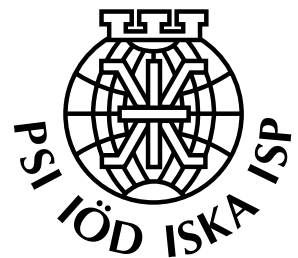


A PUBLIC POLICY FOR SCIENCE AND TECHNOLOGY



1994:2

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Preface

Society in the late 20th century has a confused attitude to science and technology. On the one hand, faced with the environmental and puzzling disease problems which plague our lives, we tend to ask: Why don't they do something about it? On the other hand, we often see them as the problem, the ones responsible for all of our fearsome uncertainties. In both cases, they are the scientists and technicians who vary between being gods in white lab-coats and evil monsters scheming to release yet another bio-technological chimera into our food or water. Many of PSI's affiliates have members in the scientific and technical professional categories, at the centre of these debates and concerns.

The PSI Scientific, Technical and Related Professional Staff Working Group decided in 1993 that these issues should be addressed in a policy paper. Such a paper could look at the roles, rights and responsibilities of scientists and technical workers in society as well as offering some thoughts on a proper basis for government policy and action in national and international scientific endeavours. No such discussion paper could look at these matters without raising a number of serious ethical issues. One of these issues is the extent to which the 'laws' and 'principles' of the free market should determine the development of society's priorities, policy and practice in science and technology.

I want to thank the members of the PSI Working Group for producing this policy paper. The PSI Executive Committee decided at its November 1994 meeting to release it as a formal PSI policy paper. Policy, like scientific and technical development, does not stand still. What is presented here will need to change in the years to come. PSI hopes, however, that the issues raised in this paper can be a basis for national and intergovernmental discussions on the way forward in these areas. Any comments which any readers have on this paper would be welcome by PSI as a contribution to the next stage in our thinking on these matters.

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November 1994



A framework

The attitude of many governments to the role of the state in many fields of public policy and action over the recent past means that there are many areas where there is no official national public policy. Developments have been left to the private sector and ‘public policy’ is often just the aggregate of what the private sector has done, with some gap-filling by governments on an ad hoc basis. In the arena of science and technology policy, this often means that government research institutions, university or other educational bodies, independent and voluntary research organisations (such as medical research trusts) and industry have each gone their own way.

This has resulted in many countries not having a co-ordinated approach to science and technology. There is often no national strategy for the conduct of science and its exploitation in industry and few performance indicators other than short-term profit (or cost limitation) considerations. There may be isolated sectors of industry or social policy where there are agreed goals and strategies but these often founder as a result of the lack of national co-ordination. In a world faced with economic stagnation or decline, climate change, finite energy sources, depletion of forests and fish-stocks, famine, poverty, disease and other major environmental hazards, it is essential that there be a co-ordinated approach to national and international science and technology policy.

This is currently a critical issue since the scale, potential and speed of some of these urgent problems or of their solutions has led some people to see science or its products, falsely, as ‘the culprit’ - the nuclear industry, bio-technology, genetic engineering, etc. A failure to engender a more positive image for science, engineering and technology could see the growth of anti-scientism. Those who are nostalgic for the ‘good old days’ before the rise of science and technology over the last few hundred years would rarely choose to live in the kinds of communities which typified those times and suffer the life risks, especially for women, which characterised the short life span of their citizens. They certainly show little enthusiasm for moving to those parts of the world which are forced to remain in that state.

It is necessary to achieve positive results in these areas if a healthy technical sector is to be achieved in

a sustainable manner to serve the needs of our peoples. There is a need to point to the successes of technology and science in dealing with conservation issues, alternative energy sources, indeed of the very bio-technologies which frighten some people who do not understand them. It is easy to be convinced that Frankenstein is only asleep and that all manner of evils are struggling to get out of locked rooms. Workers in these fields need to be more pro-active in publicising the benefits of their work.

PSI is grateful to the PSU, Australia, and the IPMS, UK for providing the original framework for the topics discussed below. It is not possible for Public Services International (PSI) to draft a policy paper which could be applied directly in any one country. What follows is a set of principles which public sector trade unions could use as a basis for examining the needs of their own country and for lobbying governments to adopt policies which will set research and development on a firmer foundation.

PSI has a Scientific, Technical and Related Professional Staff Working Group which deals with many of the matters raised in this paper. Sometimes in the paper the terms *science* or *scientist* are used; sometimes *research and development*; sometimes *scientific, technical and related professional staff*. Nothing should be read into a specific term used at any place - they are normally used interchangeably throughout the paper.

Expanding knowledge

Research and development, as defined by the Australian Bureau of Statistics, is *creative work undertaken on a systematic basis in order to increase the stock of knowledge*. It should be noted that this definition covers both sides of the artificial divide between 'pure' and 'applied' research. In fact they are each necessary for the other. The expansion of knowledge is the essential ingredient of this work and at least six conditions under which it is possible are well established and familiar to all researchers.

ACCESS TO THE KNOWLEDGE BASE

The stock of knowledge can only be increased if its present dimensions are accessible. Virtually all innovations draw on previous work. Therefore access to libraries, journals, conferences (national and international) and other research workers are essential. In the South this is a critical issue. Public libraries cannot maintain collections and even university libraries cannot afford new books or journals. A scheme to 'adopt' a library, so that northern unions consider identifying a southern union which needs books, periodicals, etc. for which funds could be found in the north, may be a useful project for a trade union or an NGO which works with trade unions.

It would also be useful for unions in the north to bargain with their employers to fund or expand the knowledge base in the south in some way. In this respect, it is also important for public sector trade unions to be positive in their approach to defining knowledge. Increasingly, international instruments within the UN are beginning to recognise that much knowledge shaped and held by indigenous peoples is scientific even if the methodologies for acquiring and developing it have not formed part of the mainstream of 'official' science.

COMMITMENT TO THE LONG-TERM

Short-term or tactical research rarely yields results of lasting value. Most innovations require long-term perseverance and a strategic approach to incremental advances and verification of results. Most innovations also need many years to achieve maximum impact and require extended development work. In other words, it is important to get the public and the policy makers to recognise that scientific knowledge

and, more especially, its application to the lives of real people are part of a development process and that start-stop-start policies and funding decisions undermine the whole endeavour.

STABILITY FOR INSTITUTIONS AND INDIVIDUALS

This long-term perspective and commitment means that there must be organisations in which the researchers are able to produce output and maintain steady employment. The continual reorganisation and high unemployment which has characterised the research and development world over the last decade or so erodes the knowledge base, reduces stability and lowers morale.

For example, in a 1993 survey of its largely scientific and technical membership, the IPMS found that 43 per cent wanted to change their employer within the next three years, 15 per cent wanted to leave science altogether and 46 per cent of those with children would not advise their children to choose a career in science and technology. Not that they need to bother - *New Scientist* has for the last few years been reporting the serious erosion in the number of student enrolments in science subjects at British universities and technical institutes. There is also evidence that the calibre of student being attracted to technical and scientific subjects has also dropped in recent years - many more 'successful' students barely pass or receive less than top grade marks.

ADEQUATE AND APPROPRIATE FACILITIES

Out-dated and inadequate facilities are a severe impediment to innovation. Buildings, laboratories and state-of-the-art equipment are essential but it is true that they are expensive. This is a further reason for having a national science and technology policy if appropriate decisions about what a nation cannot have or will not do are to be made in an efficient and effective manner and over a time scale which allows and encourages career training and planning.

Quality workforce

Many innovations are the result of the work of individuals or small teams working at the forefront of their field. Research work is highly specialised and the workers cannot be produced overnight, especially if reliable, significant results are the objective. There are many countries where the loss or absence of just one specialist can stop a major line of inquiry or exploitation within the country or organisation, not always only in the area where the person is or would have been working directly. This is one of the reasons for avoiding ad hoc or uncoordinated approaches to policy decisions.

These decisions cannot be operated like a tap. The European Union, for example, has estimated that the 'supply delay' in getting a new scientist into full operation is of the order of ten years compared to other factors (finance, equipment and buildings) where it is five years (Perry, unspecified paper, January 1993).

In particular, governments need to be aware that the international nature of research and development means that under-resourced scientific, technical and related professional staff can often be lured abroad. Other countries or organisations may be prepared or able to allow the workers concerned to use their skills fully. Scientific and technical workers who are suffering from low morale or who spend their time on wasteful administrative or grant-hunting tasks are not going to be fully productive or attracted to remaining with the organisation. This applies even more, of course, to workers in Central and Eastern Europe who have either lost their jobs or are completely under-utilised because of resource problems.

Scientific and technical staff need adequate pre-training and in-service training, appropriate and attractive conditions of employment, including salaries, well-enunciated goals and policies, a stable environment and adequate levels of support and management.

International participation

Increasingly, science and technology development is becoming too 'big' for many countries to maintain their own independent work in some areas or even for some of the largest nations to go it alone. The most visible are the giant particle physics and astronomy instruments such as the CERN (the European Nuclear Research Centre) and the space station but new technologies such as fast trains and other transport systems often require an intergovernmental or international effort. There is a rapidly growing imbalance between nations' ability to 'do' science and the temptation is there for some nations to 'free ride' on the efforts of others. Trade unions representing scientific, technical and related professional workers must ensure that their governments make an honest effort to pay their way. At the least, failure to do so can see workers from the country concerned barred from participation in these projects.

It is difficult for nations to play this role if they do not ensure or are not helped to secure a pro-rata development of scientists, engineers and technologists through their education system. For some, of course, this is more easily said than done at a time of increased mobility of such workers. The nations of the North will need to be pressured to assist with the training of scientists and technicians in the South. They must evolve policies which assist countries in the South to retain their trained people. There is a need to ensure technology transfers which reduce the need (or temptations) for people from the South to migrate to the North. One suggestion which has been made is the establishment of a fund which could purchase appropriate patents for developing nations to exploit.

Some of the most acute problems facing the planet are those with which the South is most concerned and scientists and technologists from the South have played important roles in issues such as solar energy, rural electrification, tropical agriculture and fisheries development. These are often areas where a detailed sensitivity to what will and will not work are crucial to the adoption by governments and communities of technologies which can make a difference. For example, there have been many anecdotes of technologies which have been proposed for fuel, vegetable production or irrigation which have failed because they

did not take into account the way in which technology is commandeered by men rather than by the women who need it for these problems to be addressed.

Specifically, the UN agency with the most general coverage of science and technology issues, UNESCO, has been crippled over recent years by the departure of the UK and USA governments. As wiser counsel begins to prevail, it appears likely that these two governments will begin again to play their full role, including financially, in UNESCO but trade unions in those two countries should be urging their governments to speed this process up.

Yet there is a further issue relating to international science. The workers in international bodies such as CERN, JET or UN agencies employing scientists often face governments which flagrantly transgress labour and trade union rights. Such workers are often denied the freedom of association or collective bargaining rights which the ILO international Conventions decree. They often have short-term contracts which are blatantly manipulated to enable the organisation to avoid domestic or international obligations. In the JET in the UK, the nationals from the host country are paid less than and enjoy fewer rights than those from elsewhere. None of these behaviours is an incentive for these workers to see themselves as valued contributors to the world's stock of knowledge.

Transference to stakeholders

Research is of little social or economic value if its results are not transferred to those who have different stakes in the outcome, either for using or developing these results.

END-USERS

The labour or funding involvement of collaborating individuals or companies normally ensures that they will use the results. The use may involve direct exploitation of the results but may include internal or external education and information channels or news media which these people may use. PSU notes, in its contribution to this paper, that some organisations maintain innovations ‘champions’ whose task is to carry an innovation through to fruition, again, internally or externally. Key government ministries, departments and agencies should adopt such a policy so that a speedier transfer to beneficial pay-offs occurs.

KNOWLEDGE WORKERS

Knowledge is a public good, even if ‘rentable’ via the legitimate exploitation of intellectual property rights. The question of the actual legitimacy or morality of private or privatised intellectual property rights in situations where the public has essentially funded the work which developed the outcome is a matter which will need argument on a case by case basis. The commercialisation of what was formerly public science does not lead to an inevitable conclusion that its results should be privately exploited. It has been noted by many public sector researchers that they have come under increasing pressure in recent years not to publish results where some element of private sector investment has entered a public science institution.

Transference to other knowledge workers through publication and education are the normal diffusion routes and employers must ensure that researchers can fulfil this part of their task. It should be noted that this is a solid scientific tradition aimed at allowing scientific claims to be validated through replication by others. Public sector research and development workers should also be on the offensive on this question of the role of the state in science. This is one area in particular where it can be said that many of the major innovations of this century have been made by workers in public science institutions and facilities

As noted earlier, it is also important, as specified in

the *Draft Declaration on the Rights of Indigenous Peoples*, (UN ECOSOC Working Group on Indigenous Peoples, August 1993), that scientific and related workers and governments/companies which stand to profit from their work must respect the intellectual property rights of indigenous peoples. While this includes the appropriation and application of knowledge based on the use of herbs, plants, etc. it also covers research in which indigenous peoples are the subject of the research. A case in point is the Human Genome Project* which has aroused the anger of many indigenous peoples who felt that they were not consulted on a project which is worth many billions of dollars but relies on access to body samples from people who have often not been informed about the work.

This theme intersects also with economic integration in the area of intellectual property rights. Many industrial nations have used free trade agreements to secure these rights. While they have a right to what is theirs, a balance must be drawn between maintaining sufficient rewards to motivate research investment and providing the developing world with better access to cutting edge technologies which could spur development.

COMMUNITY

Further to the above, research and development work funded by the public purse will continue only if the public continues to vote for it. While many will benefit directly or indirectly from this investment, it is essential that organisations doing publicly funded work have and are required to have an active strategy for informing the public through education, information channels and the news media. Included in the successful accomplishment of this task is a requirement that research organisations equip their staff with the skills needed for comprehensible information transfer.

*This is an international research effort to map the entire human DNA so that all genes and their functions could be listed, and perhaps patented for commercial exploitation. It has relied to some extent on a number of indigenous populations being DNA-sampled without their full knowledge and informed consent.

Strategic and tactical responsiveness

While, as noted above, short-term perspectives must not characterise science and technology policy, it is essential that research and development is able to respond to immediate problems as well as contributing to long-term strategic aims.

NATIONAL OBJECTIVES AND PRIORITIES

It is a valid role for governments to express national directives and priorities, to provide a framework for a science and technology policy and to consult regularly with the stake-holders identified above so that this policy is monitored and updated. Obviously, for public sector workers in these areas, an essential social partner in these kinds of discussions with governments must be their trade union. Trade unions are often trusted by their members more than are their employers and much of workers' knowledge about faults and their possible solutions will only be transmitted to governments and employers via the collective voice of the union.

Unions have a tradition of having to take account of the collective interests of their members. This can help to avoid the competitiveness which can follow from top-down policy decisions which are not informed about forms of co-operation which can be made to work. Trade unions often have access to information about where efficiencies can be achieved in a manner which benefits the nation, the firm and the workers concerned. Governments which do not bother to ask may not be told.

Many countries are instituting some national mechanism for dealing with these matters: whether it is a ministry, a unit attached to the central machinery of government or some nominally independent advisory body will be a matter of national choice. But some central co-ordinating body is needed rather than leaving 'policy setting' to the whims of uncoordinated actors, as noted above. Within such a body and within key ministries, it is also essential that there be career positions for senior scientists, engineers and technical staff who can anchor policy to the daily working realities of workers in the field.

There is a recognised need for consistent and co-ordinated data gathering about these workers. The Frascati manuals (actually one manual and a series of internationally recognised protocols for research and

development data) have established a standard set of information and methodologies by which governments measure and evaluate scientific and technical activity and planning. In the case of OECD countries the Frascati methodology is used in all OECD countries except Luxembourg. It covers the national (and international) definitions and measurement of: research and development boundaries; institutional classifications; functional classifications; personnel working on research and development (R&D); expenditure on R&D; survey procedures; government R&D budgets; and other related material. Many countries use Frascati as a basis for their R&D evaluation and trade unions in countries where it is not used should encourage their government to adopt this increasingly common system (*The OECD Observer*, No. 183, August/September 1993).

EXPERT TEAMS AND MATERIAL RESOURCES

Scientific and technological organisations must have the drive, the resources and the flexibility to establish and recruit expert teams. They must be in a position to redirect these resources to reflect changing priorities. Because of the long lead times mentioned above, this means that there is a need for regular consultation with users, workers and the public to alert decision makers to the changing needs early enough.

INTERNAL PRIORITY SETTING

The capacity to develop internal priorities in line with national objectives is necessary for the successful conduct of strategic science management. So also is the possession of the means to redirect knowledge of changing opportunities back to the national policy makers.

Community and international recognition

Research and development work will lack credibility and political support if there is no recognition and support from the public and the international science community. Achievement and relevance must be demonstrated at all levels. This, again, requires comprehensible communication. It requires that the public be involved in setting the objectives, credited with making possible the successes and convinced of the integrity and independence of scientific, technical and related professional workers. So, there is evidence that countries with the most open approach to government information have the most questioning populations but also the most well-informed.

Such people can take part in political debates on priorities more effectively than can those whose governments keep scientific and technical information a state secret. It is common in some countries to see public 'notice boards' next to major civil engineering projects (roads, bridges, etc.) which say which public authorities are financing the project so that people can see where their taxes are being spent and can feel that they 'own' the work. If this happened in scientific and technological projects, it might generate more public support - as well as more questions, of course. In the UK in 1994, the government-sponsored 'Science Week' featured a number of science projects/exhibitions which trade unions mounted with a special focus on 'people in science'.

In turn, as noted above, there is a need to foster North-South partnerships which develop and retain an R&D base in developing countries. Trade unions should lobby their governments to ensure that a formal commitment to this ideal is incorporated into the policy and programmes of official development aid and assistance.

The lack in some developing countries is occasionally because the potential science leaders all leave for elsewhere. They need encouragement to stay and contribute in their own country. An example is the Cook Islands which used to have a problem in retaining doctors trained at government expense in New Zealand from which they obtained medical qualifications marketable on a world market. A shift of such officially sponsored education to the Fiji Medical School, where people obtained perfectly suitable qualifications for typical Cook Islands prac-

tice but not recognised in many other countries stemmed the loss. It is also possible for developed countries to help establish satellite and other electronic systems which enable researchers and professionals to hook up to international centres of excellence for diagnosis or expertise. Such systems can reward both the local researcher and the country concerned.

Independence and integrity

Academic independence and integrity is an absolute condition for the conduct of almost all research - not the same things as policy or accountability independence.

FUNDING SOURCES

Diverse funding sources can prevent a single client, a single point of view or a vested interest from dictating outcomes -especially where this is an authoritarian government. There should, therefore, not be a constraint on public science bodies seeking alternative funding sources, including other parts of the state's machinery, such as a public university researcher being barred from applying to a state research fund. This is especially important in those countries whose governments open state scientific bodies to competition on a so-called level playing field.

Of course, this is not an option without risk and can be a vehicle for some governments to begin the privatisation of public research.

JOB SECURITY

Security of employment means that staff cannot be unduly pressured to withdraw or censor unwelcome results. In this respect, PSI policy on encouraging the enactment of 'whistle-blowing' legislation is important where governments have been engaged in attempts to muzzle research.

EQUALITY OF OPPORTUNITY

Over and above the comments already made above about the need to strengthen nations and R&D workers from the South, there is also the fact that science and related pursuits are male-dominated activities. More women should be encouraged to enter science and technology by promoting 'women-friendly' environments through the provision of child-care resources and more flexible working and career patterns. There has been some improvement in the science and engineering areas over recent years, although the number of women in senior academic or research positions remains very low; but in the technology field, the number of women at **all** levels is very low still.

A particular concern in this regard is the increasing use of performance-pay systems, which have achieved

a notoriety for being non-scientific in their gender bias. The associated development of a commercial orientation in public R&D agencies sometimes means that equality of opportunity matters are passed over. Firm equal opportunities policies and standards form an essential part of the culture in all organisations and part of the 'level playing field' which all those competing for contracts must observe.

Much of what has been said in this section could be said with equal validity of indigenous people, people with disability, etc.

FREEDOM OF INFORMATION.

Public accountability is one of the most important means of maintaining honesty and integrity. Excessive secrecy may encourage R&D workers to distort or manufacture results. This is also why PSI maintains that it is essential to avoid the situation where the use of external funds or the contracting out of research and development work means that essentially state funded workers or work are subject to the privatisation of knowledge because of claims about intellectual property rights. Legislation to require freedom of information is an essential tool for public R&D workers.

ETHICS

Adherence to professional and individual ethics is the main way in which standards are maintained through peer review, refereeing and open publication of results for others to verify. Public sector trade unions must support workers in these areas trying to adhere to these ethical standards against government pressure. Earlier comments about indigenous peoples and science are also relevant here.

Cost effectiveness

As the cliché has it: *We are misspending half of our research budget but we are not sure which half.* Cost effectiveness and efficiency in science and development work is an unqualified necessity in view of the source and the size of the funds. It **is** true that, very often, one spectacular innovation can pay for the efforts that failed; or that the real ‘pay-off’ is apparent and quantifiable only years after the initial work is finished; or that the basic nature of the work means that its benefit is measured in spin-offs and derivatives.

However, the Teflon story is wearing a little thin (and is mythical, anyway). It is essential that workers in public science and technology are very visible in their own commitment to efficiency and effectiveness: more so than the governments which contract research out to the private sector and then pay the kinds of bills that NASA and the Pentagon in the USA have had to acknowledge in recent years.

In this regard, there have been vague promises since 1989 about the ‘peace dividend’. The potential for higher, more direct pay-offs resulting from a conversion of military research into civilian research remains. Public sector trade unions have a vested interest in campaigning for this.

These cost factors mean also that a high degree of latitude exists for exercising judgement about science and technology policies and priorities. To avoid suspicion, it is essential that workers in these fields take the politicians and the public very fully into their confidence when considering these issues.

Public sector action

It is the view of PSI and its affiliated unions that R&D, and public sector R&D in particular, is in a state of crisis. It is important for PSI to support and encourage a campaign based around the following issues:

- There is a need to highlight the **positive** contributions which science and technology can make to the lives of people **if** they are under democratic control and conducted in an efficient and effective manner.
- In particular, PSI and its affiliates need to campaign for adequate resources and proper recognition for public science and technology research and development work. This should include resources for pre-training and in-service training.
- While it is important that business and industry contribute their fair share of national research and development resources, it is essential that this not result in:
 - the privatisation of research and development work;
 - its loss of public accountability; or;
 - the ability of business and industry to be subsidised by the state through ‘poaching’ from the public sector. Many scientists have been trained at public expense at tertiary educational institutions and then given in-service training in public agencies.
- Governments in the North must be lobbied to assist countries in the South and in Central and Eastern Europe in the training and retention of scientific, technical and related professional staff, in allocating sufficient resources to research and development staff and in the transfer of technologies which will assist in their sustainable development.
- Scientists, technical and other related professional staff must be given every assistance in attempts to:
 - retain their professional independence, autonomy and integrity;
 - be able to use ‘whistle blowing’ legislation to protect the public and their own research results;
 - be able to use freedom of information legislation to communicate the non-personal results of their research.
- All governments should be encouraged to establish a national body of some kind charged with the responsibility, after consultation with all social partners and the community, of framing priorities and policies for the sustainable development of science and technology work.
- It is essential that workers in science and technology have access to full, unconditional exercise of recognised trade union and collective bargaining rights. This is especially important for those working for international bodies which currently deny these rights. Included among these rights must be that of subjecting the practice of contracting out and short-term contracts to collective bargaining. It is also essential that such collective bargaining should focus on means to achieve equality of opportunity in research and development work.
- Scientists and technical and related professional staff should be given specific training to enable them to communicate with the public on their work and should be expected to use these skills.
- All countries should be encouraged and, where appropriate, assisted to play their full role in the increasingly international nature of research and development work.

Conclusions

It does matter where public science is carried out, by whom and for what purposes. In science and technology a culture can develop for each institution and the standards and ethos of one place cannot necessarily or automatically be transferred to some multi-purpose or generic research institution. A focus on private sector motivations or narrow searches for profit can lead to shoddy and secret science - the last thing people and public sector workers need in a world where science is so expensive and politically and economically powerful. It is not the 'mad scientists' whom we need to worry about so much as manipulated scientists.

