between its academic and business performance is the least able to understand the facts or costs of that disparity, or to apply corrective policies.'

Stretton may be judging us too harshly. For example, some dispute that the treatment of universities was as bad as he indicates.

Yet the P A Technology survey I have already briefly mentioned does support the view that Australian business still holds to an alarming anachronistic view of S&T. It was their second survey of senior executives from manufacturing, engineering and processing companies in Australia, the United States, West Germany, Britain and Japan. Let me list some of their conclusions and findings:

- the 1985 survey does not seem to show any improvement on the 1984 survey which revealed Australian executives did not know how to apply technology to make their companies more competitive. Companies still grossly underestimate the strategic importance of technological investment and resources by comparison with their competitors overseas.
- 55% of Australian executives interviewed have an optimistic attitude to growth, to the markets and to technology, yet they expect this growth and optimism to continue with minimal input of financial and human resources into R&D.
- None of the Australian executives interviewed believed an increased expenditure on R&D was a strategic factor in pursuing growth through technology. In comparison, 27% of overseas executives interviewed indicated that boosted R&D expenditure was the primary response.

On a slightly more positive note, while Australian executives did not see R&D as a high priority in achieving overall growth, 50% did expect to spend more on R&D.

At least there is one promising sign there. And I believe there have been others recently, particularly in the opinions expressed and actions taken by business groups such as the Business Council of Australia and the Metal Trades Industries Association.

The Australian position stands in stark contrast to the US situation. *Business Week* reported in July that R&D expenditure by the 820 companies in its R&D scoreboard — which range, as it says, from 'the battered industrial giants of the Rust Bowl to the high tech darlings of Silicon Valley' — shot up by 14% last year, the biggest gain since R&D spending began a steady climb in the late 1970s.

The biggest spenders were IBM which foosted R&D spending by 25% to US$3.2 billion and General Motors, up 18% to $3.1 billion — about 10 times CSIRO's total budget. Other big spenders include AT&T ($2.4 billion), Ford Motors ($1.9 billion), DuPont ($1.1 billion) and General Electric ($1.0 billion).

The Government is doing all it can to establish the right policy environment, in terms of providing both a favourable general economic climate and an appropriate industry policy. In doing this we reject the ideological extremes of leaving everything to market forces, or of massive government intervention and direction.

One of the most challenging tasks we face is to achieve greater co-ordination between policy instruments available to government at all levels. State purchasing preference schemes, state offsets policies and a wide range of inconsistent regulations are among the problems. Even at the Federal Government level there is the difficulty of co-ordinating the direction and activities of an array of government departments and agencies which have an influence on industry policy development.

Of particular importance to science in Australia is the 150% tax deduction on R&D investment introduced this year. We are optimistic that this will not only reverse the decline in R&D performed by the private sector but also increase its funding of research in public sector research institutions.

But the tax incentive will not work if industry feels little need to spend on R&D. In the final analysis, we have to understand that the task is a shared one — between you, the scientists, we the government, and industry. We have to break down the cultural barriers and institutional rigidities that separate us, to free up the flow of ideas and people, particularly between research institutions and between them and industry.

As I said in my opening remarks, there is a growing recognition of this need and a willingness to do something about it. But it is still very slow. The sleepers are taking some time to wake. There remains the hard work of translating this recognition and willingness into concerted and concrete action, to make the most of the tremendous human and natural resources this country possesses.

Final words

I have discussed the role of science in terms of its economic, social and cultural objectives — mainly economic: that is, technological innovation and the generation of wealth. In these terms, the function of science is to do research and to educate and train others, towards these objectives. This has been my focus because it has been the focus of public debate and political decision making.

But science has another function, a moral one. That is to ensure that the community is made aware of the directions and the results of science: its promises and limitations, its benefits and risks. Scientists are by no means the only people qualified to comment on these matters, but their intimate involvement in scientific developments makes them well placed to consider the implications of those developments. CSIRO is to be commended for encouraging its staff, in its new guidelines on public comment, to talk not only about their work, but also to contribute to public debate on scientific and technological issues relevant to their expertise.

Professor Gerald Holton, of Harvard, discussed this issue in an article in the *Times Literary Supplement* 2 November 1984) headed 'Do scientists need a philosophy?' He noted that, at least amongst physical scientists, 'the immense forward thrust today is neither enlightened nor diverted by epistemological debates of the kind that engaged so much energy and attention in the past, through the first half of this century.'

While Einstein and his fellow students read Plato, Spinoza, Hume and Mill, the Nobel Prize winning physicist Sheldon Glashow and his fellow students read Velikovsky and L. Ron Hubbard. Holton suggests that today's scientists have redirected this 'energy of explicit philosophising' into another branch of philosophy, namely ethics.

'To a degree unimaginable a few decades ago,' he says, 'scientists are discovering that there is a morality which the enterprise of science demands of itself — even if such concerns are as yet expressed only by a small fraction of the total community. Indeed with about one-third of the world's scientists and engineers working directly or indirectly on military matters while the arms race proceeds unchecked, this transfer of attention from epistemological to ethical problems may be too little and too late. At this ominous junction of science and history, as we watch the growing reign of the irrational in world affairs, the debates of former times to give precision to scientific rationality seems curiously antiquated. Perhaps this redirection of philosophical concerns signals a growing awareness that the process of scientific innovation is not in danger — but that humanity is.'

Thus, in a very real way, the more effective harnessing of science to revitalise industry and generate wealth — the source of so much debate in Australia today — is only a start — and the easy part.

Notes

1. This paper is a slightly modified version of the 16th Lady Masson Memorial Lectureship delivered at the Chemistry School, the University of Melbourne on 1 October, 1985.

University fees

Senator C. J. Puplick

Liberal Senator for New South Wales
Parliament of Australia

The tertiary fees debate[1] continues to be an open-ended one shaped by requirements to balance the issues of social equity, individual capacity to pay, the desirability of widening access to tertiary education and the right of the public to expect their tax dollars to be properly spent.

The Whitlam Government abolished fees on 1 January 1974, at the time estimating that the cost would be in the order of $27m for university fees and $7m for technical college fees.[2] It is interesting to note that the total outlays by the Commonwealth on tertiary education in 1972-73 was $262.8m, but in 1973-74 tertiary education expenditure was $524.3m, an increase of some 100% over the previous year. This increase in direct Commonwealth expenditure was offset by an equivalent reduction in Commonwealth grants to the States in that year.

Let us compare those figures with the amount now spent on tertiary education by the Federal Government. The 1985-86 estimate is $2,517.2m. This represents an increase in money terms of some 380% over the past 12 years. However the real increase in tertiary education spending from 1975 to 1985 is negligible (6.3% increase in real terms over the period)[3].

As part of its attempts to wind back levels of Government expenditure, the Fraser Government attempted to reintroduce fees for second degrees, but the measure failed in the Senate in November 1981.

The report of the Committee of Review of Student Finances noted in March 1983:

The selective introduction of fees in this way ignores the need for a strengthening of research activities, and the need to encourage new skills and upgrading in a time of rapid technological and economic change. Fees would impose even greater hardship upon postgraduate students without awards and act as a further disincentive to disadvantaged groups.[4]

This view of course raises two quite distinct questions, the first related to postgraduate degrees, where I think the argument is well founded; and the second to the impact of fees on the socioeconomic mix of tertiary students, where I think the argument fails.

The history of fees is an interesting one from the Federal Government's perspective. The Commonwealth, prior to the Second World War, had no funding role in the university sector, however the wartime shortage of graduates led the Government to assume some financial support for the universities and some students. Living allowances and tuition fees were introduced in 1943.[5]

This arrangement continued until the introduction of means tested scholarships in 1951. This Commonwealth Scholarship scheme was expanded in 1966 and by 1973 40,760 university students and 10,567 CAE students were receiving scholarships.[6] There was, I believe, a general acceptance that the Commonwealth Scholarship Scheme worked in a very satisfactory fashion and indeed for most of its existence it was further complemented by a widespread existence of other scholarship schemes. One of the most regrettable consequences of the decision of the Whitlam Government to abolish fees was to provoke the collapse of other scholarship schemes such as those provided at Education Department Teachers' Colleges, or by other State Government Departments such as Agriculture, or by the private sector which offered various tied scholarships.

The economics of fees

Students on campuses around the country have expressed their opposition to the concept of the re-introduction of tuition fees.[7] This is not surprising as no-one likes the idea of paying for something that is presently "free". Some students have responded in surveys that the re-introduction of fees would cause many to postpone or cease their studies.[8] It was argued by Malcolm Fraser when the Whitlam Government abolished fees that the fees system encouraged students to work hard and pass examinations and that the abolition of fees would require the universities to scrutinize standards even more.[9] This argument has been counterbalanced by others claiming that it is the parents who would be paying the fees for a large proportion of students so there is little incentive for the students to perform except out of obligation.[10]

It is important to ask whether the abolition of fees in fact had any impact upon the socioeconomic mix of students in higher education and whether it in any way achieved its stated objective of benefiting the 'socially disadvantaged'. A survey undertaken by the University of Melbourne and published recently in *The Bulletin* seems to indicate that there has been very little change in the social composition of the students attending that university:

Taking figures for 1962, when tertiary fees were charged, the enrolment make-up comprised 58 percent of students from the high income bracket, 22 percent from the middle and 20 percent from the lower income area. The academic year following the removal of tertiary fees (1975) showed a student body composed of 55 percent from the upper income bracket, 18 percent from the middle income section and 27 percent from the lower income area. The 1980 survey showed that 55 percent of students were from the upper income area, 19 percent from the middle and 23 percent from the lower income bracket.[11]

This evidence shows that when compared with the distribution of the workforce as a whole, the children of upper income families have a much better chance of attending university than their counterparts in lower income families, regardless of whether fees were being charged or not.

There have been other studies on the consequences of the abolition or possible re-introduction of fees. D.S. Anderson *et al* produced a comprehensive report on the social composition of students since the abolition of fees. Their conclusion was that at best, the abolition of fees has had some effect on the accessibility of higher education, but at worst, it could be seen as a further benefit to the economically advantaged at the expense of the average taxpayer.[12]

More recently Anderson has claimed that his research has been misused and that the 'effect of the abolition of fees would take six or seven years to become clear'.[13] He believes that the work he did in 1979-80 had shown that there was some movement towards greater 'equity' in tertiary education.

Don Smart and others in a recent paper 'The Hawke Government and Education' have concluded that the essential return to 'pragmatic' education policies, including the possible re-introduction of fees along the lines suggested by Senator Walsh with

Hawke's approval, may well lead to 'a set of educational policies which are destined on balance to increase rather than reduce inequalities in our society'.[14]

A recent article in *The Australian Bulletin of Labour* written by R.D. Linke *et al* concludes that the universities have shown a reduction in socioeconomic enrolment bias, but that other areas of the tertiary sector have not fared so well. I think it worth quoting part of their conclusion:

On the surface it [the abolition of fees] would appear to have had no effect at all, though this ignores the possibility of a moderating influence on other circumstantial changes of a more discriminatory kind, such as the subsequent abolition of teacher education and other vocational training scholarships which, together with the dramatic rise in youth unemployment and reduction in teacher education provision experienced during the late 1970s might well have had a more pronounced effect on lower socioeconomic groups. Nevertheless it is difficult to see from these results how the abolition of fees could alone have sustained any consistent and substantial pressure toward greater equity in higher education participation.[15]

After reviewing several other studies on this question, Anderson himself has now concluded that:

the social mix does not appear to have altered significantly over a period of twenty or thirty years, and that there appears to have been no change following the introduction of TEAS and the abolition of fees in 1974.[16]

The fees proposals put forward by various sources have not much to do with actually meeting the cost of the university education. Rather they combine measures to recover some part of that cost so presumably more places could be provided, or that assistance to some students could be improved, together with a consequential improvement in the financial independence of the tertiary institutions themselves.[17]

There are two main suggestions for the implementation of fees for tertiary study. The first method would involve the universities collecting the fees and being able to keep the money to fund part of their operation. Prior to the abolition of fees, some institutions received up to 17% of their revenue from such sources. This has, on the whole, been rejected by the universities as being an administrative burden and an unwelcome and unfair method of making the universities de facto tax collectors.

The second method would keep the universities fully funded by the Federal Government. Under the proposals presently being examined the universities would not be direct recipients of the fees moneys. It is likely that the money would simply be used to partially offset the cost to the taxpayer of providing tertiary education, although it has been mentioned that the money could be used to assist some students with their financial problems by directing the money into the TEAS scheme.[18]

As an aside, this of course would mean that the universities would not have any independence in funding arrangements, but even with a small measure of non-government funding the universities would still not be in a much better position to call the shots. The Government will always be able to direct the overall development of the tertiary education sector as it desires.[19]

The current Finance Minister, Senator Walsh, has proposed two quiet different methods for the re-introduction of fees. His first proposal envisaged the charging of tuition fees at the rate of 15% of average recurrent costs (currently estimated at $1400 for university students and $900 for CAE students), but there would be TEAS-type income tests for all first degree students, those students falling below the income levels set not having to pay any fees. Under this proposal Senator Walsh estimates that some 40% of students would be exempted totally and some 20% partially exempted.[20]

In July Senator Walsh expounded a new proposal which featured universal fees and a loans scheme administered through private financial institutions to enable students to meet the fees. The loans would be repaid at a set rate when graduates' income reached $15,000. The Minister stated that even if all the students defaulted then the cost to the Federal Government would be no more than it is presently.[21] (It is fascinating to note that in the United States, where a somewhat similar scheme is in operation, over the past 25 years over 1.5 million students have failed to pay back some $1.8 billion in loan debts.)[22]

Liberal Party policy development

The Liberal Party is currently undertaking a review of its policy on tertiary fees as part of its overall review of education policy, and while no final decisions have been made, the following points will certainly be borne in mind as the new Shadow Minister, Peter Shack, considers the options.

It is fundamental to the Liberal Party's position that the existing level of funding for places at tertiary institutions be continued. A Coalition education policy will endeavour to increase the number of places at universities. One option for consideration is the introduction of a fee-based supplementary entry for those students who failed to gain supported entry to a course but who could afford to pay the fees to attend that course if places were available. Such a scheme is already available for overseas students in Australia.

Student loans would be part of any such package to allow low income students to defer payment of the fees until such time as their income is high enough to afford repayments.

Two other planks of existing Liberal Party policy should be noted at this point as both impact upon this question.[23] Our policy pledges us to close the gap between TEAS (or any similar student support scheme) and the Unemployment Benefit, a gap that has widened under the Labor Government and secondly we are committed to the introduction of an 'Open University' based upon utilisation of the domestic satellite and other modern technology. The latter proposal of course would significantly extend access to education services at minimum costs to consumers.[24]

A possible model

What is needed is a model which will solve some or all of the following problems which arise from that facts that:

a) lower socioeconomic groups are presently disadvantaged in access to education;
b) higher socioeconomic groups are deriving private benefits from the transfer of resources to them from the public purse;
c) there are insufficient places at universities and colleges for those who are qualified;
d) there needs to be greater responsiveness by the universities' administrations to the demands of the market (students and employers being the principal consumers of education);
e) there is a need to maintain quality of education;
f) total government expenditure needs firmer containment.

Are there answers to these, in some cases, conflicting problems?

One concept proposed is a 'voucher' system whereby students or parents are given education 'vouchers', won by attaining the required educational standard, to enable them to 'pay' for a place at university in the course of their choice. This system has its problems insofar as there would be difficulties in the determination of how much the vouchers should be worth, how transactions would work and how social inequity manifest in the school system could be reduced. However none of these problems is insoluble and the voucher system, not unlike the way the old Commonwealth Scholarship Scheme worked, has great attractions provided it is combined with adequate levels of student financial assistance.

If fees were to be re-introduced it could be done in a number of ways. One method would only charge fees to those who could afford them. To means test fees as TEAS is means-tested would present some dilemmas however; would the government means-test the parents' income or that of the student? What would be the criteria for independence if the means test was on the parents' income? If the means-test was on the student's income how could indirect parental support be taken into account? These questions raise many of the same problems that are faced now over the whole student finance issue.

The means-tested model would allow about 40% of the present student body to still attend university and not pay any fees; an additional 20% with only partial fees.[25]

Another system could be the universal re-introduction of fees in conjunction with a comprehensive scholarship scheme. This model would charge all university students a modest fee, with scholarships available on the strict application of the merit principle. Students who could not afford fees and who failed to qualify for scholarships, and who needed additional financial support would be able to take out loans that could be paid back upon completion of the degree.

In addition to those students who are paying a portion of the cost, there could be extra places made available to overseas students and others who would be willing to pay full fees (that is the total average cost of the degree). A problem of course with this is that the standards of the universities could decline if care is not taken to only allow students to enter under these conditions who have otherwise qualified on the basis of educational merit.

Into the future

Could we see private universities?

It is quite possible that with the re-introduction of fees the impetus to make tertiary education more responsive to the market place will also lead to private universities. These institutions could be funded by endowments and fees and might work along the lines of similar institutions in the United States. They should **not** be government supported in a financial sense but could be credentialled through the usual CTEC arrangements.

I do not intend to discuss this matter in detail, only to say that I regard it as a most worthwhile and exciting concept. Within Australia, the proposals advanced by Dr George Fane in a study for EPAC are worthy of close analysis.[26] The recent Federal Government trade and education mission to South East Asia identified a real need and interest for this development within our region with potential revenue raising capacity of up to $100m annually.[27] For both educational and international relations reasons the proposal must now be taken seriously.

There are other options open to the universities to improve the quality of education and to cut down on waste and inefficiency. For example I favour a significant reduction of tenured academic positions in favour of more contract employment.

There is also, in my view, a need to separate out and provide separately, funding for research from the general grants to universities, thereby ensuring that research is not cut back within university budgets and that internal economies are forced in the areas where they are most needed, i.e. administration.

Conclusion

The debate over the possible re-introduction of fees remains an open one. It is clear that the simple abolition of fees has failed to achieve its stated objective of altering the socioeconomic mix of the student population or redressing the imbalance apparent against students from less privileged circumstances. Once again this piece of 'social engineering' like so many similar experiments has turned out to be another example of 'middle class welfare', relieving the obligations to pay from the shoulders of those able to afford it. A university degree is a valuable resource, it confers long-term real financial benefit upon the recipient (especially in disciplines such as medicine, dentistry, law etc) and I see no reason for those advantages to be provided at subsidised cost to those capable of paying. Provided that financial and other assistance is available and adequate to support those who, being otherwise qualified for university entry, would be economically precluded from university entry, it seems to me that the balance of the evidence and arguments favours the re-introduction of fees.

In the long run, however, the real challenge of the Australian education system lies not in the tertiary sector, but in the schools. Until we get our primary and secondary education sectors running at levels adequate to meet the challenges of the 1990s and beyond, all the rest is rather peripheral — but that is another question entirely!

References

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2. *House of Reps. Hansard* 23 August 1973, p. 320.
3. see Department of the Parliamentary Library Basic Paper No. 2 1985, *Commonwealth Involvement in Education*, p. 30. *Tertiary education expenditure as a percentage of Total Budget outlays 1973-74 to 1985-86 (est):*

73-74	4.1%
74-75	5.2%
75-76	4.6%
76-77	5.0%
77-78	4.9%
78-79	4.8%
79-80	4.5%
80-81	4.6%
81-82	4.5%
82-83	42.%
83-84	3.9%
84-85	3.8%
85-86 (est)	3.8%

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19. Don Anderson, 'Tertiary Fees and the social mix' in *Vestes*, 28, 1, 1985, p. 20.
20. Jane Smith, 'The case for restoring tertiary fees', in *The Bulletin*, 30 July 1985. See also: Michelle Grattan, 'Ministers differ on tertiary fees' in *The Age*, 20 February 1985; and Senator Walsh's letter to *The National Times* on 3 May 1985 headed:

'Educating the wealthy at the expense of the needy'.

21. see Gregory Hywood, 'Walsh tests waters again in uni fees debate' in *The Australian Financial Review*, 11 July 1985; Michelle Grattan, 'Walsh urges uni loans, fees system' in *The Age*, 11 July 1985; Mike Steketee, 'New battle to make students pay' in *The Sydney Morning Herald*, 11 July 1985; and Liz Glasgow, 'Walsh pushes loan scheme for university fees' in *The Australian*, 11 July 1985.
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24. see details given in my speech in the Senate, *Hansard* 8 May 1985, pp. 1538-40.
25. Senator Walsh's letter to *The National Times* on 3 May 1985 headed: 'Educating the wealthy at the expense of the needy'.
26. see David Barnett, 'Ryan rejects plan for privatisation' in *The Bulletin*, 9 July 1985, pp. 53-5.
27. see Florence Chong, 'Australia's Latest Export Commodity' in *Business Review Weekly*, 16 August 1985, pp. 35-6; also 'Education: Our New Export Industry?' editorial *The Australian*, 5 September 1985.

Intellectual property in the context of research-industry collaboration

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Introduction

This article considers the legal and social implications of the collaborative arrangements being made between research institutions and private firms for the development of new technologies. It focuses on the intellectual property policies and strategies that may be developed in this area.

It identifies the forms this collaboration may take, and discusses in turn the disposition of intellectual property rights between the employer and employee, and the customer and contractor, in the context of academic and other public research institutions.

It is interesting that the promotion of these arrangements should find a place on the national agenda at this particular time. A 'consensus' is emerging in favour of intensifying high technology development and, to this end, of applying public research institutions to the industrial and commercial potential of their work. Someone familiar with the structure of the Australian economy and its record in high technology development might remain unmoved by the current fashion until he or she sees the evidence of an increase in investment in this area, but it would be ungenerous not to acknowledge the recent efforts of various government departments in generating interest in high technology development through a series of conferences, enquiries, and the like. The governments of Australia are taking a more and more active role in the promotion of new technology, no longer content to leave the management of technological change to industry and the market[1].

It goes almost without saying that co-operation between the 'state' and industry operates on several levels. For example, governments provide much support for high technology activity through a range of general policies concerning taxation, tariffs, energy, communications and so on. Within the legal sphere, support and facilitation take the form of property laws, laws of economic association, and even, on one interpretation, liability rules, licensing schemes and other forms of regulation which settle responsibility for the costs of high technoology activity. This paper however concentrates on the direct contractual arrangements between the public and private sectors, rather than on the sorts of policies of government which provide a backdrop for high technology activity.

In analysing the progress of high technology development, several stages can be identified, beginning often with basic scientific research[2]. High technology may originate in pure science insights and techniques, moving on to strategic, mission-oriented research, designed to solve industrial and social problems, the products of which are in turn applied to find solutions to the specific, short-term needs of industrial undertakings. Prototypes of processes and products are then developed and, if feasible, production and distribution are mounted on a commercial scale. In fields such as bio-technology, the firm distinctions between research and production break down, as science itself gears up on an increasingly industrial scale, and high technology development becomes much more an integrated than a serial activity[3]. It continues however to require a variety of inputs, and so the conditions may vary under which various forms of capital and labour are made available.

To ensure greater co-ordination between research and production, collaborative bodies have been established to identify areas of need and steer programs designed to meet those needs; a good example is the CSIRO's Advisory Council. Many of these bodies do not create essentially legal relationships; it is not common in this country for their deliberations to be subject to the administrative law standards of due process and *intra vires*, for instance. (Comparison can be made with the United States where it could be alleged in a suit against UCLA-Davis by the California Rural Legal Assistance that research into the mechanization of agricultural production was contrary to the University's charter[4].) This is not to say that the legal capacities of those research institutions which are statutory authorities do not require attention; so too the scope of the memoranda of participating companies.

It is of course the closer, project associations between researchers, industrialists and financiers, which have the most concrete legal consequences.

Forms of association

These associations have been of several kinds. Particularly in the United States, large private corporations have provided research centres with funds for basic research work[5]. And of course government, through a variety of agencies, has provided funds for such work — in Australia, most of the money for fundamental research comes from the public purse, going to the CSIRO and to the universities.

Mission-oriented government agencies and industry associations provide funds for generic solutions to problems facing sectors; major sources of this complexion in Australia are the Defence Department, the National Health and Medical Research Council, and the statutory agricultural produce corporations. Unlike the United States, most of this money goes to public research institutes and universities. Finally, private and public firms may act as customers and outlets for applied research. In Australia, it seems, much of this applied research is actually done in-house, if at all, and it has been rare for firms to contract out to public institutes and universities; rare too for research institutions to find commercial firms to finance and market inventions. It is this pattern which is meant to change.

In the range of legal forms available for such research and development activity, the parties may be involved in an employment relationship, as independent contractors, in a joint venture, in an unincorporated association, in a partnership, or as members of a company or a statutory authority.

As essentially heterogenerous participants in a sophisticated, purposeful undertaking, the parties are likely to seek a form which creates sufficient identity and security for the undertaking but at the same time allows each of them some flexibility and autonomy; in other words, the parties need a form that puts the undertaking on a footing to attract resources but which allows them room to perform their different functions and maintain their individual 'integrities'. For those constituting the undertaking, then, the lawyers list several considerations: (1) maintaining the identity and continuity of the undertaking so as to bind the participants and to present a face to outsiders in order, where need be, to attract loans, subscriptions, grants, tax allowances and the like, (2) controlling and managing the undertaking, its costs, schedules, and membership, (3) preserving the independence and autonomy of the participants in the conduct of their part of the operation, establishing their individual shares, protecting personal assets, and limiting joint and several liability for tax, harm to outsiders, regulatory offences (including restrictive trade practices) and so on, and (4) adapting the undertaking to changing circumstances and dissolving the undertaking once the project is at an end[6].

These considerations establish some very practical criteria by which to choose the form such arrangements are to take. To the extent that the parties are willing and able to agree, they may best translate these considerations in to practice through the express terms of a contract. But care will be required in the formation of the relationship, for, in doing so, they may constitute sufficient of the ingredients of a distinctive form of economic association recognised by the common law or by statute, thereby attracting obligatory incidents to their relationship and perhaps rendering inoperative some of their own provisions.

It is here that the advice of commercial lawyers needs to be taken. For example, a 'partnership' allows the parties freedom to regulate their internal affairs and requires little in the way of documentation, but a business carried on in common for profit involves joint and several liability and a sharing of proceeds and assets. A company limits the liability of members, and provides continuity in legal personality, but the affairs of companies, especially public companies, are the subject of substantial external regulation, and their proceeds are taxed twice, once in the hands of the company and once in the hands of the shareholders or employees; capital gains, however, through the increase in value of share equity, are not taxed. (The current tax reforms indicate that such conditions are subject to change.)

The American venture capitalist, Johnson, charts how the form and the membership change as the technology progresses from initial research to industrial operation[7]. In the initial stages of invention, the collaborative relationship is likely to be one of 'doer' and 'provider', the exchange of skilled services for support, taking the form of either an employment contract or a joint venture agreement. As the activity proceeds to development and commercial exploitation of the invention, a partnership or private company may be formed, and at some stage the firm may go public or hand over to an established corporation.

In the discrete, contractual association, the terms of the association, including the distribution *inter se* of intellectual property rights, might largely be regarded as a domestic affair. However there is a second set of 'external' considerations, that conceivably might also need to be operationalized. Given the importance of high technology activity to the national interest, it may sometimes be an issue whether such matters as the distribution of intellectual property rights should be left wholly to the parties or should be regulated according to an appropriate public policy.

In constructing a public policy about the distribution of property rights, several criteria vie for attention[8]. One that remains compatible with the parties' own view is the freedom with which the participants in high technology activity may determine their rights and obligations. A policy might place a premium on distributions freely made, not only because freedom is valued itself but because it is regarded as the best means to further some external goal such as research efficiency. Still, it might be conceded that in some cases freedom of choice is inhibited by 'transaction costs', lack of information, or lack of bargaining power, and that some intervention is justified in order to overcome these inhibitions or to supplant the choices so constrained. The policy then needs a criterion of its own by which to guide government intervention. In relation to research and development, the measure most often cited is the level of innovation, and the legal regime is accordingly judged by its capacity to act as an incentive to innovation. Opinions can differ within this approach about the appropriate recognition and location of intellectual property rights. But the formulation of a policy is further complicated by the claims of such other legitimate considerations as 'reward for meritorious work' and 'the public interest'. While it can be possible to reconcile the various considerations — rewards for meritorious work may encourage innovation, and innovations may promote the public interest — sometimes conflicts will be encountered. There seems to be special concern about conflict where one of the parties is public or academic in character and the other is private or commercial.

The employment relationship

The distribution of property rights between employer and employee is of course not a new question, and so a considerable body of law is available for the guidance of the parties. The common law has given precedence to the express terms of the particular contract of employment. Employers have frequently availed themselves of this facility in obtaining the agreement of their employees to the assignment of intellectual property rights to the employer. In the absence of an express term, the common law has identified an implied term to the effect that the employer is entitled to the benefit of inventions made in the normal course of employment and so, for example, made in circumstances where the employee is employed to invent or directed to invent. Additionally, as part of an implied duty of fidelity to the employer, the employee is obliged to disclose any inventions he or she has so made and to respect any technical information of a confidential kind obtained in the course of his/her employment. The rights to inventions not expressly defined, or implicitly owed, or taken up by the employer, reside with the employee.

In Australia, there is no real legislative interference with these common law rights. The *Patents Act* 1952 (Cth) does not require the application be made by the inventor, and patents are regarded as a form of property that may be freely assigned to another or for which another may be licensed exclusively or non-exclusively to work the invention.

Within such a legal policy, the allocation of any rights to inventions will depend largely on the employer's attitude: ordinary employees, if they want special terms, will have to rely on the goodwill of the employer or the strength of their