ELECTRONICS AT THE CROSSROADS

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Ladies and Gentlemen,

I approached the delivery of this lecture in honour of the memory of Ralph Slade with some diffidence. Those who knew him well are becoming fewer and I can claim only the most passing of acquaintances. I believe I talked to him as an amateur radio operator in my young days. I met him face to face only once when he took me to task over an earlier episode in my life, before offering me a job. Not much on which to base a memorial lecture, you might think. But I would disagree, and as I work with many others to advance the electronics industry, I often think of the example of this one man who was fighting the same fight nearly 30 years ago, and largely by himself.

The result of his foresight was, of course, embodied in the formation of EDAC which, in addition to its role as an independent sales outlet for Philips components, incorporated a development organisation which not only produced instruments to its own design, for example the line fault indicator, but would undertake contract work for New Zealand industry and government departments, whenever it had the chance. One of Ralph Slade's principal pleas was for a slice of the government purchasing action. It would be unfair to say that nothing has changed in the last 30 years, but as this conference may demonstrate, things have only changed very recently. In 1955, New Zealand industry was fairly primitive and not much interested in electronic control. For a firm such as EDAC to be viable it would have to depend on substantial government orders, as Ralph Slade clearly saw, and these were, very largely, not forthcoming. With his untimely death, the dream and EDAC faded, and finally disappeared.

It was not the end of the industry however, and as we all know, the last few years have seen a real growth in the N.Z. electronics industry, with the emergence of a viable professional sector.

ELECTRONICS IN NEW ZEALAND TODAY

As Angus Tate pointed out in this lecture last year, the electronics industry has been under study as never before, but after reading all the reports, and the optimistic forecasts that some of them contain, I am left with the question, "Why have we done so poorly?". We started off well enough, firms like Philips, Collier & Beale, and Radio Corporation of N.Z., produced in the 2nd World War more than 10 000 ZC1 communication sets, rated the best of their kind in the allied forces. They developed radar sets which protected New Zealand and helped to guide

even American aircraft in the Pacific in the early days of the war, not to mention high powered communication sets and a host of electronic equipment and instruments for our defence services. Many of the items were produced as a result of a marriage, albeit a shotgun affair, between government scientists and the local industry, but it worked.

That this was possible was largely due to the excellence of our education system, and we all know of New Zealand scientists and engineers who have gone overseas and ended up in positions of power and authority. There is no reason to think that the quality of the training we offer has declined in the last 40 years. Our wartime prowess was also due to the fortuitous imposition of impart controls a few years previously; this fostered the growth of the local consumer industry that is now said to retard New Zealand's development. I hope that those who are about to decide the fate of that industry consider this apparent discrepancy very carefully.

New Zealand would appear to offer an ideal environment for the growth of technological industry. The vagaries of Wellington weather and the impact of major sporting events aside, we have a well fed, well housed, well educated, and generally peaceable population living in pleasant surroundings in a politically stable society, yet last year we exported $15M of electronic products out of a total production of $18aM, compared with figures of $800M and $1 Billion respectively for Eire and approximately $l.$ Billion and $2 Billion for Singapore. But there were special factors in the case of these countries, you will say, and I am sure there were, as there were also in Denmark, Hong Kong, Canada, and South Korea. The difference I suggest is that they exploited their special factors, while we did not (Table 1).

That, of course, is not quite true. There are a number of firms, large and small, who, because of New Zealand's special factors, or despite the opposition, managed to generate $15M in exports. In so doing they proved that it can be done and, if nothing else, that distance is not an insurmountable barrier. The question remains, "Why were there not 50 times more of them?".

In looking for an answer to this question, I have made an admittedly cursory study of the electronics industry in these and other overseas countries, and I am struck by two things:

Firstly, the importance they attach to attracting overseas investment to their electronics industry;

TABLE 1

ELECTRONICS EXPORTS

COUNTRY	PRODUCTION	EXPORTS
NEW ZEALAND	$ 180 M	$ 15 M
EIRE	$1000 M	$ 800 M
SINGAPORE	$2000 M	$1800 M
SOUTH KOREA	$3800 M	$2200 M

HONG KONG		$2000 M
DENMARK	$ 660 M	$ 520 M
CANADA	$4288 M	$2000 M
SWEDEN	$2100 M	$1500 M
AUSTRALIA	$ 800 M	$ 74 M

COMPARISON OF EXPORTS

	AGRICULTURAL	MANUFACTURED	ELECTRONICS	EIRE
$3000 M	$4100 M	$ 800 M		
NEW ZEALAND	$5200 M	$ 800 M	$ 15 M	

Secondly, the scale of the support offered to their own electronic industry, the overseas industry they have attracted, and to their other manufacturing industries, to adopt the new technology and embrace the microprocessor revolution.

That other countries value overseas investment is obvious from practically every technical magazine, but the investment opportunities are neatly collated in 'The Electronics Location File' from which I have collected the following examples. As expected, there are entries from the developing nations for this is the path by which Hong Kong, Taiwan, and South Korea achieved rapid growth in their electronic industries. These entries are, in fact, outnumbered by those from the highly developed areas in the world, the USA and Europe, including those from many individual cities. It is of interest to note that in the United States, the most technologically advanced nation in the world, of 500 electronic firms questioned, 68$ are in favour of overseas firms being attracted to the USA and operating from within it. An even greater number of firms, over 830, would favour joint ventures with foreign firms within the USA. From this I think it is fair to deduce that the most successful practitioners of high technology believe that increasing the total activity leads to better markets and works to the advantage of all.. If you were looking for an entry from New Zealand, so was I when I received the book and I too, was disappointed. Despite this, I note that New Zealand is listed 20th from a total of 50 in the locational preference by the US electronics industry and it seems a pity that so few US firms have followed their inclinations (Table 2).

The same 500 US companies were also asked what they would look for in a country if they proposed to invest there, and, with one exception, financial aid and incentives, New Zealand would appear to score well. in the criteria they consider important (Table 3, page 8). Another absentee from the file was Singapore. They have a policy of doing their own advertising of which "Singapore Science Park" is an example and also of using the personal approach. They target the individual firm they want to attract and then send a man to cultivate the relevant people in that target firm. Men one considers they have attracted some 300 firms of whom 75 are in electronics and whose names read like a "Who's - Who" in that industry, one can but admire the system.

There are those, of course, who say we do not need more overseas investment, that it will harm the New Zealand electronics industry, and that it will create a shortage of engineers and technicians. Well., we have heard the American opinion on that issue, but if we accepted that these local sceptics were correct, then surely, to be consistent, the overseas firms al-ready established here, Philips and ITT with their PABX systems, AWA with their radio telephones, not to mention Cutler Hamer, Wormald, Plessey, and others who have contributed so much to the New Zealand electronics industry should be asked to leave. This, of course, is nonsense and I believe that New Zealand needs many more firms of this type rather than fewer.

The answer to the shortage of trained staff, and there is a shortage, is more staff training, and it is here that the critics may be on firmer ground. New Zealand graduates about 200 engineers and scientists qualified to work in the electronics industry each year, and 160 people with New Zealand Certificates, together with a somewhat larger number of certificated technicians. This is to be compared with 1200 engineers to be graduated annually in the 1980's by Singapore, and some thousands of technicians. As one who chose four technicians trainees from the several hundred offering at the end of last year, I can certify as to the availability of suitable material in New Zealand. The draft IDC Report fails to address this problem, although there is to be a report in the final edition, but I have little confidence that the plethora of committees, viz. AAVA, EEITB. VTC, METAC, IDC, at present operating in the training field will achieve much. Training is one area where government departments are, I believe, doing a good job. If we need more technicians, industry must do more, but it is not unreasonable for them to expect the sort of assistance that their overseas competitors receive. This, however, is a challenge to be met and I would rather see two or three of the American electronics leaders operating in New Zealand even if it meant my losing all my technicians, rather than the 200 or so that go to industry each year at present.

TABLE 2

COUNTRIES LISTED IN ORDER OF LOCATIONAL PREFERENCE BY THE U.S. ELECTRONICS INDUSTRY

NR	COUNTRY (1)	VOTE (2)
1 United Kingdom	53	28.5
2 Germany	38	20.5
3 Ireland	37	15.8
4 Canada	28	15.1
5 Mexico	25	14.1
6 Taiwan	22	11.9

7 France	19	10.3	
8 Japan	17	9.2	
9 Italy	16	8.5	
10 Singapore	13	7.0	
11 Spain	12	6.5	
12 Netherlands	11	5.9	
13 Austria	10	5.4	
14 Philippines	10	5.4	
15 Australia	9	4.9	
16 Belgium	9	4.9	
17 Malaysia	9	4.9	
18 Egypt	8	4.3	
19 Morocco	7	3.8	
20 New Zealand	7	3.8	
21 Sweden	7	3.8	
22 Indonesia	6	3.7	
23 Israel	6	3.2	
24 Norway			6
3.2			
25 South Africa	6	3.2	
26 Sri Lanka	6	3.2	
27 Tunisia	6	3.2	
28 Barbados	5	2.7	
29 Brazil	5	2.7	
30 Portugal	5	2.7	
31 Switzerland	5	2.7	
32 Argentina	4	2.2	
33 Hong Kong	4	2.2	

34 India	4	2.2
35 Jamaica	4	2.2
36 South Korea	4	2.2
37 Chile	3	1.6
38 Denmark	3	1.6
39 Saudi Arabia	3	1.6
40 Cyprus	2	1.1
41 Greece	2	1.1
42 Luxembourg	2	1.1
43 Nigeria	2	1.1
44 Pakistan	2	1.1
45 St. Lucia	2	1.1
46 Ghana	1	0.5
47 Haiti	1	0.5
48 Kenya	1	0.5
49 Kuwait	1	0.5
50 Turkey	1	0.5

(1) Number of relocating electronics companies (total 185) expressing preference for one or more countries.
(2) Preference vote expressed as per cent of all U.S. electronics companies planning to set up overseas facilities.

TABLE 3

MOST IMPORTANT FACTORS TO CONSIDER FOR NEW PLANT LOCATIONS

"If you had to make a locational decision (within USA or abroad) which factors would be most important? Please tick up to five.)"

Good labour relations	61.0% - 310 companies

Good transport and communications	56.5% - 287
Good financial aids and other incentives	55.1% - 280
Skilled workforce	50.8% - 258
Low rent/price of real estate	48.2% – 245
Good access to foreign markets	46.7% – 237
Low wage levels in relation to productivity	45.9% - 233
Large domestic market	36.4% - 185
Clean environment	3.6% -120
R & D facilities	10.20 - 52
Good training facilities	8.5% - 43

INCENTIVES

I mentioned above that New Zealand could not compete with other countries in the incentives offered to firms who might wish to locate here. It is true that we have very generous export incentives which, even if they are phased out, will doubtless be replaced by something equivalent. It appears, however, that overseas companies wishing to invest in a new country are looking for front-end grants and allowances, and the amounts required are indicated by the $20M out of a total of $100M offered unsuccessfully by Australia to entice National Semiconductors to Canberra. I am not competent to judge the relevant merits of the various incentives available. However, I note that in some countries they pay subsidies and grants of 25% of the investment in plant and equipment; in Singapore the government will invest up to 50% of the equity capital required for the project, with the option to buy out the government share at a later date. In 1980 the Industrial Development Authority of Ireland made grants of $550M for overseas investments of $1550M. Big money you may say, but we are told also that the cost per job to the Irish government was $15,700 which is to be compared with our own unemployment benefit of $6600/Annum for a single man.

I believe there is some front money available in New Zealand (e.g. export suspensory loans) but expensive.

SUPPORT FOR THE ELECTRONICS INDUSTRY

Like you, I am aware of the current political philosophy in New Zealand which says that we should strive to create a free enterprise society where market forces determine the direction of development, but operating within some reasonable social environment with equal opportunities for all and protection for the needy. This philosophy is, I believe, well expressed in the magnitude of the only risk capital available for research and development in New Zealand, namely the ATP funding of $2.5M of which only 30% goes to electronics. Even if this is doubled and you add the $5M readjustment fund (both suggested by the IDC) the support is miniscule compared with what is offered by practically all developed and many developing nations.

May I quote: President Francois Mitterrand, "Priority will be given to industrial development and the biggest priority of all will be placed on electronics. It is our weapon of the future." and M. Jean-Pierre Chevenement, Ministry of Industry and Research in the French Government, "If we had to single out one industry for a concerted development effort it could only be electronics." In monetary terms they intend to increase the $US2 Billion that France spends in electronics research and development in 1980 to $US4 Billion in 1986.

Well, what would you expect? They are both socialists.

It is perhaps more interesting to look across The Channel and see how Mrs. Thatcher's private enterprise monetarist policies, often suggested as a model for NZ, apply to the electronics industry. A handful of glossy brochures from their Department of Industry might suggest that the policy is not working very well at all and a casual reading supports that conclusion to the full. These are aimed at management of all British Industry, not just the electronics sector. They set out to explain what the new electronics technology is. They tell management where it and its staff can obtain training in the new technology with government assistance. They point out what can be achieved by the use of electronics with government assistance and they state what is likely to happen to British industry if it doesn't make much more use of it. They show, with examples, how t'~ apply for assistance under the Department of Industry's microprocessor application project, MAP for short. Having regard to the population of the United Kingdom, the scheme initiated in 1978 with a budget of $US110M and to run for 5 years is perhaps not particularly generous. It is, however, available for projects with eligible costs up to $1M, of which 25% would normally be available as a grant and up to 50% in special cases. In addition to this, however, there is a $140M 5-year support programme for the microelectronic products industry and the UK government also has a loan guarantee system operating which helps the smaller business with the risk capital it needs. This is still less than half_ the money the UK government is putting into electronic R & D in the next few years. When one looks at Defence, RSRE, ASWE and the others with staffs of many thousands, the total sum must be very great indeed.

Not bad for a non-interventionist, free enterprise economy, you might agree.

Other countries such as Germany, Canada, Australia, and the developing countries of the near north run programmes designed to encourage industrial research and development (Table 4). The case of Singapore is interesting; among their generous tax incentives is an investment allowance of up to 50% of the capital investment in R & D, excluding building costs. This is to be

compared with our own punitive 4©o sales tax on microprocessor systems. If you want to co-operate in a joint R & D project with a public sector institute in Singapore, such as SISIR, then a $25M fund supports this activity which grants up to 100% of the projects costs. Personally, I would he against that level of funding.

TABLE 4

GOVERNMENT ASSISTANCE TO INDUSTRY

(Examples not exhaustive)

COUNTRY	**INDUSTRY**	**ASSISTANCE**
USA	Semiconductor	$700 M /year
JAPAN	VLSI	$ 50 M /year
WEST GERMANY	Computers	$150 M /year
	Components	$ 30 M /year
	VSLI	$ 25 M /year
FRANCE	Computers	$750 M /year
	VLSI	$ 30 M /year
UNITED KINGDOM	Integrated circuits	$ 30 M /year
	MAP	$ 22 M /year
	INMOS	$l00 M /year
	IT87	$500 M /year
SWEDEN	Computers	$ 20 M /year
	Electronics	$3-4 M /year
CANADA	Microprocessor applications	$ 13 M /year
AUSTRALIA	Micro-electronics training	$ 2 M /y
NEW ZEALAND	Electronic applications	$0.95M in 1981
	DSIR Electronics	$2.7 M /year

FURTHER TECHNOLOGICAL CHANGE

If New Zealand has failed to accept fully the present technical challenge, how do we stand in future? If one thing is certain it is that technological change continues to accelerate and this poses serious questions for all nations, particularly a small and isolated one like New Zealand.

The Japanese, of course, have realised this and set themselves another goal, the fifth generation computer, the computer that learns and thinks like a human being and if precedent is anything to go on, it will, in due course, take its place at the head of a list which starts with steel and progresses through ship building, electronics, automotive, LSI, large computers - all goals which Japan set itself and achieved.

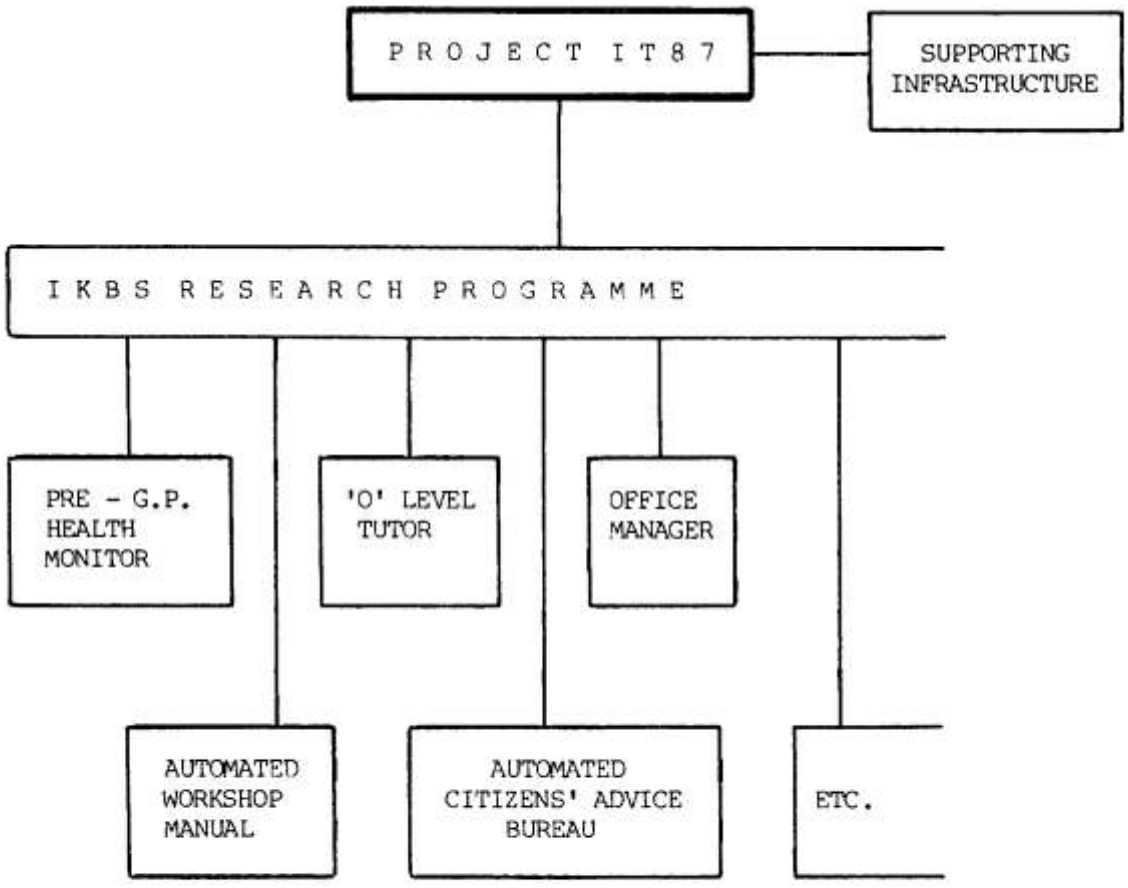

FIGURE 1. Diagram showing inter-relation of IKBS research programme, demonstration experiments and supporting infrastructure.

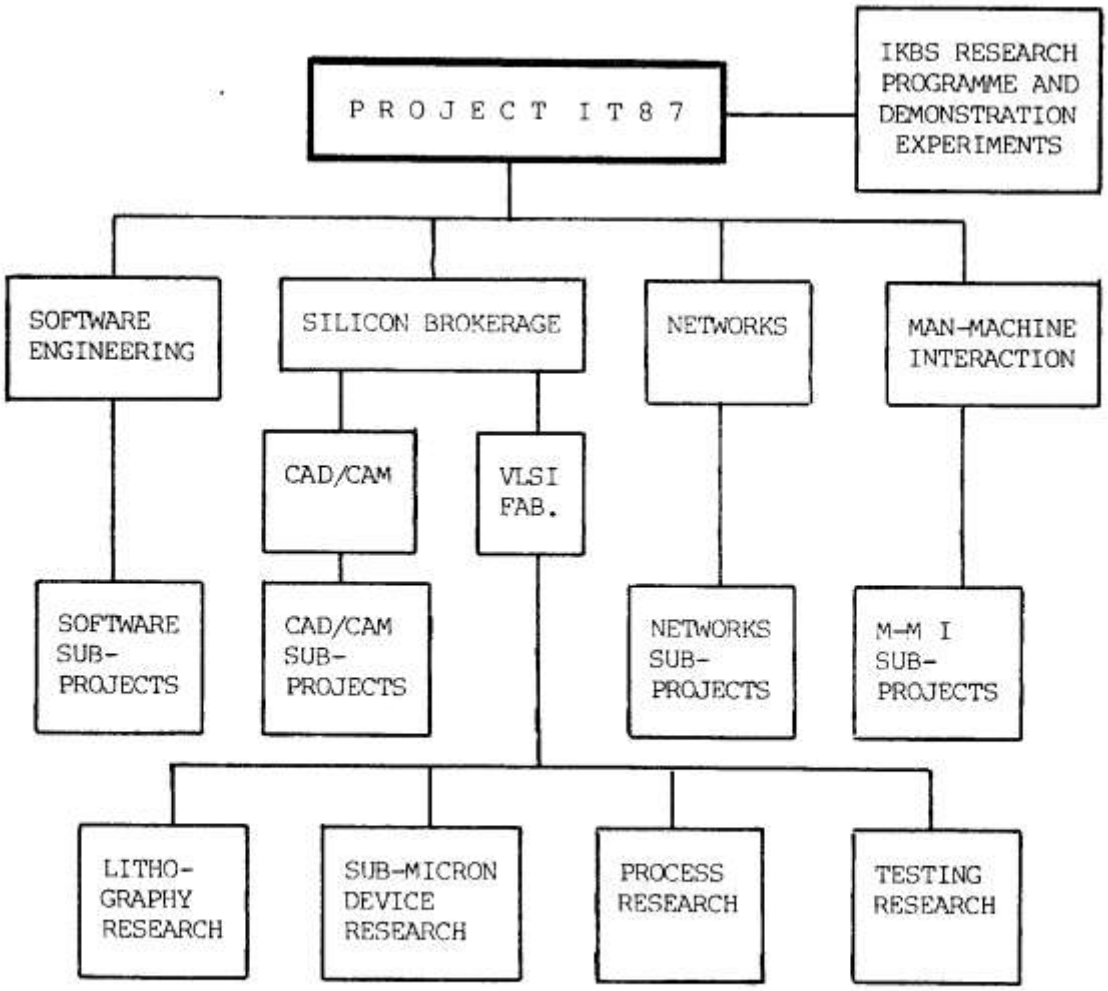

FIGURE 2. Diagram showing inter-relation of research projects to develop improved infrastructure with rest of programme.

Japan has asked for international co-operation in the fifth generation computer from, among others, the British who probably lead the field in certain areas of software and architecture development. Britain now realises its own deficiencies in VLSI when compared with the Japanese and is making a desperate effort to achieve parity and to make its own major contribution to the field of information technology with a project which is known as Intelligent Knowledge Based Systems, or IKBS for short. In this programme the aim is to establish co-operation between industry, government and universities, in the pattern that the Japanese use so successfully.

The projected expenditure is $US 500M over 5 years.

The proposed programme is shown in Figure 1. One proposal for the IKBS domestic system is a pre general-practitioner health monitor. A patient coming to a Health Centre would sit in front of one of these, and it would ask him, in plain speech, about his problems, and would receive the replies again in plain speech. Armed with this information it would consult its stored knowledge of symptoms and diseases and, after further questioning and use of its intelligence, it would suggest

various possibilities to the doctor when the patient came to him. Simple systems using VDUs and keyboards have already been tried successfully in the UK.

The difficult, and essential, part would he the recognition of free speech and most of the proposed projects include this feature. The extension of the knowledge store to include the whole gamut of medical conditions would also be a non-trivial task.

This programme envisages the necessity for one micron devices and substantial sums will go to the development of this capacity in the UK semiconductor industry (Figure 2).

There is obviously no way that New Zealand can enter this league, not even in a fully consummated CER association with Australia. It is interesting to note, however, that the Australians are trying and have recently nominated 10 special research "Centres of Excellence" with associated grants of $16M. $2M of this will be shared by the Royal Melbourne Institute of Technology and the University of New South Wales, in improving their existing microelectronic facilities. This, together with the VLSI design facility of the CSIRO, will give the next generation of Australian Engineers and Scientists the familiarity with this technology which, I believe, is required so urgently in New Zealand.

As you are aware, DSIR is also setting up a silicon wafer fabrication unit and if I say it is belated, then Z presumably will have to take part of the blame for that myself. This facility will be described later in the conference.

I believe it is only through familiarity with silicon processing and design that New Zealand will be able to use the advanced processes being set up overseas and apply them to our own particular problems as we have done in the past with other technologies. Surely there are some agricultural problems to which we could apply IKBS, perhaps a system that would give a farmer detailed farm management information, based both on previous knowledge of the district and up to date measurements of climate, soil variables, and stocking patterns. It has been said that New Zealand farm production could be doubled or quadrupled by the uniform application of the methods employed by the top 1©0 of our farmers and IKBS could help to achieve this.

If we are to take part in these developments we will need a larger, more self-reliant electronics industry with much greater research and development in-house. To achieve this growth considerable help will be required from government and I have dwelt on this at some length. I believe, however, that industry can do a lot to help and I have the following suggestions.

1. Seek out joint ventures with overseas firms willing to invest in New Zealand and introduce new technology. I am aware that a number of American firms have made approaches which have foundered through the apathy of both the New Zealand Civil Service and industry.

2. Actively chase the contracts that are becoming available with the major government departments.

3. Invest in research and development to the maximum extent possible and look for areas where New Zealand has particular expertise or a need that is shared by other developing nations. Electric fences and small communications systems are obvious successful examples.

4. Install meaningful quality assurance programs throughout your works from design to despatch.

5. Aggressively market what you have to sell: the taxi meter, the petrol pump, the polarised ion source and the VHF radio were not sold through an overseas agent from a desk in New Zealand.

6. Train all the staff you can afford and, through your associations, lobby government for support.

But if our electronics industry is to become a major force in our economy, if we are to join the likes of Eire, then I am convinced that New Zealand needs a coherent industrial policy including:

Specific investment objectives Incentives for high technology Targets for staff training Increased assistance for the successful progressive firms in New Zealand.

The cost of these measures would be great, but so would be the rewards.

All these matters are touched on in the IDC Report but not, in my opinion, with sufficient clarity or at a level likely to make a significant impact.

Even if the draft recommendations are accepted in their entirety, I believe we will have missed the right turning at this cross-roads, and we will have, if we are lucky, more of the same.

To Mr. Tarrant I would say let us have a specific plan for investment, incentives, training and a higher target for support. The IDC is our best and probably only hope of achieving an "international" electronics industry. Please do not refer us to further committees.

But much of this was being said nearly 30 years ago, which brings us back to the memory of Ralph Slade.

It is a sobering thought that if we had applied his teaching and achieved half the growth rate of Eire and Singapore, New Zealand would now have no balance of payments problems and perhaps another 50,000 jobs.