# A NOTE ON JOB CREATION IN HIGH TECHNOLOGY INDUSTRIES AND LOCAL ECONOMIC PLANNING

**Peter McLoughlin**

*The results of a number of studies sponsored by the Californian Commission on Industrial Innovation concerning the job generating potential of four major high technology sectors are reviewed. The prospect for increased employment opportunities may not be encouraging. Likewise a recent Melbourne based case study finds that businesses which introduce new technologies coupled with reorganisation methods (an increasingly common strategy as companies strive to remain profitable) have predominantly negative effects on employment. On this basis local economic planning proposals which rely heavily on small firm sector attempts to promote industrial innovation are regarded as suspect. Instead, it is argued, local policies designed to create jobs would do better to concentrate on community service programmes. In addition where subsidies to industrial innovation persist they should at least be directed at medium to large size locally based firms through the medium of Development Corporations or Enterprise Boards.*

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Given the prevalence of commentaries berating the likely impact of high technology applications on unemployment levels in almost all sectors another article in the same vein would, perhaps, seem somewhat superfluous.[1] Nevertheless it is felt that the results of a number of studies sponsored by the Californian Commission on Industrial Innovation concerning the job generating reality and potential of high technology industries deserve further consideration.[2] Using questionnaire surveys and interviews with firms in four major high tech sectors (photovoltaics, robotics, computer software and biogenetics), these studies examine the processes and problems restricting employment and industrial growth in the respective sectors. Their findings are mainly designed to provide policy guidance to the Californian Commission for the planned development of the four sectors and yet cast serious doubts on the capacity of these industries to create substantial new employment in the foreseeable future, let alone jobs which are well paid and sustainable in the long term.

When viewed alongside some of the results of a different survey which in part analyses the association between different types of technology and employment change in sampled Melbourne based companies between 1976 and 1981, then it becomes clear that there is also cause for scepticism over the prospective lack of completely new job opportunities emanating from Australian high technology industries.[3]

First then a summary of the American evidence.[4] Taken as a whole the four Californian studies suggest that high tech industries can and do produce significant employment opportunities. In certain individual instances astonishing rates of job increase, upwards of 50 per cent per annum, have been recorded by the surveyed companies. Despite this the job generation picture for the remaining years of the 1980s does not look rosy. The studies stress that further rates of employment expansion are expected to drop below 10 per cent and probably less than 5 per cent per annum as the decade proceeds. Though some would argue (quite rightly) that these rates of increase are perfectly respectable given the prolonged nature of the present world-wide recession, the point to grasp here is that previous job gains were derived from a generally small job base in the first place. As such the absolute number of jobs created is unlikely to impact greatly on prospective unemployment levels. Recourse to the results from each individual study reveals why (see Table 1).

By 1990 then these four sectors are expected to provide some 600,000 jobs. However there are good reasons to suspect that even this seemingly conservative total may be something of an overestimate.

**Table 1**

**Employment Projections for Selected Californian High Technology Industries**

| Sector | Current Employment (1982) | Estimated Employment by 1990 |
|---|---|---|
| Photovoltaics | 2,400 | 5,000 |
| Biogenetics | 5,000 | 44,000 |
| Robotics | 10,000 | 100,000 |
| Computer Software | 250,000 | 450,000 |
| TOTAL | 267,400 | 599,000 |

Source: Californian Commission on Industrial Innovation, Department of Businees and Economic Development, Sacramento, 1982.

For example, the photovoltaics sector has achieved dramatic market expansion by any standards throughout the 1970s and early 1980s and yet this growth has not been reflected in job generation of like proportions. Why? Simply due to the equally impressive labour productivity gains made by firms over the same period — productivity gains which, incidentally, are seen as crucial to company survival in the photovoltaics sector.[5] In like manner the biogenetic and robotics sectors display similar if not as remarkable trends. Furthermore, apart from the more or less inevitable job displacement elsewhere in the economy accompanying the continued growth of the four sectors (this amounts to an estimated replacement of 440,000 jobs by the robotics sector alone[6]), a more alarming development is anticipated in the software sector.

It is almost certain that shifts away from software services towards software products as the decade progresses will produce a surplus of software engineers.[7] In fact with the attendant gains in productivity which this shift entails, retrenchments are likely to take place within the software sector itself. Since this is the sector which shows most promise in terms of the absolute numbers of potential jobs generated by 1990 the importance of this finding cannot be over-stressed. In addition, the expected extra employment spin-offs from all four sectors do not warrant much enthusiasm. Markusen demonstrates as much by placing the tentative job creation figures into the broader economic context thus:

> If we generously estimate total related support jobs generated at four times this direct job creation, the total number of high tech jobs in these sectors would amount to about three million in 1990. While this is substantial, it pales in comparison with the estimated 25 million jobs needed to compensate for jobs expected to be displaced by high technology.[8]

Apart from the fact that a multiplier effect of four times is obviously a very generous estimate, the majority of the additional jobs generated will also probably be found in clerical, service and assembly occupations. Unfortunately these are precisely the jobs which are either generally low paid or removed overseas and replaced by greater machine productivity as firms attempt to cope with the deteriorating economic circumstances the future seems destined to bring. Again this leads to a further reduction in the expected job creation benefits associated with the four surveyed high tech sectors.

As far as the Australian case study is concerned the evidence by comparison is restricted, being confined to an analysis of new technology inputs rather than high technology industries *per se,* but nonetheless looks initially much more promising. Although no future figures of employment created through the introduction of new

technologies are predicted, it does seem that on past performance certain Melbourne based companies have generated significant employment opportunities as the result of new technology incursions into their business operations. What is more, in terms of workforce composition the effect on the blue collar segment has been largely beneficial.[9] Skill levels have in fact increased contrary to popular expectations of deskilling but with one very important caveat.

Where new technologies are introduced in conjunction with reorganisation methods the employment effects are predominantly negative. Since production reorganisation is actually becoming an increasingly common strategy amongst firms striving to remain profitable under progressively adverse economic conditions,[10] further applications of new technological developments in industry as a whole are likely to be more severe in their impact than identified in the past.[11]

Obviously these findings raise several important questions over the advisability of policies designed to promote economic development and employment based on subsidies to industrial innovation. The American evidence in particular suggests that the pursuit of a "Silicon Valley Model" policy option elsewhere is unlikely to produce anything approaching future employment requirements. Indeed the adoption of a high tech strategy of this nature is at least fraught with difficulties and most probably unattainable in Australia.[12] In any case, if high technology industries are not producing or going to produce new jobs in the desired quantities and if the "technology gap" is lessening all the time as Tisdell suggests,[13] then attempts to gain technological sovereignty (seen as the Australian policy-makers' principal concern[14]) may be regarded as uneconomic if not downright wasteful of scarce resources. Australia, whilst lacking comparative advantage in the production of high technology industries,[15] is far better placed to import such technologies as a means to continued economic development.[16] Even so, the evident intransigence of policy formulators presents a difficult obstacle to overcome.

The imperative to hitch a ride on the high tech bandwagon remains strong. It finds acceptability in the prevailing dogma favouring a small firm sector revival especially in many locally based plans for economic regeneration.[17] Yet it is precisely this orientation towards small firm sector measures which confounds local government involvement and compounds policy problems associated with high technology industrial development strategies.[18]

The rationale for assistance directed towards the small firm sector in order to promote high technoogy industries and job generation is definitely questionable. Although it is frequently held that small firms have a particularly important part to play in the creation of new products and new technologies, the extensive body of literature on

firm size and innovation is quite divided on this point.[19] It may be true to say that small firms are more cost effective when undertaking research and development but this is so only when it actually happens.[20] In reality the supposed innovative abilities of new and small firm entrepreneurs merits severe criticism regardless of the evidence presented by Jewkes and his colleagues in their classic study.[21] In fact at least two-thirds of the 70 successful innovations cited in Jewkes' study only became commercially viable through the activities of large firms.[22] Moreover well before multi-national organisations had gained the economic ascendency they now possess, the research and development activities of smaller firms could be regarded as suspect.[23] "Inventors" or "product innovators" are few and far between as the recent work of Cross and Storey confirms.[25] In addition both the American and Australian case studies under review reinforce this point.

Three of the four high tech sectors examined by the Californian Commission on Industrial Innovation are highly concentrated. Only in the computer software sector do small firms display any dominance. However the increasingly oligopolistic nature of competition, wherein small firms are subject to intense pressures to join or be subsumed by larger corporations, suggests that this process of concentration will eventually overtake if not oust the smaller computer software firms.[26] In short, high tech sectors are not small business dominated reservoirs in the economy. For the most part the role of small businesses appears to be confined to the early stages of technological development and is usually temporary. Indeed this latent dependency on larger firms reflects an emerging theme in the present procurement of new technologies — the transfer of innovation-risk from larger to smaller companies during the first uncertain stages of experimentation followed by mergers/take-overs once the successful innovations become apparent. This is certianly the case in the Californian photovoltaics sector where corporate entry by absorbing smaller firms is common practice.[27]

This innovation-risk shifting trend has important implications for local planning pursuing the small firm high tech route to economic prosperity. For example, science park strategies are likely to parody conventional supply-side planning packages since they can not guarantee the truly independent variety of high technology firms necessary to produce long term indigenous growth. On the contrary the likelihood is that science parks will eventually merely be subsidising the research and development activities of large firms through their dependants, producing a new variant of branch plant economy.

In Australia the evidence is supplementary and relates to the introduction of new technologies and firm size. Basically innovation

in smaller enterprises is uncommon and where it does take place it is to a large degree controlled or aided by the import of technology.[28] This propensity is also convincingly demonstrated by the Myers Report which reveals firms with more than eighty employees as the main sources of technological innovation in Australia.[29] However the Melbourne case study uncovers one potential aberration from the general rule.[30]

The anomaly lies in the behaviour of small scale subsidiary enterprises. Subsidiary companies are shown to form the highest proportion of firms introducing new methods and products. Although this suggests that there is some scope for including small privately owned subcontracting subsidiaries in local economic planning policies, there are complications. Specifically it is just such firms which are prone to the vagaries of multi-plant organisations, being the first to suffer as instruments of large firm rationalisation procedures.[31] Finally, as Searle points out, there is a tendency in his study for the introduction of new methods and products to be associated with lower relative employment change in the companies.[32] Thus if job creation or retention is the main objective of new technology innovation oriented policies (though by no means the only one[33]) then the use of small firm sector strategies appears contradictory.

Recognising the inadequacies of small firm high tech promotion policies is all very well but are there any serious alternatives? Fortunately yes. Two other possible policy options exist, both of which are arguably more relevant to an Australian economy which can be regarded as having already lost the high technology race.[34]

Firstly, over the past ten years or so the Dutch Government has pursued both small business and community service job creation schemes side by side. This facilitates direct comparison and it appears that on at least two counts employment generation in the community service programme fares better. In the first place the cost of creating jobs in community services is three-fifths of that in the small firm promotion schemes. In the second, the longevity or relative permanency of work in the former compares favourably with the latter.[35] Hence policies seeking to create employment using small firms as the focus of new growth are on the whole misdirected. Undoubtedly it would be more fruitful if community based labour market strategies targeted at disadvantaged groups of individuals were devised.[36] In fact the usual objection levelled at community service jobs, that their provision needs to be refinanced year after year compared with jobs generated in the private sector, deserves close inspection.[37] Many community service schemes have the potential to become self-supporting commercial enterprises once established. Equally subsidies to small firm job creation schemes may be just as ongoing and are

perhaps even more suspect given the high probability of business failure associated with such ventures. Finally, notwithstanding the Dutch evidence, it now appears that in some areas community services hold the highest potential employment generation effects for a given change in final demand in Australia as well.[38]

Secondly, although it is as yet too early to assess their impact, a number of local government bodies overseas are busily establishing Development Companies and Enterprise Boards. The remit of these organisations varies between individual authorities but basically their aim is to invest in the interests of the community and to ensure that concrete *quid pro quos* are obtained for any public sector financial assistance rendered. This usually entails the completion of Planning and Investment Agreements between the Enterprise Board and locally based but medium to large size existing companies rather than new or small firms. Such agreements may include provision of employment and investment plans, a commitment to continued operation in the vicinity, the intention to develop links with customers and suppliers within the local government area, the taking of equity stakes and so on. In this way it is hoped to avoid renegade grant stripping firms. Moreover Planning and Investment Agreements are explicitly aimed at assisting firms in the development of new products, in the application of new technologies and in sponsoring research and development activities but, importantly, it is the medium to large size firms which are the principal recipients of their aid.

A prescription to avoid small high tech firms in favour of subsidies to medium and large-scale businesses may be premature, even faulty. Firm size could prove nothing more than a red herring in the local economic planning field, being an unimportant criterion for policy discrimination.[39] Yet for a local government body with limited resources faced with the imperative for immediate action there are probably few practical alternatives. Furthermore, so far there have been no difficulties elsewhere in persuading larger firms to sign and uphold Planning and Investment Agreements.[40] This is something which cannot be said for the small firm sector.[41] For local economic planning policy the implications are straightforward. At least through the exercise of some public equity and long term financial control in selected larger companies it is possible "to ensure that such companies survive and grow, and hence help to create and preserve jobs on a scale which small firm policies can never hope to do."[42]

## NOTES AND REFERENCES

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