A back ground to the electronics industry

Ralph Slade Memorial Lecture H A Whale

Ralph Slade's interest was basically in communications and hence in electronic components since these form the raw material on which the communications industry is based. Since that time, another major industry - computers - has grown, using the same raw material so that we are now living in the communications/electronics/ computer era.

With this, the electronics components themselves have changed to be more complex (integration) so that we have a new type of raw material; the end products of yesteryear are the raw materials for today.

>Can we use this situation to resolve some of our economic problems?
> If so, why have we not already done so?

> What tactics should we adopt to improve the situation?

Can electronics help economically?

Firstly, let us look at the economy as a flow chart in block diagram. This is dangerous ground for me because I am not an economist. When economies were stable, we accepted the simplified system:

Refer fig (a)
It was a negative feed-back system and was thus stable. In New Zealand the stability was at < .5% unemployment. The requirements were that open competition existed in order that the various effects could occur. But, according to Maynard Keynes, now that wages are deter-mined by the overall cost/price structure of the economy, there is a positive feedback component that makes the system unstable unless other inputs or loops are provided. Refer fig (b)

We can, for example lower effective costs by cutting taxes and thus reduce the impact of costs on wages but since it is extremely difficult to produce an acceptable downward trend, we have the ratchet effort that constitutes inflation and continued unemployment.
The businessman's response to the situation is to attempt to contain costs by increasing efficiency: introduce automation computerisation etc. in the hope that reduced costs higher sales more employment.

Unfortunately, in a stagnant economy, any direct displacement of labour is much more evident that any indirect longer term effects on employment so that there is some opposition to this process. Nevertheless, there have been some very successful ventures into increased efficiency through computerisation as, for example, in the New Zealand banking industry which, while not directly productive, is an essential part of our production infrastructure.
The system that we have been considering above is closed in the sense that no external factors are included. The extra factor that be-comes important if increased efficiency is to be effective in reducing unemployment is that the markets for the extra products must be sought externally.

Thus, under present conditions, the main thrust for increased efficiency through automation etc. must be in those areas where the market can be expanded and,

associated with this, the most effective use of our enhanced communication / information services is in the area of market research and development for our traditional products.

This leads immediately to the next conclusion, that we must also develop new markets for new products. Part of the answer lies in further exploitation of our natural physical resources like oil, gas and electricity for smelting but the largely neglected raw material is our stock of educated intellectual power arising from a very effective educational system. These are the people who can think of new ways of doing things or of new things to do in any field: nowadays, because of its pervasiveness in all sorts of fields, new techniques tend to be mostly electronic in nature. We know that our internationally competitive standards are adequate, both intellectually through the international scientific community and commercially through those companies who have developed new products that have been successful even though long-term survival has proved *difficult* to sustain in many cases. In general terms then, we can use electronics as a means *of* assisting our economic recovery. This leads to the second question -

If this is true, why have we not been more successful?

We all know that many countries have made massive national investments in electronics and allied technologies and in most cases these have resulted in enhanced export earnings. Some of this expenditure has been largely to buy in technology (Korea and Taiwan), some to induce foreign companies to establish local subsidiaries (Singapore, Ireland) and some mainly to encourage local development (France, Baltic countries, Japan).

Actually, a mixture of all these approaches seems to be used in most countries. The most expensive method, but also the method that shows the quickest return is to buy in the technology. This was probably the most suitable method for our large development projects.

There is a short term gain but the most important gain occurs if it stimulates the development of a local technology. Persuading overseas companies to locate subsidiaries here and encouraging local companies is not as straightforward. It is a matter of establishing an environment in which they can flourish, or at the very least, survive. We can assess what this environment should be, and it is much the same for both home and overseas based industries, from the desirable at-tributes listed in the "Electronics Location File". There are eleven main factors rated by US companies in decreasing order of importance:

I - Good labour relations
II - Good transport and communications
III - Good financial aids and other incentives
IV - Skilled workforce
V - Low rent or price of real estate
VI - Good access to foreign markets VII Low wage levels in relation to productivity
VIII - Large domestic market
IX - Clean environment
X - R and D facilities
XI - Good training facilities

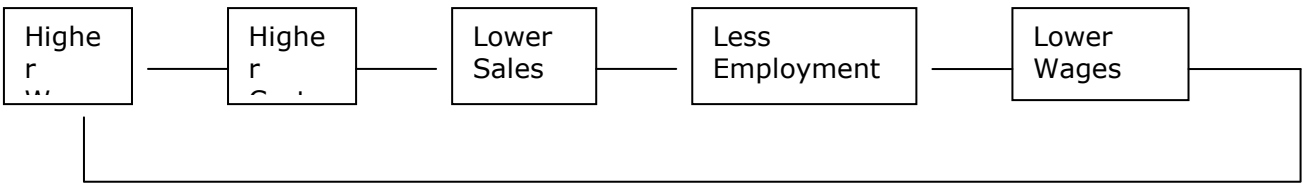
If we look at these one by one we may be able to see where our problems arise.

Labour relations - we do have our problems, but have an extreme-ly good record in the electrical and electronics industries as a whole.
Transport and communications - our communications systems, both external and internal are excellent, and our overseas air trans port is efficient and reliable but ex-pensive when compared with other routes. This is the cost we pay for our remoteness and indicates that we must compensate in some other areas.

Financial aids and incentives - although we have some direct assistance schemes the real impact comes from the indirect schemes. In particular, a relatively small company is in no position to weather a setback in sales or an unpredicted hold-up in a development programme. Almost the whole of the US electronics industry has been developed with the support of R and D contracts from Defence, NASA and other government organisations.
The guiding rule is that government departments do only enough work themselves to provide the expertise necessary to be able to monitor contracts - the two-way interchange of ideas and experience benefits both the private and the public sector. Electronic products have a limited commercial earning life since they can so easily be copied and modified slightly, i.e. registered designs, copyrights and patents are of limited value. Thus, there is a necessity for on-going redesign and development. It is in this area that the real value of government sponsorship or development contacts appears: these are not seen as direct import subsidies and are thus an acceptable part of international trading. Such schemes are almost non-existent here.

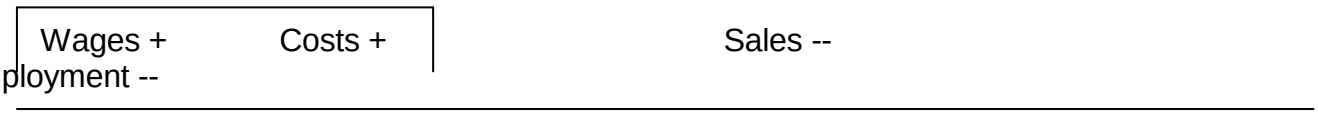
Skilled workforce- in this area of education and training we still have very real problems. It is undoubtedly true that we do have many very talented people in the general fields of computers/communications/ electronics. It is also true that not many of these were specifically trained for the type of work that they now do. This is typical of the whole range of electronics workers and is the logical outcome in such a rapidly changing area. Rapid technological change dictates that all technological training courses must be widely based - a broad area of fundamental knowledge in physics, chemistry and mathematics is necessary with specialisation only in the later years.

Fig a



Wages + Costs + Sales --
Employment --

Fig b



This ensures that the specialist content can be easily changed, that the choice of specialist subject can be deferred as long as possible, that the foundations are laid for future change of specialty if and when job requirements change such that there is a high degree of substitutability built into the work force so that shifting between specialties or changing emphasis as the technology changes is made much easier.
This seems to stress the need for education rather than training; the emphasis on principles rather than processes and indicates a need for re-examination of the role that vocational training should play in electronics education.

We have, as a nation, two reserve pools of skilled manpower that could be utilised if the demand arose.
One, of course, is in the large number of able scientists and technologists who have gone abroad, usually with the intention of returning, but who have found so much more exciting and rewarding an environment that they have stayed away. Given the right incentives in the way of a local environment, many of these would return. The other pool exists in many of our smaller government departments where such people have been necessary for the development of some project or other and have stayed on, usually as very competent administrators - a very large number of these would welcome the chance of getting back into genuine developmental work.

Low rent or price of real estate

This problem is easily solved and is well known. We have many local bodies willing to make concessions in the hope of establishing "science" or "technology parks". This, by itself, does not accomplish much but, if enough of the other factors can also be assured, it could make all the difference in the area that is finally chosen.

Access to foreign markets

The market depends on the product. We do have good access and knowledge of the South Pacific and Australian areas. Whether we can find the appropriate products is an open question.
This emphasises that there are three phases to any commercial undertaking:

- Market research to establish the proper product to make,
- Development and manufacturing,
- Establishing the market selling.

It has been maintained that we are not very good at either the first or last phase in the electronics field. If this is indeed the case, then consider-able extra effort would be well worth-while. Markets for the type of specialised product that seems suited to our economy are relatively few. If one is found, it must be cultivated and treasured; the most important characteristic of a New Zealand product should be its high quality.

We must cultivate a reputation for quality of product, delivery and service. We certainly do not need an approving authority for every New Zealand product that goes overseas but, in the absence of this, some kind of implied national guarantee. A whole market area can be wrecked by an entrepreneur who turns out to be a racketeer. This bad image has certainly occurred in the past with local markets; we can not afford to let it spread just through lack of even primitive quality control.

Wage levels and productivity i.e. efficiency

At the levels where some skills are required we still com-pare favourably with most developed line operations needing relatively un-skilled workers but this does not appear to be a fruitful field for us to enter because of our small domestic market.

Large domestic market

Whether CER will provide us with an effective domestic market that is large enough to support the development of semi-consumer goods is still not known. New Zealand is a good market for fairly sophisticated products so that our small size may not be so important a factor for the more specialised type of product, the small scale/high value device.

Clean environment

This refers to working conditions. Successful technologists are in great demand so that they can choose where to work. One of the reasons why California flourished is the very equitable climate and the high quality of housing areas, schools and facilities available here. We can match that and even improve on it in many areas.

R and D facilities

Although we are getting near to the bottom of the list, this brings out another factor that the US companies that were polled in order to generate this list did not mention because they took it for granted.

This is the whole question of an adequate infrastructure for an industry. Is there a company to make all the trivial little things like boxes and knobs p/circuit boards and special castings actually exists. Associated with this is the question of whether there is a pool of versatile expertise available to tackle the unexpected problems that occur.

An infrastructure only appears as an industry grows. We had the usual problems with a small electronics industry that it was necessary for many companies to become vertically integrated to ensure a timely supply of quality components for their own manufacture. Our professional electronics industry is still too small to stimulate a viable infrastructure but, together with a reasonably large consumer industry, it shows signs of doing so. It is certainly true that, at the moment, we need a consumer electronics industry to provide the weight for the electronics industry as a whole.

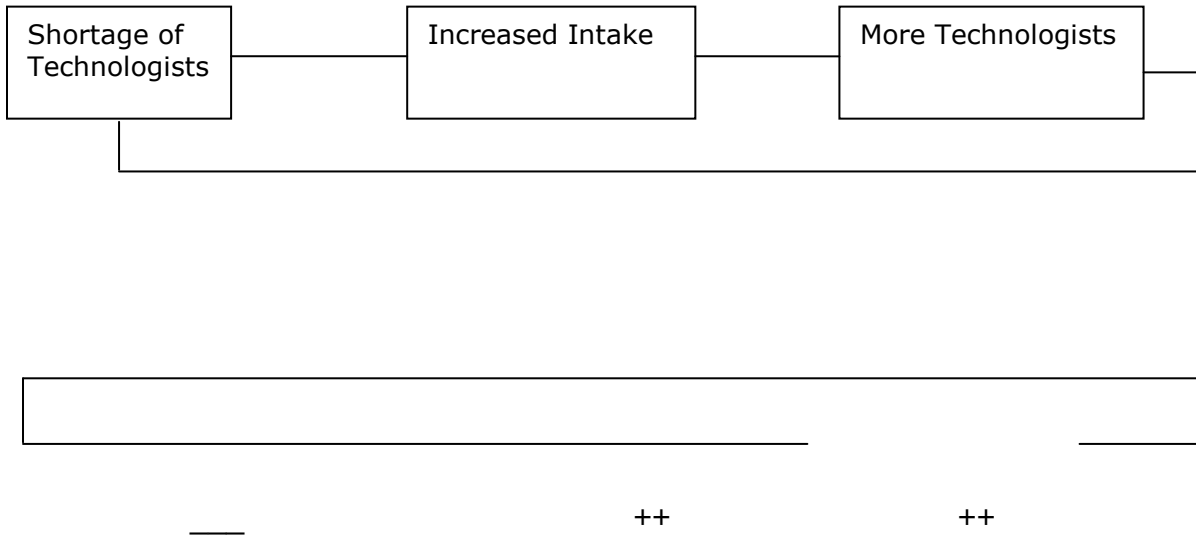
Training facilities

Have been touched on in connection with the question of skilled workforce. Recent moves towards a more flexible approach in the technical institutes are very encouraging but we still have some vested interests in this field.

In this connection it is interesting to point out just a few of the problems of predicting specialist training requirements: generally, the present demand or the projected demand is used as a criterion. Unfortunately, projections are just

extrapolations since we rarely know what the economy is going to do. Thus we have the following set-up with a five year or so delay between input and output.

Refer fig (c)



Four to five year delay

This automatically leads to a 10 year oscillation. Economists studying this problem have, in fact, found that in underdeveloped countries, in-creased intake into vocational training is associated with some increase in productivity in 10-15 years, but in developed countries, the indications are that there may in fact, be an associated decrease!

Overall then, we come out reasonably well in the above considerations, except on the basis of financial incentives and aids. The particular point about government contracts and support is very important and suggests another area where we have problems. As with the assumed presence of an infrastructure, US companies assume that any business community works together for the economic benefit of that community as a whole: prosperity for one is dependent on prosperity for all.

How many times have we in New Zealand found government departments, educational groups, manufacturers and retailers working together and taking the long term view that only what is good for all is good for the individual?

It happened during the last war, but I know of no other occasion since. Competition is a necessary part of our system but co-operation is also necessary. We need a different kind of co-operation from the all-too-common kind that leads to some kind of price-fixing. Fortunately, the one organisation that is dedicated to fostering co-operation in the electronics industry NEDA has had some success**.**

We now come to the critical question - what tactics should we adopt to improve the situation?

Let us go back to our three broad phases of industry; find a marketable product, make it, market it. For the first we need imagination and innovation and effective market research. The latter can be carried out by established organisations like DFC with, perhaps, some augmentation.

New ideas and new possibilities of old ideas need creativity, an art that can be fostered in the right environment but can also be stifled in an environment involving long and detail-ed courses of study. The difference is that between the work of the artist and painting-by-numbers.

I know of only one way to develop this flair for creativity and innovation and it is associated with the definition of research as the creation of new knowledge. There is not much creativity involved in being able to do what somebody else can do. In fact, the most difficult part of any worthwhile research programme is deciding whether the answer can be decided.

The most valuable aspect of research work in any organisation is to provide an environment in which people can develop their innate innovative abilities and this, itself pre-supposes that there are already some people with the desired flair working in the establishment.

The Germans are well aware of this because of their very formal education system that tends to stifle individuality and they attempt to overcome the problem by providing a large number (about 30) research establishments where great emphasis is placed on attracting over-seas scientists for short periods. The science itself is really only a means of exposing their own technologists to a wide range of stimulating contacts.

Coming back to our analogy with art, there are confidence tricksters in modern art and there are also similar effects in what is claimed to be research.

The second stage is relatively straightforward but needs the sup-port of sponsors. What we need are companies that continue to be productive, not companies that fail because all their resources have been used up in developing one product while they still had enough enthusiasm and doggedness to fight for survival.

Quality is paramount and we, as a nation, should be prepared to con-tribute to maintain an image of quality in our products. We did it with agricultural research and we must now up-date ourselves to deal with this new raw material that we have available. The organisations needed already exist in embryo in DSIR, for example. The necessary co-operation and co-ordination should be done by an. organisation like NEDA but properly supported. The associated role of tax incentives for R and D must not be overlooked.

Thirdly, we need experienced overseas marketers or wholesalers. This is probably not a job for official groups or boards. It is expensive and needs professionals; this cost is seldom appreciated at the beginning of a project. Direct government assistance may be necessary but it would be preferable if the indirect support that also seems to be necessary from government departments, for example, during the developmental period is sufficient to provide funds for the marketing phase. Again we need to co-operate - any producer who has found an outlet for his

goods would probably welcome the addition of further lines provided that the quality is such that it generally enhances the regard for "made in New Zealand". I believe that New Zealand electronics type manufacturers have toiled very hard up a very different road: the survivors need a boost over the top so that they can help others on the same path to the benefit of all. Our electronics industry is pathetically small but its potential is enormous. When they ask for help, they are not trying to build empires, they are trying to help this country to survive. Let us answer them.