

Aspects of Recent Reforms and their Effect on Jobs in Science

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The new approach to the funding and delivery of state sector research, science and technology had three principal objectives: *accountability, enhanced economic growth and improved decision making.*

The radical reorganisation of the scientific institutions, their changed legal status, and the profound redesign of the funding system of research and scientific services were introduced at speed and simultaneously with many other changes in the structures of the public service, the health and education systems. There appears to be an ideology behind all these ultra-rapid and profound changes. The creators of the new institutions and new systems are subject to the "Genesis Effect": known to us from the Old Testament (Genesis, Ch. I, 31): "And God saw every thing that he had made, and, behold, *it was very good*". Imbued with this intrinsic faith, the creators lack incentive to find out whether their creations really work. Karl Popper recommended the method of "piecemeal social engineering"¹, i.e. proceeding with reforms in small steps to allow for errors to be corrected, rather than in grand leaps by what he calls an "holistic approach". Clearly, there was a need for the critical appraisal of unexpected or unintended side effects of the reforms. Recognition of this need led the New Zealand Association of Scientists to carry out the 1994 Survey.

Job Content

A major finding of the survey was that there had been significant changes in the job content. Half the respondents from the Crown Research Institutes (CRIs) or private industry reported substantial change, while less than one third of university scientists did so. A significant percentage of university staff reported no change. Replies to the question: "*Has your job content changed in the last five years?*" were classified in Table 1 by the employer and in Table 2 by the funder.

The Nature of the Changes in Job Content

One would have expected from other results that these changes would be, in the main, changes from basic to applied science, or maybe from that to research and development, thus focussing on enhancing economic growth. It was not until reading the answers of the respondents, that changes of a different kind were found. Respondents were asked to characterise these changes by stating in their own words: "I now spend more (or less, or about the same) time on..." (Table 3).

Quite clearly, 233 respondents who report that they now spend *more* time on *non-scientific activities* i.e. 64.7% of the

360 employed by the CRIs are balanced by the 227, i.e. 63.1% who say they now spend *less* time on *scientific activities*. This balance is not just *over-all*, but applies to the vast majority of the individual respondents who each have to *trade-off* science for non-science in their daily work.

Tables 4 and 5 examine more closely the nature of these *non-scientific activities* that take more of the time of respondents from the CRIs and the *scientific activities* on which they now spend less time. The words which describe these activities were those largely chosen by the respondents themselves, and have been grouped together.

It is not surprising that the respondents from universities classify their *non-scientific activities* somewhat differently from those of the CRIs. Specifically, administration related to teaching, and teaching itself, are often coupled by respondents from universities (Table 6).

Most respondents say they are now spending more time on *non-scientific activities* at the expense of scientific work (Table 7). There are differences between university and CRI employees. The teaching load has increased for many in the universities and, as they have indicated, with an increase in teaching goes an increase in the time spent on administration and less time for research. It is noteworthy that about one third of the university respondents say they spend about the same time now on their various activities, as in the last five years, as compared with about one quarter of the respondents from the CRIs.

The most significant difference is the amount of additional time taken in the CRIs in seeking funding and preparing bids: 31.1% of the 360 respondents employed by CRIs, compared with 7.3% of those 206 from universities spend more time on these activities at the expense of research and other science.

Were all these changes in people's job content designed and deliberately created? Were they expected? Or were they unintended side effects?

Apart from finding out which correspondents spend more or less time on administration now, we can get an estimate of just how much time is spent on administration by various groups of respondents. Of a total of 837 respondents, 617 (73.7%) spend some percentage of their time on administration. Over-all, 586 described themselves as working in scientific research. Of these, 335 are employed by CRIs, 141 are working in universities. 147 say they are working in "other science". Of these, 49 teach at universities, 20 are employed by CRIs and 67 state that they are now "out of science" (Table 8).

Those working in a university seem to have a greater administrative burden, not surprisingly, as much of it is related to their teaching. Roughly speaking, about half the respondents spend between 6-25% of their time on administrative tasks.

A question which respondents employed by the CRIs, (360) and those employed by the universities (206) answered very differently was the following: "I now spend time on new tasks, eg" (Table 9).

About 29% in the CRIs mention new tasks relating to bidding, chasing money, grant applications, marketing skills, shuffling paper, commercial contracts, management, while over-all only about 5% spend time on new scientific tasks such as new technology transfer, new scientific fields or new techniques. The category "Other" varies from understanding a new computer package, typing and draughting, to teaching. In contrast, about 14% in the universities refer to new administrative tasks such as form-filling, shifting xeroxed paper round, only few mention grant applications, funding, pedagogic planning and management. "Other", covers a variety of tasks eg safety and dealing with legislative requirements.

Overall, the new funding systems have had a profound influence on the job content of many scientists. Thomas Kuhn² has characterised the activities of *normal scientists* as puzzle solving. Normal science is following accepted *paradigms* to establish *routines* which are then used to solve these puzzles; and a puzzle is a puzzle only if it has a solution.

The bidding process, and the adjudication of a proposed research topic as worthy of funding, depends on the acceptance of the *paradigm* by the judges. This leads to "safe" science.

If *routine* takes over, this will be the end of science, which depends on the imaginative attempts to solve problems in novel ways, by trial and error elimination by a critical approach, not knowing whether there is a solution. Science is a risky business.

"But *routine* may well take over, may completely supersede science. That is a danger to which I was blind before Kuhn opened my eyes. We may soon move into a period where Kuhn's criterion of a science, a community of workers held together by a *routine*, becomes accepted in practice. If so, this will be the end of science as I see it." This is Popper's criticism of Kuhn's notion of the Normality of Normal Science³.

Footnotes

1. Karl R. Popper, *The Poverty of Historicism*, 2nd ed. 1960 Routledge and Kegan Paul Ltd, London. "The piecemeal engineer, like Socrates, knows how little he knows. He knows that we can learn only from our mistakes. Accordingly, he will make his way, step by step, carefully comparing the results expected with the results achieved, and always on the look-out for the unavoidable unwanted consequences of any reform; and he will avoid undertaking reforms of such complexity and scope which make it impossible for him to disentangle causes and effects, and to know what he is really doing.

Such 'piecemeal tinkering' does not agree with the political temperament of many 'activists'. Their programme ... may be called 'holistic or Utopian engineering'." (p.67)

"One of the differences between the Utopian or holistic approach and the piecemeal approach may be stated in this way: while the piecemeal engineer can attack his problem with an open mind as to the scope of the reform, the holist cannot do this; for he has decided beforehand that a complete reconstruction is possible and necessary." (p.69)

2. Thomas S Kuhn, *The Structure of Scientific Revolutions*. 2nd ed., enlarged, 5th impress. 1974, University of Chicago Press. (p.37)

3. *The Philosophy of Karl Popper*, Book II, Ed. Paul A. Schilpp, La Salle Illinois, Open Court, 1974. (p.1146)

Table 1 Degree of Change in Job Context (Employer)

Job Content Changed:	CRI %	Private %	University %
Substantially	50	52	31
Somewhat	41	35	47
Not at all	3	8	15
Not Applicable	3	2	4
No reply	4	3	3
TOTAL	100	100	100
All 628	360	62	206

Table 2 Degree of Change in Job Context (Funder)

Job Content Changed:	NSF,CRI, FRST %	Cntr. Industry %	HRC University %
Substantially	50	47	28
Somewhat	40	36	49
Not at all	3	7	15
Not Applicable	3	5	5
No reply	3	4	3
Total	100	100	100
All 655	361	91	203

Note: CRI = Crown Research Institute; NSF = Non Specific Funds, Cntr = Commercial Contract; FRST = Foundation for Research, Science and Technology, HRC = Health Research Council

Table 3 - Nature of Change in Job Content

360 respondents, employed by a CRI, state:

I now spend ON:	more time		less time		about the same time	
	N	%	N	%	N	%
Non-scientific Activities	233	65	16	4	31	9
Commercial, Consulting, Tech. Transfer	18	5	6	2	6	2
Servicing	9	3	8	2	2	1
Research, R&D, Science	31	9	227	63	50	14
Other	13	4	9	3	5	1
TOTALS Respondents:	304	84	266	74	94	26
No reply to question	56	16	94	26	266	74

Table 4

In detail, the non-scientific activities on which 233 respondents spend more time, are:

	N	%
Administration	67	17
Admin. & Funding, Bidding	112	31
Admin. & Management	23	6
Management, Planning, Policy	31	9
Total	233	65

Table 5

In detail, the scientific activities on which the 227 respondents spend less time, are:

	N	%
Research (Pure and Applied)	114	32
Field, Bench, Experimental	52	14
Science, Hands on Science	40	11
Writing, Reading, Thinking	17	5
R&D	4	1
Total	227	63

Table 6 - Nature of Change in Job Content

206 respondents, employed by a University, state:

I now spend ON:	More time		Less time		About the same time	
	N	%	N	%	N	%
Non-scientific activities	82	40	9	4	10	5
Admin. & Teaching, Teaching	49	24	24	12	42	20
Research, Field and Bench Work	20	10	106	52	11	5
Writing, Reading	2	1	2	1	—	—
Other	4	2	6	3	5	2
TOTALS Respondents	157	76	147	71	68	33
No-reply to question	49	24	59	29	138	67

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Table 7

In detail, the *non-scientific activities* on which the 82 respondents of Table 6 spend *more* time, are:

	N	%
Administration	54	26.2
Admin. & Fund Seeking	15	7.3
Admin. & Management	13	6.3
[Sub-Total	82	39.8%]
Teaching & Administration	20	9.7
Teaching	29	14.1
[Sub-Total	49	23.8%]
Total	131	63.6

Also the 49 respondents of Table 6, listed as spending *more* time on Administration and Teaching, do so on:

Table 8 Time Spent on Administration

Time spent on Administration	Working in Scientific Research including University	Working in Other Science but not in a University	Employer and Funder CRI, Research funded by FRST, NSF	University funded by University
	N=586	N=98	N=305	N=190
0 - 5%	36	36	36	22
6 - 10%	24	15	27	23
11 - 25%	23	30	23	28
26 - 33%	8	9	6	11

Table 9 New Tasks (Employed by CRI)

Nature of New Tasks	N	%
Bidding, Funding	57	16
Managerial	14	4
Administrative	14	4
Commercial	21	6
Scientific, Technological	14	4
Consultative, Advisory	4	11
Other	12	3
Percentage of Time, Unspecified	6	2
Respondents	142	39
No Reply to question	218	61

Table 10 New Tasks (Employed by University)

Nature of New Tasks	N	%
Bidding, Funding	6	3
Managerial	4	2
Administrative	18	9
Teaching, Pedagogic	7	3
Scientific	2	1
Other	5	2
Amount or Percentage of Time, Unspecified	2	1
Respondents	44	21
No Reply to question	162	79