding the survey. This is surprising given the size of the bioscientist population and past government expressions of support for a bio-based economy. This independent 'voice' for scientists provided by the survey can be a welcome alternative to carefully crafted institutional or organisational statements for policy purposes that are only lightly informed by workaday scientists. The 'voice' of the bioscientist is heard to be more strident on many issues than that of the rest of New Zealand's scientists and technologists.

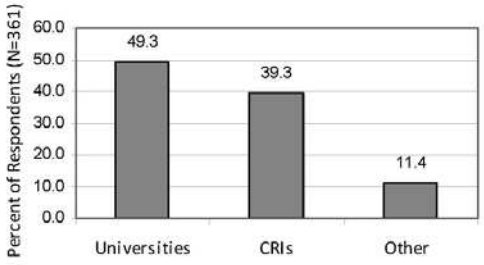

Figure 2. Sources of survey population.

Source of information for science policy

In general, scientists are reluctant to enter the world of political exchange, but the survey offers the possibility of 'leverage without lobbying'. The 1988 Sigma Xi Survey performed this role effectively; the results were read into the United States Congressional Record *in toto* and provided a powerful science committee chairman with evidence used to formulate the agenda for legislative hearings during that session of Congress (Sommer 1991). Publication of the opinions of the membership of this global scientific honour society did provide 'leverage without lobbying'. The New Zealand surveys of 1996 and 2008 are strictly non-partisan and they have established a source of unbiased information for science policy decision-making in New Zealand.

The 1996 New Zealand Survey established a benchmark of information on ***Attributes*** of the science community such as Age, Gender, Fields of Science, Income, Publications and Patents, and other data that make up the hard bits of evidence upon which policy can be formulated. The 2008 Survey provided a second data point for all of these attributes, thus initiating speculation on trends, and added a key new question on time spent on administrative duties versus time spent on research.

Release of the Report of the Crown Research Institute Task Force in 2010 indicates that the 'voice' of the scientific community is being heard and that the 2008 Survey had been helpful in the deliberations of the Task Force (Crown Research Institute Task Force 2010). Many of the Task Force recommendations address issues raised in the past two surveys. Dr Wayne Mapp, Minister for Research, Science and Technology at the time, cited examples from the survey as reasons for policy adjustments in his speech to the NZBio2010 conference in Auckland (Mapp 2010). The additional capability of probing the views of bioscientists introduces a subtlety that reduces the hazard of creating a one-size-fits-all policy.

Monitor of science policy

The 1996 and 2008 surveys contain questions developed from government policy statements of goals to be achieved over a period of years. For example, gauging the morale of the scientific community (and improving it) was a goal expressed in the 1996 MoRST document *RS&T2010* and reiterated in 2006 (MoRST 1996). The 2008 survey results give a second data point on the same ***Attitude and Opinion*** questions from 1996. The results are mixed on the morale issue but generally trend downward.

The 2008 survey contains new questions developed from MoRST's *From Strength to Strength* statement that sets out a vision for 2020 (MoRST 2007). Future surveys can repeat these questions too, to provide those concerned with the management of science with some indicators of policy effectiveness. These goals were established under the Labour-led government that

was voted out of office as the Survey was being conducted. These goals will be reviewed under the new Ministry of Science and Innovation that has now replaced MoRST.

Enhanced public understanding

Although the press and other media often come in for criticism by scientists for their treatment of science stories, it is also recognised that this is the medium through which science is filtered to the public. Among the eight broad fields of science employed in the survey, bioscientists are the most critical of journalistic media, probably because biological sciences deal with complex issues where strong emotions are in play among the general public. Questions on how scientists view issues that concern the public present a kind of human interest dimension for a larger audience: genetic modification, stem cell research, global warming, and nuclear power development provide a window for the general public from a sometimes obscure world of scientific research.

A case may be made for a fifth function of the survey, and that is *hypothesis formulation*. Some curious results emerged from the comparative analysis of bioscientists versus the remainder that have led us to consider what could have contributed to their existence. We address a few of these results in this paper.

Because the 2008 Survey was taken at the termination of a government led by the Labour Party the next survey will follow a period of leadership by the National Party. This introduces a virtual 'natural experiment' and invites lively speculation over future survey results because a National-led government will have a clear baseline from which to work and an opportunity to relate their performance to that of a competing party.

With this background we turn to the focus of our discussion: Bioscientists versus all other scientists.

Are bioscientists different?

The answer is **'**No' with respect to their reasons for becoming a scientist, their commitment to scientific research, their views on whether government should establish research agendas or demand specific results in advance of initiating research, and on a host of other issues explored in the Survey. We refer readers to the published results (Sommer 2010).

However, the answer is 'Yes' with respect to some important attributes and opinions. We will get to these differences in a moment but first consider an example of congruence of bioscientists with the remainder of the science community.

Most important issues facing scientists

When asked, 'What are the most important issues facing scientists and technologists', the top three reported by the entire sample (n=361) were Interruptions in research funding, Bureaucratic accountability, management and red tape, and Emphasis on funding applied research over basic research, in that order (Table 1).

Table 1. Most important issues facing science.

Lack of public understanding of science and technology	11.00%
Interruptions in research funding	25.40%
Over-politicisation of research	8.60%
Decline of student interest in science and technology	11.90%
Bureaucratic accountability, management, and red tape	24.00%
Emphasis on funding applied research over basic research	15.80%
Fraudulent development of data and its use by scientists	1.10%
Other	2.30%

Bioscientists responded in the same order as the entire sample but with a special emphasis on Interruptions in research funding – 28.6% versus 21.2% for non-bioscientists.

This congruent ordering and ranking is interesting, but it is made more so because this result repeats that of the 1996 Survey of New Zealand Scientists and Technologists. More interesting still, the results of both 1996 and 2008 New Zealand surveys repeat those of the 1988 Sigma Xi survey in the United States. (Sommer 1988b). *In all three surveys, Interruptions in research funding was the most important issue for bioscientists, and in each survey their concern exceeded that of all other fields of science.* This persistence across time, space, and scientific communities is a conundrum that we have not yet resolved.

Consider some differences between the bioscientists, who made up 30% of the 2008 survey respondents, and the rest of science community in terms of selected attributes, below. Later we reveal differences in their opinions on some sensitive questions that have policy implications.

Attributes

Gender and Age

Bioscientists mimic the larger science community in terms of gender, with 27.5% female compared to 29.4% female in other fields combined, but the important datum for gender is the increase in the proportion of women in the survey sample from 22.8% in 1996 to 28.8%. This information alone is an important contribution to science policy deliberations as well as for academic institutions and human resource managers in firms.

Bioscientists are younger, their mean age being 46 and other scientists 49. Forty-three per cent of bioscientists are under 45 years old compared to 37% of other scientists (Figure 3). Throughout the survey results we find that younger scientists, bioscientists included, have some different opinions from older scientists.

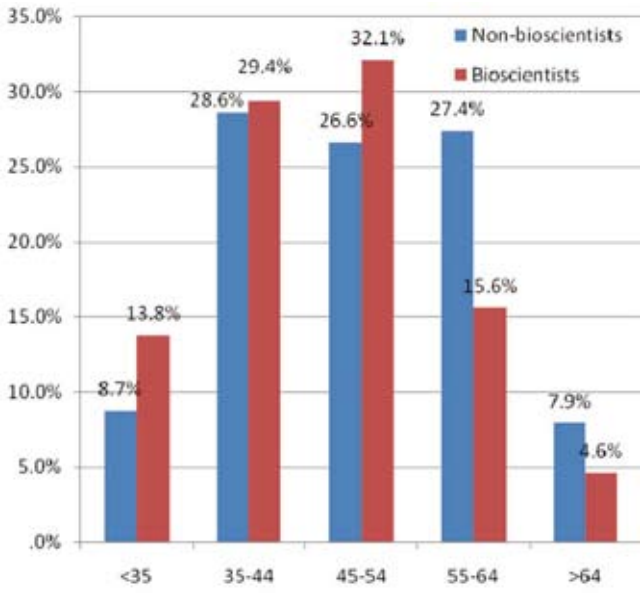

Figure 3. Mean age of bioscientists v. all others surveyed.

Work location

Work location is another important difference: among survey respondents Crown research institutes employ 58.7% of the bioscientists, universities 28.4%, and other venues 12.8% (Fig-

ure 4). The remainder of the science community reverses this order: 31% are in CRIs, 58.3% in universities, and 10.7% in other positions. On average, CRI scientists have higher salaries than those in universities.

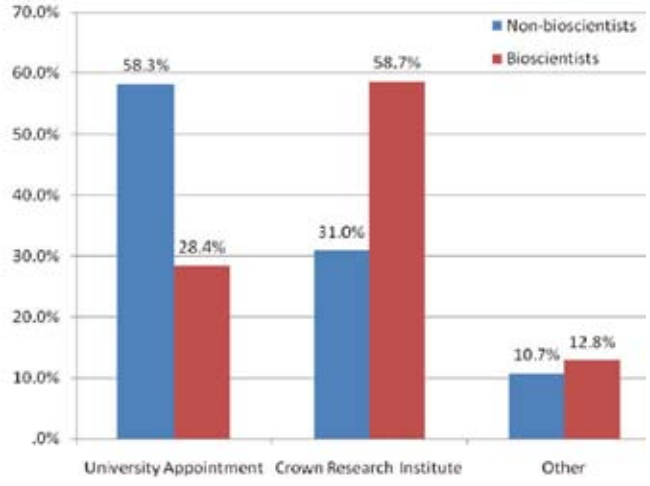

Figure 4. Work location of scientists surveyed.

Personal income

Age difference contributes to differences in annual personal earned income, which average about NZ$10,000 less for bioscientists than others, making bioscientists among the lowest paid fields, approached only by agriculture and soil scientists (Figure 5). In contrast, medical and health scientists are amongst the most highly paid.

The relative youth of bioscientists contributes to the difference in level of qualifications (hence income), where 71.5% of the bioscientists hold Ph.D.s compared to 82.2% of the other scientists. Some young bioscientists are still working on their doctorate.

Given the demographic composition of this population of research scientists, one can expect the income profile to change over the next five years.

Research budgets

In terms of span of control over research budgets, bioscientists have an advantage (Figure 6): 53.1% are responsible for research budgets over NZ$100,000 compared to 33.7% for other

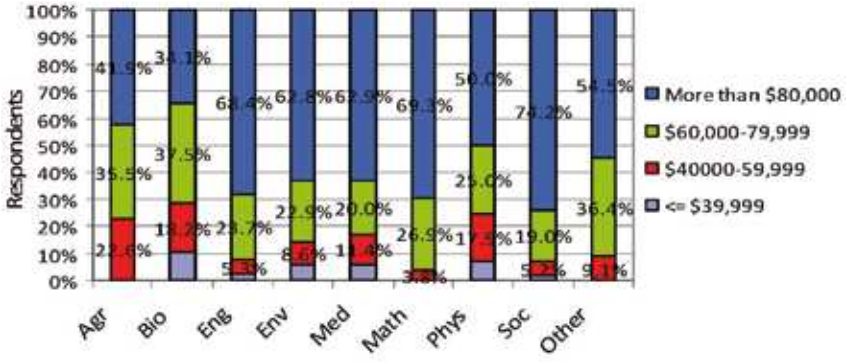

Figure 5. Personal income by field of science. (Agr = Agriculture & Soil sciences; Bio =Biological sciences; Eng = Engineering sciences and Applied sciences & technologies; Env = Earth & Environmental sciences, and Natural Resources; Med = Medical & Health sciences; Math = Mathematics & Computer sciences; Phys = Physical sciences; Soc = Social & Behavioural)

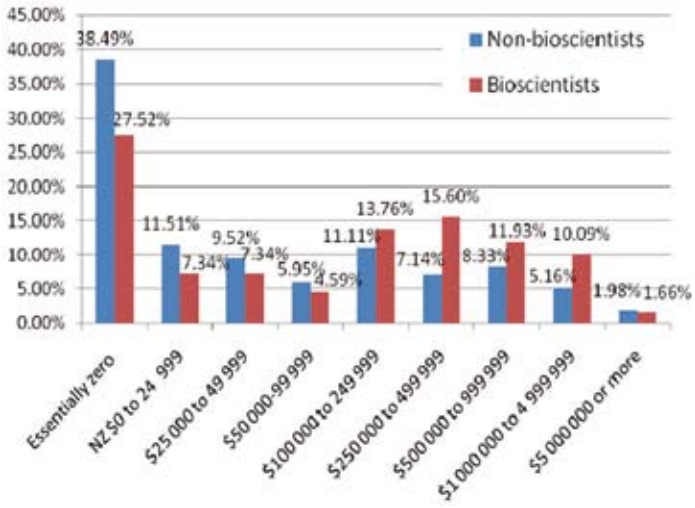

Figure 6. Research budgets.

scientists, and only 34.8% of bioscientists have budgets under NZ$25,000 compared to 50% for the others.

Note the high percentage of individuals who have essentially no research budget to speak of. It comes as no surprise that concern exists across the entire research community that funding for science is inadequate and skewed toward certain individuals or groups.

Sources of research funds

Individuals were asked what has been their principal source of research support over the past five years. For nearly half of all bioscientists the Foundation for Research, Science and Technology (FRST) was their main source of funds (Figure 7). By contrast, FRST was the main source for only a quarter of all other scientists. Moreover, a follow-on question asked from which organisations had one received *any* funding over the past five years: 65% of bioscientists and 43% of all other scientists identified FRST.

This concentration of funding in one place is not mitigated by the variety of alternatives found in other science systems, where multiple government agencies, private foundations, and, more importantly, private industry complement government sources. New Zealand's Marsden Fund provides modest but welcome support for basic or 'blue sky' research but it, too, is limited to a small proportion of funded scientists. Universities fund much of their research through government/TEC's Performance-Based Research Fund (PBRF).

Exacerbating this situation is confusion over the funding guidelines of FRST and changes in priorities that can threaten the career of an individual or a whole research team. One survey question sought to discover what applicants for FRST support thought of the bidding process and found that nearly half of all *grant recipients* felt they did not have enough knowledge of the system to make an informed application (Sommer 2010, p. 18–19). Moreover, only one in ten scientists thought the FRST award process works well and bioscientists were among the most critical (ibid. p. 17).

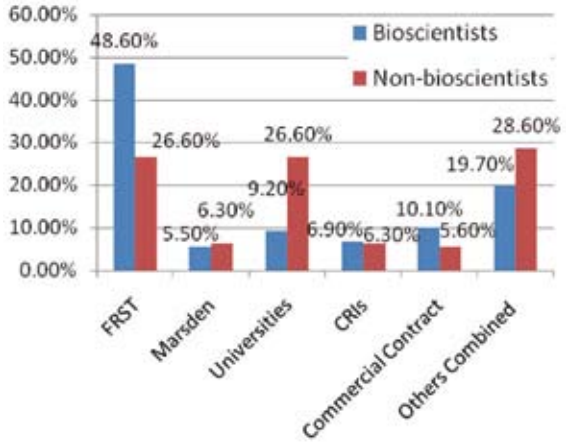

Figure 7. Funding sources.

One consequence of lack of diversity of funding sources in New Zealand is an ever-present sense of dependency on government and lack of control over one's career. Uncertainty prevails. Animosity was directed at FRST by many in the science community, but it was particularly acute among bioscientists.

To quote one of the many narrative submissions by survey participants, a 52-year-old male bioscientist employed at a CRI wrote:

> *FRST has become a surreal system in the Kafka mould, with values and objectives that are against the operation of good science. When asked, I counsel young people to steer clear of science careers in New Zealand.*

A 51-year-old female bellwether bioscientist at a university commented:

> *I have found that mainstream ideas get funded by FRST. New and original ideas are not favourably looked at. The funding seems to be controlled through 'old boys' networks'. The outputs seem to be mediocre in comparison to funding levels. Small businesses struggle and substantial funding is not directed towards these businesses.*

Moreover, to indicate that bioscientists are not alone in their views, a 55-year-old male university engineer said**:**

> *I have no faith at all in FRST. Its 'foresight' process and reinvention of the English language as a substitute for real insights into potential research gains are jokes worthy of Fawlty Towers. It would be laughable if it was not so damaging to science in New Zealand.*

Regrettably, these comments are not isolated instances of a voice crying in the wilderness, but the animosity directed at FRST is likely to be dissipated, or possibly redirected now that the organisation has been restructured as part of the Ministry of Science and Innovation, as of November, 2010. The challenge for government, of course, is to dispel these concerns of obfuscation and mismanagement of the research investment process.

Research versus compliance

The amount of time meeting administrative responsibilities such as grant application writing and reporting versus time spent on research has implications for productivity and it has been a universal source of irritation for scientists. The distribution of responses to this question is shown in 10% intervals, with a peak of 25.5% (mean of all respondents) saying they spend 20–30% of their work time complying with administrative matters (Figure 8). Bioscientists dominate the upper end of the distribution, where more than half of their work time is not in actual research. If this is the penalty for managing larger grants, or perhaps multiple small grants, one might wonder about diminishing rates of return to research!

On this point another survey respondent commented:

> *Administration and reporting continue to stifle science research efforts. Little or no independence by or within CRIs is leading to a mediocre research environment for all but a few science workers.*

Self-reported time estimates are certainly not hard data *per se*, but responses to this question, as with almost all of the others, become more useful with further iterations of the survey. This is a dimension of the life of scientists in New Zealand that bears continued monitoring.

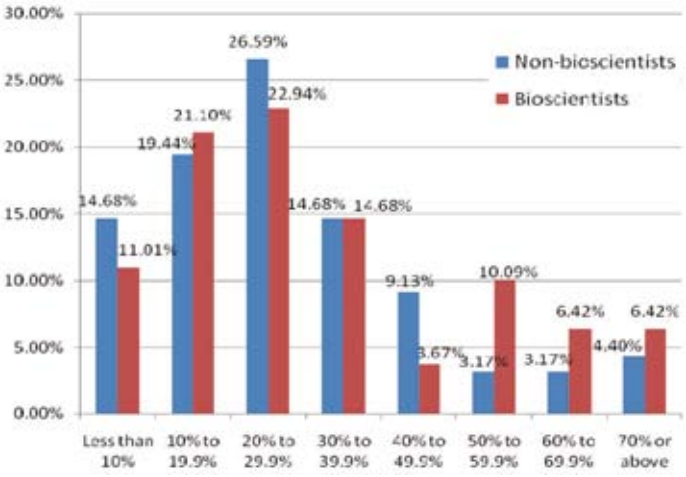

Figure 8. Time budget for compliance activities.

Attitudes and opinions

Job security

There is no question that New Zealand scientists have an 'attitude', as revealed by their opinions expressed in several questions. Respondents were offered direct statements to which they could Agree Emphatically, Agree, Neither Agree nor Disagree, Disagree, Disagree Emphatically, or remain Undecided. One statement concerned the important issue of job security:

> *I feel my job is reasonably secure for the next five years.*

Bioscientists differ from other scientists, with 51.3% agreeing compared to 65.0% of non-bioscientists (Figure 9). Bioscientists disagree more, 31.2% to 21.0% for all others, but much of this difference may be accounted for by the stage of career of these more youthful individuals. It is worth noting that the difference between these two groups is lodged in the most strongly held views.

Management of science

The restructuring of New Zealand science over the past two decades (1989–2008) created great uncertainty, and much of the search for vibrant programmes to meet the priorities set by government appeared frenetic, or even frantic. Widespread discontent over alarming shifts in government priorities left a

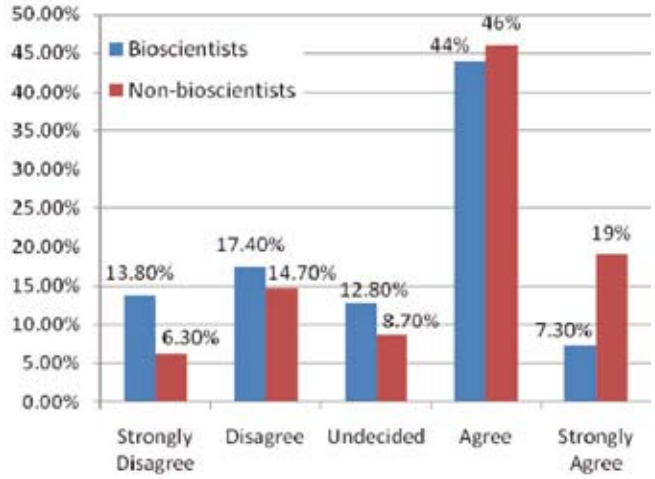

Figure 9. Job security.

'flavour of the day' taste in the researcher's mouths, and scientists were heard to complain that more resources are spent on new and clever names for initiatives and persuasive charts and diagrams than on making the system run effectively.

So, how did scientists respond to a question that sought an opinion about the guidance systems put in place to manage science? The statement read:

The management systems in New Zealand science are appropriate for the effective advancement of research.

Bioscientists begged to differ: only 2.8% agreed with the statement and 73.4% disagreed (Figure 10). Contrast this with 11.1% agreement and 60.8% disagreement by non-bioscientists. Not one of the respondents Strongly Agreed with the statement, the only such question in the survey to fail to record such a response.

Since 1996 when this question was first asked, the needle on this monitoring device moved into more negative territory. This result indicated a challenge then, and that challenge remained in 2008. The current government is moving to address important structural issues in the organisation of New Zealand science as it seeks to move the needle back to the positive side (Key 2010).

Career recommendation

On another bellwether issue the following statement confronted survey respondents:

The way things are going with scientific and technology careers in New Zealand today, I would recommend such careers to New Zealand youth.

Again, the bioscientists demurred (Figure 11): only 23.8% agreed compared to 42.5% non-bioscientists, and 58.7% of bioscientists disagreed compared to 33.7% of all other scientists. Troubling as this may seem it is an improvement over 1996.

The persistent discontent of bioscientists should be a cause for alarm, especially in light of the fact that bioscientists make up one-fifth of the under 35 age cohort of New Zealand's scientists.

These three key questions indicate that bioscientists possess a substantially different, and more negative, outlook on matters of policy relevance than the rest of the science community.

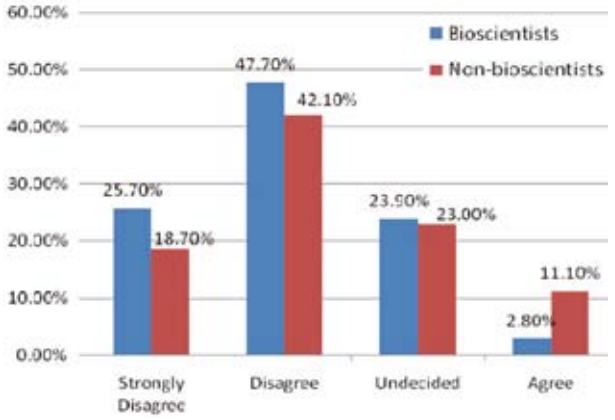

Figure 10. Effectiveness of management systems.

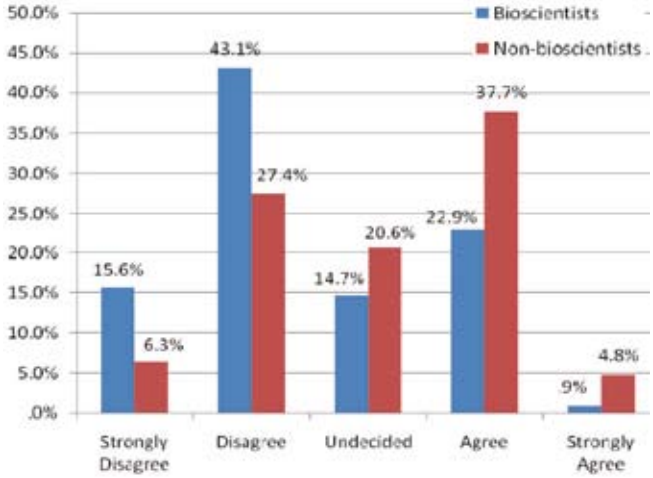

Figure 11. Recommending careers in science.

These differences contribute to the negative assessment of the morale of the scientific community mentioned in the *RS&T 2010* document.

Even with this negative assessment, bioscientists (25.7%) have not sought to leave New Zealand much more than those in other fields (23.8%), according to their response to a direct survey question. Of course, the survey could not account for bioscientists, or others, who had already left the country.

What's up?

With these disturbingly negative views, one can ask, 'What, if anything, is up'? There are a few positive changes from 1996 that bioscientists shared with the remainder of the science community.

Even with the viewpoints expressed on bellwether questions of job security, efficacy of management, and lack of enthusiasm for recommending a career in science, aggregate ***job satisfaction*** improved although bioscientists were slightly less satisfied than other scientists.

Some other indicators of goals pointed upwards (Table 2). Memberships on boards of directors of companies increased dramatically. Access to equipment and availability of staff support improved and inter-institutional collaborative opportunities increased. There was a doubling of the percentage of Māori participating in the survey. In the 2008 Survey these questions

were framed around 'the past five years', whereas in most cases those in 1996 were framed around 'since the restructuring' or 'ever', for example, patents appeared to decrease slightly in 2008 but the period compared was 'the past five years' to the 1996 'ever'.

Table 2. Rising indicators 1996–2008.

Indicator	Yes (Agree or Strongly Agree) 1996	2008
Research collaboration	18.10%	40.20%
Board of Directors	1.20%	5.20%
Māori origin	0.70%	1.70%
Patent	13.60%	12.50%
Access to equipment	13.60%	69.60%
Staff support	9.60%	47.90%

It is important that the media report on positive developments rather than focusing solely on the negative.

Some controversial issues

The general public is confronted daily with confusing and sometimes frightening issues seemingly requiring advanced scientific knowledge. Even with the best of intentions, print and electronic media exaggerate the potential risks of these issues. Expert opinions based on current understanding of the science behind the issues helps to engage media outlets and enhance public understanding of science and technology.

Consider two issues on which bioscientists have special expertise, genetic modification and stem cell research.

Scientific opinion on genetic modification

Confronted with the statement: *My understanding of the science of genetic modification of organisms leads me to believe they pose sufficient threat to the ecosystem to warrant suspension of research endeavours,* almost three-quarters of bioscientists disagreed compared to just over half of non-bioscientists.

We understand that consensus is not conclusive in science, but it is reassuring to the journalist community and to the public at large to know what experts think, even when contrasting viewpoints are also held by other scientists.

Scientific opinion of embryonic stem cell research

In the aggregate response to the statement: *I believe that embryonic stem cell research should be suspended while other stem cell sources are researched,* older scientists and female scientists agreed more than their counterparts but real differences showed up with respect to fields of science.

Bioscientists registered pronounced disagreement relative to most other scientists. Seven in ten bioscientists disagreed.

An interesting result came from those in the Medical & Health Sciences who disagreed more than others (71.4%), even bioscientists, and were also among the strongest in agreement (17.2%), a result made possible because they were more resolute in their opinion than all others.

Statistical evidence on science as a career

Several issues of importance for New Zealand science have been subjected to more in-depth statistical analysis. Specifically, multiple-regression techniques have been employed to sort out significant factors in the areas of career advice and job security.

Career advice

The regression model shows that both Field of science and Work location are significant predictors of enthusiasm to recommend a career in science to New Zealand youth (Table 3). Specifically, bioscientists were less likely to recommend a career, relative to scientists from all other fields; scientists working in universities, relative to all other work locations, were more likely to recommend a career in science. Interestingly, Gender also emerges as a factor, as female scientists were more likely to recommend science careers than males.

Table 3. Enthusiasm to recommend a career in science.

	B	Std Error	Beta	*t*	Sign.
Bioscientists (1 = Bioscientists)	–0.316	0.099	–0.194	–3.206	0.002
Gender (1 = female)	0.241	0.102	0.144	2.36	0.019
Income	0.009	0.021	0.029	0.44	0.66
Work location (1 = University)	0.248	0.097	0.164	2.565	0.011
Age	0.042	0.04	0.062	1.03	0.304

Job security

This regression model shows that bioscientists were less likely to feel secure about their job relative to non-bioscientists (Table 4). In addition, income was a significant predictor of one's feeling about their job security; not surprisingly, scientists earning more income felt more secure about their position. When we considered the relationship between work location and job security, we found that scientists in CRIs were feeling less secure. However, when we control for age, gender, income, and field of science, the relationship between work location and job security disappears.

Table 4. Feelings of job security.

	B	Std Error	Beta	*t*	Sign.
Bioscientists (1 = Bioscientists)	–0.232	0.108	–0.124	–2.149	0.032
Gender (1 = female)	0.195	0.107	0.104	1.827	0.069
Income	0.12	0.023	0.325	5.192	0
Work location (1 = University)	0.039	0.101	0.023	0.382	0.702
Age	–0.061	0.046	–0.076	–1.325	0.186

In closing

Results presented here support the four functions of the Survey of Scientists and Technologists and they make audible the specific voices of age, gender, work location, and field of science. Most emphatically, the voice of the bioscientist has been singled out amidst the cacophony of data, permitting us to peer into important differences within aggregate information.

Our disaggregated information has helped to make specific what are the unvarnished concerns of bioscientists within the entire New Zealand science and technology community. The voice of the bioscientists is certainly clear enough on important issues and raises questions for the direction of public policy.

Whether the bioscientist's voice will be acknowledged by the public, press, and policy domain is an open question but there are results of sixty other survey questions that may amplify the urgency to hear this voice.

Most of what we have had to say has been a descriptive report on the 2008 Survey with special reference to bioscien-

tists. What we have reported about this foundational field of inquiry that supports a bio-based economy in New Zealand's future indicates there is much work ahead for those who would manage science.

Will public policy under a National-led government direction seize the opportunity to move the morale needle back from negative territory into a positive realm?

What are the prospects?

Prospects for a less troubled science and technology community in New Zealand are on the rise as recommendations from the Crown Research Institute Task Force Report move towards implementation by government. Five features of the proposed changes hold out the possibility to raise morale as well as productivity:

- Devolution of decision-making away from central government to CRIs on the science needed to address broad public priorities should enhance consultation between scientists and managers in those organisations thus reducing the sense that they are excluded from decisions about the direction of their scientific research. This initiative will also address the time-intensive issue of 'bureaucracy and red tape'. Given the concentration of bioscientists in CRIs, the result of this policy initiative should reduce anxiety and animosity within the field.
- The promise of more stable funding by increasing the proportion of funds that are Core funds and less reliance on Contestable funds addresses, to some degree, the sore issues of 'Interruptions in research funding' and 'Time spent on administrative rather than research activity.'
- Moving the system from *competition toward collaboration* by inducing opportunities to collaborate across institutional boundaries should promote synergies between CRIs and universities and with the private sector.
- Increased focus on technology transfer, combined with greater freedom for the individual scientist to innovate should result in a more dynamic environment for contributions to the New Zealand economy.
- Appointment of a Chief Scientific Advisor sent a loud message that the Prime Minister is serious about government commitment to science.

If these initiatives are backed up with implementation there is no guarantee that all in the science community will benefit to the same degree nor will changes occur without dissent. It does seem likely that bioscientists will modify their opinions on the issues we have identified insomuch as they are able to capture the fruits of their research in terms of recognition of their contribution to scientific advancement and in financial reward.

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