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<th>New Zealand country report.</th>
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<td>Author(s)</td>
<td>Rajasingham, Lalita.</td>
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Expert Group Meeting on Training for Prioritisation of Scientific and Technological Culture.

Singapore, 23-31 May, 1997

NEW ZEALAND COUNTRY REPORT

By
Dr. Lalita Rajasingham
Chairperson
Department of Communication, Victoria University of Wellington, New Zealand

In presenting a country report on what is happening in New Zealand to R&D initiatives in science and technology I make the point that my findings are not specific to New Zealand but are validated worldwide.

Why R and D? Because I believe that unless we conduct research and development into the impact of communications technologies we would be unable to assess the implications for cultures of what is the metaphor of the industrial society in terms of communications—the railway—to the metaphor of the internet and global communications.

A country’s future performance indicator is its proportion of R&D to GDP. Up to recently New Zealand R and D in science and technology has been mainly in the agriculture, health and dairy industry. In this, the country has won undoubted world acclaim.

However, in 1986, the Department of Scientific and Industrial Research produced a discussion paper on what I believe was the critical document that outlined how New Zealand stood to becoming peripherised if the country did not seek to address the issues of information technology (ie, computers merged with communication technologies like telecommunications) and the rapid change process.

The aims of the paper inter alia was

- To stimulate discussion in NZ on IT,
- To examine how NZ is responding to the rapid international developments in IT,
- To identify specific opportunities that IT might generate for NZ;
- To suggest how NZ could exploit IT in the future to gain competitive edge, through planning, cooperation and commitment of resources.

In another crucial Ministerial Report “Key to Prosperity: Science and Technology,” Sir David Beattie the then Governor General, clearly argued that “we must compete, and if we are to succeed, we must have the competitive edge. The development and application of appropriate technology is inherent in that.
These reports were supplemented by OECD reports that showed the pivotal role of education and training to alleviate NZ’s long term decline in its terms of trade. Changes in the international marketplace in the 1980s were brought about by the technology revolution which spawned the rapidly growing new industry—the information industry.

We moved from being industrial societies where the units of exchange were land labour and capital, to information societies where the unit of exchange is information. Information is power. To paraphrase HG Wells, for NZ its future in the 80s becomes a race between education and economic stagnation and social dislocation (he used the word catastrophe).

The OECD report in 1985 noted that while there was in NZ a comparatively long cycle of compulsory secular education for the 5-16 year old, the rates of post school retention and full time participation in tertiary education of Nzders and amongst the lowest amongst OECD countries apart from Portugal. Other disturbing data showed that 41% of the workforce had no skills at all, compared to Germany and Japan’s 10%.

In 1983 the UN International year of Communications NZ Sub Committee decided that education in the use of communications technologies was key to NZ’s future and sought to establish a chair in communications in a NZ University that would research the applications of information technology to society. Under Sir David Beattie, a Trust the DBT was formed which was sponsored by industry. The main donors were Telecom Corporation of NZ, Hewlett Packard Independent Newspapers etc. All universities tendered for the Chair which my University, Victoria University of Wellington got and the inaugural professor of the David Beattie Chair of Communications in Professor John Tiffin.

In 1986 I began my PhD studies with him. Given that the future of New Zealand (and indeed any country) depended on an expanded, skilled workforce, there was concern that our education system currently structured was failing to provide the dimensions and quality of workforce that be required for sustained economic growth in the 21st century. I noted that the education system was too slow for new curricula to be developed, bureaucratic, cumbersome, and hierarchical. In short our education and societies’ future needs were becoming seriously out of synch.

Today it would be true to say that my research into the application of information technology to education and training has earned critical extensive international and national acclaim. It has provided blueprints for the Prime Minister and Cabinet and the Maori Development Ministry for designing education and training for the next millennium.

My main objective was to examine how education and training opportunities could be increased for more people than is possible with the conventional face to face classroom which is dependent on fast depleting extractive fuels used for transport and building. My research findings showed that effective learning for more people is possible by the appropriate use of new information technologies, and since the 1990s through the Internet, multimedia and virtual reality. In the last 10 years my department with Prof. Tiffin have continued in our research.

Briefly my research argument is as follows:
The Dilemma

Because education systems are designed to meet the needs of past environments, the gap between the needs of evolving information societies and the response of their education systems appears to be widening. Educational systems are preparing people for the past, for the ideas and attitudes and values of way of life that is fading away and for work in areas of shrinking labour requirements. Schools seem unable to respond to the new needs of the societies which support them.

What is needed

What is needed is effective, cost-efficient instruction that can match the needs for skills related to technological change, delivered interactively, at the convenience of the learner. This is Distance Education the learner, no matter where their physical location, should be able to interact with the teacher, with the content and with one another in synchronous and/or asynchronous mode. This telelearning. As telecommunications and computers merge, new ways of learning and teaching will challenge the traditional classroom, not to replace them but to provide alternative and complementary ways to extend educational and training opportunities for more people than is possible with conventional classrooms. These new technologies create a communications environment where the functions of a classroom can take place at different locations. This is the virtual class where teachers, learners and curricula interact in telepresence.

My ongoing research is reflected in the book which I co-authored with my colleague Professor John Tiffin. Titled In Search of the Virtual Class: Education in an Information Society and published by Routledge in 1995.

Why the Search?

We live in a period of transition between an industrial society and an information society. Schools as we know them are designed to prepare people for life in an industrial society emulating factories and offices of the environment. What kind of system is needed to prepare people for life in an information society? The future economic advancement of all societies depends on an expanded, skilled workforce. Around the world the demand grows for more education and training opportunities. Most societies now believe that their future advancement depends upon how they are educated. Education is fast becoming the key issue of our time. However, education and training systems as currently structured are unable to provide the dimensions and skills needed in an unpredictable, fast moving future.

Does the problem lie in the way education is administered, the methods of instruction and the content of curricula? These are the issues that advanced industrial societies focus on as they attempt to find a solution. In our book our concern is with the extent to which the problem lies with the classroom as a communication system for learning. Our argument is that the classroom is a technology that emulates the way people live and work in an industrial society. It does not relate to the way people will live and work in an information society. As technology impacts on all our activities it will change how we live, work, shop, bank, play and learn.
What shape will education take in the future? What will replace the classroom as the focus of instruction in the information society? Today, policymakers and educationists worldwide face the challenge of how to provide effective and cost-effective education and training that can match the skills required by societies in the next millennium. At the moment, telelearning based upon teleconferencing and the Internet is developing rapidly around the world. Also evolving rapidly is multimedia and virtual reality.

It is important to stress that the Virtual Class will not replace the conventional classroom. Instead, it would provide a complementary, alternate loci of education. This is already happening today as we note the number of courses offered on the Internet and as the WWW is replacing the conventional library.

Virtual Reality and information technology are not a technologies per se. They are in infrastructure that defines an environment. The virtual class is when teachers and learners meet in electronic space for the purpose of education. When we use telecommunications to connect across distance, we are not in the same space. Seduced by the effortless gathering of information, we may be discounting the transaction costs of turning information into knowledge and knowledge into wisdom (Harris, 1987, p395).

In highlighting some of the implications of the virtual class, social implications need to be examined within cultural contexts. Information is rarely neutral or objective. In the virtual class based on computer-generated virtual reality, information is collected, selected and collated by the authors and each bit of the process allows for a subjective input. Virtual reality is not new. We are in virtual/or alternate worlds when we dream, read books see films and television.

I suggest that in our daily lives most of our realities are artificial in the sense that the same real things appear to be very different to different groups of people/cultures. With CGVR of course which is the basic building block of the virtual class, are we dreaming someone else’s dreams, perhaps the virtual reality creators dream? How do we teach values in a virtual class?

Information technology has redefined cultures spawning many different microcultures. The word culture is one of the most complicated words in the English language because of its intricate historical development and because it is used for concepts in several distinct intellectual disciplines and often incompatible systems of thought. And so, has lost its usefulness.

Cyberspace the locus of the virtual class in more egalitarian than elitist; more decentralised than hierarchical. In fact life in the virtual class is turning out to be what Thomas Jefferson described:

Founded on the primacy of the individual liberty and a commitment to pluralism, diversity and community allowing communication with anyone anywhere any time, giving the individual teacher or student the freedom to work anywhere anytime.

This Meeting is very timely because the technology to create alternate realities are here today and will increasingly become more sophisticated. But if technology which is a double edged sword is to be used for the good of society, then training people to examine and address the implications on cultures becomes highest priority. Societies need to design and author software that are suited to their cultures.
To conclude let me signal some global issues that must be examined as we seek to put the VC in place:

1. Technology is not in place yet;
2. Where they are, proprietary rights and patents are held by the developed nations;
3. Equity issues of access (this exists even in the developed countries) need to be addressed in developing countries.

In teaching the Master of Communications via the Internet to Taumarunui (a rural town) about 400 Km from our University, for example, they are bedevilled not by bandwidth having got an ISDN link but by power surges euphemistically called brownouts. Every time the train passes by, the power drops; in the winter evening when all heaters are switched on, the power drops and surges at the end of the evening. So power surges are not merely a developing country scenario.

**Training**

The critical need for instructional design courses for teachers is matched by an equally critical need for trained technical support that makes the virtual class on the Internet work.

Virtual reality technologies reflect the culture of the designers of the technology usually from the developed countries. When it is installed, provision must be made for training people in their use, for infrastructures that can handle the maintenance and ancillary services so that the equipment can be utilised to its optimum in culturally appropriate ways.

Well ladies and gentleman, just as the map is not the territory, the virtual class is only a model. A model that seems to be adopted globally as we witness the increase in courses offered on the Internet. Let me end by quoting George Bernard Shaw:

> ... Imagination is the beginning of creation. You imagine what you desire; you will what you imagine; and at last, you create what you will.

**NZ Communications infrastructure: Some statistics**

**Communications**

The Communications infrastructure of New Zealand has undergone a dramatic change in the recent years. Over the past decade competition has been introduced to all aspects of the communications market. It now represents one of the fastest growing areas in New Zealand’s economy.

In the area is handled by the Communications Division of the Ministry of Commerce.

**Telecommunications**

Prior to 1987 Telecom had a monopoly on the provision and general telecommunications service. As a result of the telecommunications Act, 1987 goods and services in this sector are now only constrained by general law.

New Zealand has one of the most advanced telecommunications infrastructures in the world. There are approximately 468 main lines per 1000 people. 98% of all customers are handled on a digital exchange (enabling the provision of a wide variety of additional services).
Information Technology
NZ's IT industry is aligned toward an avid domestic industry and niche global markets. It employs around 4% of NZ's working population and accounts for around 2-3% of GDP.

It is well known that New Zealanders are fast adopters of technologies - the 'uptake' of cellular phones was one of the fastest in the world. However, penetration of PCs into the home is relatively low. In 1994 this was a mere 18.6% compared to 25% for the USA.

The Internet
New Zealand has seen a rapid growth in the usage of the internet. In 1990 users were primarily researchers, academics and the larger scientific community. By 1995 it is estimated that there are over 80,000 users. In the four year period from July, 1991 through to July 1995, the number of hosts grew from 1,193 to 43,864 an increase of 3577%. In the same period the increase of the number of hosts globally increased only 1,141%.

Freedom of the Press
In 1995 New Zealand was rated among the top 15 countries in terms of press freedom (carried out by Freedon House, New York).

Computers in Schools
NZ has seen rapid growth in the use of computers in schools since 1985. In 1989 most schools had a computer to pupil ratio of 1:20. By 1994 this had become 1:16. However, it should be noted that until recently (as it appears that the Ministry is currently drafting a IT curriculum) there has been an absence of a specified statement about computer use. As a result there is a wide range of ad hoc activities and software.

Science and Technology
The biggest change has been the institution of a new system of funding and delivery in the public sector. The new approach has three principle objectives: accountability, enhanced economic growth and improved decision making.

Despite these, the key change has been the organisation separation of research bodies from government. So far this change has enabled these institutions to pursue "a clearer science focus".

The Ministry
The two ministerial portfolio's for Science and Technology are handled by:

1. Research Science and Technology (RS&T) - who handle the policy, ownership and funding.
2. Crown Research Institutes (CRI's) - that handle the operations.

To a great extent these bodies are in the process of carrying out the government’s "statement of science priorities, 1995" that outlines the strategic direction and funding for 17 socio-economically delivered science 'outputs'.

Health
Possible due to its geography, one of the most advanced areas of IT in NZ appears to be health.
Table 5.9. Average R&D intensity ratios

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<tr>
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<td>OECD Average</td>
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1. International Standard Industrial Classification, Revision 2.
2. For all countries 1990-92 except for Australia, Denmark, Finland 1990-92 and for Canada and Sweden 1990.
3. Unweighted average of above data.

Table 5.8. R&D expenditure

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<td>2004</td>
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Source: Main Science and Technology Indicators 1995-1. OECD 1995.

The data for "total R&D" and R&D performed by the higher education sector are biased upward because R&D personnel and labour costs for higher education are not adjusted for non-research activities.