Towards the Connected Learning Society

An International Overview of Trends in Policy for Information and Communication Technology in Education

Peter Kearns

Global Learning Services
10 Fisken Crescent
KAMBAH ACT 2902
AUSTRALIA
June 2002
Acknowledgements

Global Learning Services is grateful to many people for their assistance with this project. In particular we thank the members of the Steering Committee for their keen interest, helpful advice and constructive feedback:

Margot Bell, Information, Innovation and Infrastructure Policy Unit, Higher Education Group, DEST
Mike Brough, Office of Post-Compulsory Education and Training, Tasmanian Dept of Education
Doug Gorman, Skills Analysis Section, Research and Evaluation Group, DEST
Russell Hunt, E-learning Section, Schools Group, DEST
Anna Pol, Training and Reform Section, Vocational Ed and Training Group, DEST
Rapin Quinn, Education Technology Team, Higher Education Group, DEST
Vivienne Teoh, Education Technology Team, Higher Education Group, DEST
Louise Tucker, Chief Information Officer, ACT Dept of Education and Community Services
Gerry White, CEO, education.au Ltd.
Mark Wigley, Education Technology Team, Higher Education Group, DEST

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This project was funded by the Commonwealth Department of Education, Science and Training. The views expressed here do not necessarily represent the views of the Commonwealth Department of Education, Science and Training.
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Executive Summary

This study of policies for information and communication technologies (ICT) in education and training in ten countries across Europe, North America, Oceania, and Asia is a component in a project undertaken for the Australian Department of Education, Science and Training (DEST).

The project comprised three components:

- the development of a searchable online database where policies have been summarised and which can be accessed through EdNA Online (http://www.edna.edu.au);
- a report on Australian developments;
- this international report covering ten countries.

The report on Australian developments has been completed and provides a comparative analysis along with this report. In addition to national policies in the ten countries included in the study, a selection of American states and Canadian provinces have also been included, as well as all Australian states and territories.

The database of policy summaries has been structured around the five goal areas built into the Australian Education and Training Action Plan for the Information Economy prepared by the former Department of Education, Training and Youth Affairs (DETYA), the predecessor of DEST. This structure has been carried over into the report, with the addition of the final chapters on outcomes, innovation and the transformation of learning.

The Countries and International Agencies

In the brief for this project, DEST specified that the following jurisdictions and international agencies be included in the study:

- **Countries:** Australia, Canada, Finland, Ireland, Malaysia, New Zealand, Singapore, Sweden, United Kingdom, United States of America.
- **States/provinces:** all Australian states and territories, California, Ohio, Texas, South Carolina, British Columbia, Ontario, Quebec.
- **International agencies** European Community, OECD, APEC.

All these jurisdictions and agencies are included in the database, while this report undertakes a comparative analysis of the policies and programs they have adopted for ICT in education.
The Context

Policies for ICT in education have been devised and implemented in the context of the emerging globalised information society and economy. The conjuncture of the impact of globalisation, information and communication technologies, and the accompanying shifts in the economy, labour market, and in the operations of enterprises have led to fundamental changes in the economy and society that have profound implications for the role of education and training. Policy for ICT in education is positioned at the frontier of this transition to an information society.

While a number of terms for this new epoch in human history have been used, such as information society and knowledge society, a defining feature is the key role of ICT in business and industry and in society generally. How education policy has responded to this new context is the story of this report.

The context of the information society presents both opportunities and challenges for education policy in adjusting to this new environment for policy.

Reports examined from the countries studied pointed to the “new learning reality” and the need for “rethinking the whole learning enterprise” if countries were to succeed in the global knowledge-based society.

Stages in Policy Development

We found that all countries included in the study had progressed, in varying ways, through a number of phases in their policy for ICT in education. These usually involved:

**Phase One:** rolling out computers into schools and colleges with some professional development of teachers and development of online content;

**Phase Two:** mainstreaming and integrating the role of ICT into education in a more strategic way with more concern for objectives, and with linkages forged to overall education strategies.

A survey of ICT in education undertaken by the European Union through its Eurydice program in 2001 noted that most EU countries had followed this sequential approach rather than a simultaneous one.

Several countries now stand on the threshold of a third phase of development which could lead to a more radical transformation of the way people learn in a learning society. Sweden has articulated this vision of a third phase of development, and is currently developing a new Action Plan for ICT in schools to progress this vision. Countries of the ICT League share this interest with Sweden. The United States is also on the threshold of a transformative phase and Britain has initiated consultations on transforming the way people learn.
Innovation Strategies

Phase One and Two may be regarded as foundation stages in developing the role of ICT in education and learning. Various countries included in this study have gone beyond a foundation stage and implemented policies and strategies to bring about innovation in their education and training systems in adjusting to the new context of education.

These strategies are discussed in Chapter 11. They usually include:

- strategies to build a shared vision and leadership;
- strengthening and focussing research and development;
- building networks to foster the generation and spread of new ideas;
- building banks of case studies as models and exemplars of leading practice;
- linking education reform to broader community-oriented strategies;
- fostering a range of partnership strategies.

The Partnership Factor

A key finding across the countries studied relates to the growing significance of innovative forms of partnership in these countries. These involve new forms of public/private partnership, education cross-sectoral collaboration, local and regional community partnerships, and innovative partnerships in federal systems. e-learning has been aptly termed by OECD The Partnership Challenge, and there is a requirement for ongoing development of new forms of partnership to drive education and learning policies and strategies, with consequent shifts in roles.

The discussion of online content, infrastructure, and professional development of teachers, and innovative community-oriented strategies in the report illustrates these developments.

Responding to the Pace of Change

A particular challenge for ICT policy in all countries has been how to deal with the pace of change, both in the impact of new technologies and in socio-economic shifts. This has led, on the one hand, to an emphasis on strategic planning and review, while on the other hand action has been taken to enhance flexibility in responses to the exponential pace of change. In federal systems this has sometimes led to strengthened partnership between the levels of government, as in both Australia and Canada, including innovative forms of partnership in Canada where a federal education power does not exist. A further response has been to stimulate innovation at the local level with strategies such as those discussed in Chapter 11, so that local initiatives have become increasingly significant as a means of achieving flexibility and innovation in responding to a context of rapid change.
Outcomes of Policy

Overall, we found disappointment expressed in a number of international reports and studies at the slow pace of change, with the view commonly articulated in these documents that current developments needed to be speeded up if the potential benefits of ICT in education were to be realised. This had led to a search for strategies that will accelerate the pace of change and innovation in education systems with a stronger research effort seen to be necessary to guide the change processes. Research priorities identified in a number of jurisdictions are outlined in Appendix 2.

Educational outcomes are discussed in Chapter 10 where research evidence is provided to show that ICT, when well applied, can enhance desired educational outcomes. However, the impact overall on schools and teaching is more problematic, and research from case studies suggests that the adoption of ICT in schools follows the pattern of other education innovations in progressing through a number of defined stages. This has led to the current interest in how the pace of change in the way people learn can be accelerated, so as to bring about the desired transformation and to realise the full potential of ICT as a tool for learning and progress in the information age.

Cultural Heritage and Internationalisation

A number of the countries studied have seen a close link between ICT and culture, and have seen ICT has a tool to make cultural sources more accessible to education and for the preservation of the cultural heritage. At the same time, ICT is also seen as an instrument for the internationalisation of education with enlarged international contacts, and with international sources available to enrich education and to heighten its relevance in a globalised society and economy. This includes the aspiration of working towards an international information environment where information will be freely available for students, teachers, and researchers. Appendix 3 comments on the role of selected international agencies and informal networks in strengthening international exchanges of experience in policy for ICT in education.

Questions for Australian Policy Makers

The report concludes with identifying fifteen criteria for leading practice in policy for ICT in education which could be used in evaluating Australian performance. These criteria relate to key aspects such as vision and leadership, strategic planning, lifelong learning, monitoring progress, establishing foundations and ensuring digital literacy, access and equity, innovation, partnership, and research and development.

A set of nine key questions is identified for consideration by Australian policy makers.

These questions involve:

- the relation of ICT policy and policy for lifelong learning;
- ways of providing affordable bandwidth;
- developing an innovation strategy for ICT in education;
• equity and the digital and learning divide in society;
• strengthening research and development on ICT in education;
• building networks to stimulate the flow of new ideas;
• building a bank of case studies and models of good practice;
• linking education and community strategies for the role of ICT;
• encouraging innovation in partnership action.

These questions reflect key themes observed in the countries studied where benefits for Australian education and society might be obtained in the further development of policy for ICT in education.

NOTES

1 Kears and Grant 2002.
2 Advisory Committee for Online Learning (Canada) 2001. There are similar views in the OECD, European Commission and other reports cited, and in the Summit Declaration from the 2001 European eLearning Summit. See also, for example, OECD 2001b.
3 Ibid, p.18.
1. INTRODUCTION

This study of policies for information and communication technologies (ICT) in education and training across sixteen jurisdictions and three international agencies is a component in a project undertaken for the Australian Department of Education, Science, and Training (DEST).

The project comprises three components:

- the development of a searchable online database where policies will be summarised which will be accessed through EdNA Online (http://www.edna.edu.au);
- a report on Australian developments;
- an international report covering policy in sixteen jurisdictions and three international agencies.

A companion report on Australian developments has already been prepared, and is drawn on in this international analysis.

The Database and this Report

The database of policies has been structured around five goal areas built into the Australian Education and Training Action Plan for the Information Economy prepared by the former Department of Education, Training and Youth Affairs (DETYA), the predecessor of DEST, with the addition of a further category of Overarching Strategies which covers strategic plans for the use of ICT in education and frameworks for collaboration and co-ordination.

The five goal areas built into the Education and Training Action Plan are:


We have accordingly decided to structure most of this report around these action areas, and Chapters 3-7 are based on these action areas.

However, an overview of Australian and international development points to the reality that these action areas do not stand alone. Rather, it is the nature and quality of the interaction, often in synergistic ways, between these policy areas which drives innovation and progress.

For this reason, we have attempted in Chapters 10 and 11 to look beyond specific action areas to consider educational and community outcomes and the components of an innovation system that drives the transformation of the way we learn to fit the conditions and opportunities of the Information Society. While these chapters are by their nature speculative, we have also been able to draw upon a growing body of international research on the processes of change and the transformation of education systems in the information and knowledge era.
The Selection of Jurisdictions

In the brief for this project, DEST specified that the following jurisdictions and agencies should be included in the study:

- **countries**: Canada, Finland, Ireland, Malaysia, New Zealand, Singapore, Sweden, United Kingdom, United States of America.
- **states/provinces**: California, North Carolina, Ohio, Texas, British Columbia, Ontario, Quebec.
- **international agencies**: APEC, European Community, OECD.

While this overview of policies across nineteen jurisdictions and international agencies is inevitably selective, further information on specific policies can be found in the database which provides hyperlinks to national sources.

The jurisdictions selected for this study fall into three main groups: European Union countries, North America, Asia and Oceania, and there are contextual influences that influence government policy for ICT in each of these blocks which are discussed throughout this report.

Selection of Policies and Programs

The database which accompanies this report contains some 400 items. We have not attempted to be comprehensive by including all relevant policies in every chapter. Rather, we have selected the examples which have a strategic thematic significance in illuminating key directions for policy. In some cases we have added examples which are particularly innovative in addressing a policy issue, and which are likely to be of interest to Australian policy makers. The inclusion of the Digital California Project in Chapter 7 on the Infrastructure Challenge provides an example of such a program.

For this reason, most chapters commence with an overview of key themes and issues, with analysis of policy responses to these themes then following. The database can be searched in each of the policy areas covered and further policy examples can be identified. In addition, web references are given throughout the report, and a list of key web sites in each of the countries studied is given in Appendix 1 to assist policy makers and researchers who wish to follow up by direct reference to the responsible agencies.

In addition to the database, we have drawn on a large number of reports in our analysis of key themes and issues. These are cited throughout the report and listed in the references.

While a number of Australian policies and programs are included in the international report, further examples of Australian policies may be found in the Australian report which is structured in a similar way to this report to enable easy comparisons in the people, infrastructure, online content, and organisational and regulatory framework chapters. As with this report, web references are given to enable follow up to the
responsible agencies. For readers in other countries, there is a brief description of the Australian education system in Appendix 7.

Policy and the Sectors of Education

We found that government policy in most of the countries studied had a focus on the school sector, and that higher education and vocational education were less prominent overall on the policy landscape. This situation reflects a number of things including:

- varying responsibilities between countries in the responsibility of national governments for the sectors of education;
- a view that schools were the fundamental foundation and if policy objectives were achieved at this level, the benefits would flow through to the other sectors;
- differences in the structure of education between countries;
- the desire of some governments to use ICT as a tool of school reform in achieving broader reform objectives.

These influences were expressed in various ways. None of the countries studied has an exact equivalent to the Australian VET sector, with British further education colleges the nearest equivalent, while American and Canadian community colleges are regarded as part of the higher education sector in these countries, and Swedish vocational education is delivered in upper secondary schools.

Although much of the analysis of this report has a schools orientation, the general lines of the analysis in Chapters 10-12 is as relevant to the VET sector as it is to schools. The same pressures exist in each sector to find strategies that bring about cultural change and innovation so as to transform the way we learn in the information age.

While a school focus was unavoidable, we have brought in higher education development in such areas as infrastructure development, policies to extend access, and intellectual property issues. These issues were the main practical concerns in the Australian Higher Education Action Plan for the Information Economy.

Culture and other Contextual Influences

Policy for ICT in education is influenced by the socio-economic context of the country, the history and traditions of its education system, and by a range of government and cultural influences. The Swedish way is not the American or Australian way, and ICT policy is inevitably conditioned by these contextual influences.

In a short overview report of this nature, it is not possible to do justice to these influences on policy. Some sense of the influence of these contextual factors on policy may be found in a related study by the author of this report and George Papadopoulos on policies to build a learning culture in Britain, the United States, Sweden, Netherlands, and Germany.²
Cultural and government differences, and differences in the structures and funding of the systems included in the study, pose issues for a comparative study such as this. For this reason we have generally avoided overall judgements, except where the judgements are made by the country itself or in authoritative reports such as those of OECD. Nevertheless, certain significant trends emerge from this analysis which we report, and we found that in each policy area examined there were dominant themes that were being addressed in the policies adopted. Despite the differences, there were certain similarities in the key policy thrusts that hold valuable insights for policy makers in Australia.

**Diversity, Partnership and the Pace of Change**

All countries included in this study are confronted by the challenge of the exponential pace of technological, social, and economic change. How countries have responded to the rate of change in developing policy for ICT in education, so as to preserve flexibility and nimbleness in responses, is a key theme in this report.

This has led, on the one hand, to the use of strategic planning and review, as discussed in Chapter 3, so as to guide adaptation to changing circumstances and to ensure that responses are sufficiently comprehensive. On the other hand, a number of the countries studied have concluded that traditional top down policies are too slow, and no longer work in the turbulent context of the information society. This has led to a focus on stimulating local initiatives and innovation with strategies such as those discussed in Chapter 11.

It has also led to the new forms of partnership – including innovative forms of public and private partnership – as a response to change. e-learning has been aptly termed by OECD as the partnership challenge, and innovation in partnership arrangements are discussed throughout the report.

The countries selected differ in their systems of government, and partnership arrangements are particularly significant in the federal systems studied as a means of achieving co-ordination and coherence between action taken at national and state/territory levels.

Australia and Canada are both of interest in this respect, with a strengthening of collaboration and partnership between the levels of government evident in each country. In the case of Canada this is particularly significant in a country without constitutional education power at the national level and without a federal education ministry or department. Ways in which Canada has secured collaboration between the federal and provincial levels of government are discussed in Chapter 3.

Diversity is also present in those countries studied without federal systems, where there are significant differences in the roles and relationships between national agencies and local authorities with education responsibilities.

While this report, and the accompanying database, includes policies at the national and state/provincial levels, it was beyond the scope of this study to include the policies and roles of local education authorities such as British local education authorities, American school districts, and Swedish municipalities. These relationships require a separate study.
The Concept of e-learning

A further threshold issue relates to terminology. While a number of terms are used in Australia for ICT in education, with online learning the most common, we found a growing international usage of the term e-learning. This is now the common term in business around the world, and is used in education action plans in the United States, European Union, and Britain. e-learning is the natural counterpart of e-commerce in the business world and it is desirable for Australia to come into line with this growing international usage.

The United Kingdom Situation

There is considerable reference throughout the report to United Kingdom policies and to the roles of the Department for Education and Skills (DfES) and the British Educational Communications and Technology Agency (Becta) in the development and administration of these policies. A necessary clarification to be made up front is that whereas the United Kingdom (UK) comprises England and the three devolved administrations of Northern Ireland, Scotland and Wales, the role of DfES relates to England only and development in the devolved administrations is the responsibility of the Scottish Executive, National Assembly for Wales, and Northern Ireland Assembly.³

On the other hand Becta has a remit that covers all the United Kingdom so that its programs serve England, Northern Ireland, Scotland, and Wales. While our references to Becta programs bring in a UK perspective, the reference to the DfES policies and programs involve England only.

Implications of the Knowledge Society and Government Reforms

Policy for ICT in education is inevitably caught up in the conditions and imperatives of the emerging knowledge society and its new economy. We turn to this subject in Chapter 2 and then discuss in Chapter 3 the overarching strategies and frameworks for action which governments in all countries studied have adopted in responding to the challenge of the information era.

Whether technology is outpacing policy is a question we examine through the chapters of this report, while we attempt to draw international experience together in Chapters 10, 11 and 12 in considering the components of an effective innovation system that is responsive to changing conditions, and which drives the strategies to transform the way we learn in the digital era.

NOTES

1  Kearns and Grant, 2002.
3  Contacts for Scotland, Wales and Northern Ireland:
Scottish Executive
16 Waterloo Place, Edinburgh, EH1 3DN
Tel: 0131 244 3823       Fax: 0131 244 3832

National Assembly for Wales
Cardiff Bay, Cardiff CF99 1NA
Tel: 029 20 8251 111       www.wales.gov.uk

Northern Ireland Assembly
Rathgael House, 43 Balloo Road, Bangor, Co Down BT197PR
Tel: 028 9127 9279       Fax: 028 9127 9100
2. THE EVOLVING CONTEXT OF THE INFORMATION AND KNOWLEDGE SOCIETY

It is a new economy in which a country’s standard of living, and the quality of life of its citizens will be directly linked to its success in fostering knowledge creation, innovation, and adoptability, and in maximising educational opportunity and cultural expression.

Jean Cretien, Prime Minister of Canada, 2000.

A new epoch is dawning. Ahead of us lies the knowledge society. An almost completely unknown continent, but full of possibilities. If we learn to understand and dare to respond to the changes now sweeping the world we have a unique chance to becoming an important motive force of development.

Swedish IT Commission, 1998

We found, across the nine countries included in this study, a general recognition that a new era in human history is emerging which offers great opportunity, and great challenge.

While varying terminology was used from country to country, the central role of information and knowledge in building the new society was widely recognised. The knowledge revolution was leading to a new era, a reality recognised by OECD.

The concepts of “knowledge economy” and “knowledge worker” are based on the view that information and knowledge are at the centre of economic growth and development. The ability to produce and use information effectively is thus a vital source of skills for many individuals.

OECD 2000.

The implications of a knowledge or information society have received considerable analysis across the countries included in this study, and articulation in the vision statements built into national action plans for responding to the new era. There has been general recognition that the information society has profound implications for the economy, society, and for education.

The following are typical statements across these domains:

Globalisation and technology have redefined the marketplace
Jean Cretien, Prime Minister of Canada, 1998

The rapid development of the information society both requires and facilitates an increase in the knowledge level of the nation as a whole.

The information society by its very nature cuts across traditional boundaries.

European Commission, 2001a

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These statements reflect the reality that the implications of the information and knowledge society are radical, fundamental, and provocative in requiring creative thinking and innovative action.

The new centrality of knowledge for economic outcomes has brought with it a growing interest in human and social capital, including ways in which these are fostered and strengthened, that is reflected, for example, in the current work of OECD. The role of human and social capital in the success and wellbeing of nations is now a key issue for government, business and industry alike, and has implications for the role of ICT in fostering the development of both human and social capital in the context and conditions of the knowledge society.

In addressing the requirements of the emerging knowledge society, the countries we studied have been confronted by a broad spectrum of issues. These include:

- responding to the pace of change;
- meeting the learning and skill requirements of the new order;
- ensuring that all citizens are given opportunities to benefit from the new conditions;
- assisting business and industry to adjust to the imperatives of a knowledge economy;
- assisting individuals and communities that are adversely affected by the new conditions;
- encouraging social institutions such as schools and their teachers to adjust to the new order.

While there is considerable diversity in the policies adopted in response to these key issues, there are nevertheless certain strategic perspectives which are reflected, in varying ways in the policy responses of the countries we studied.

These strategic perspectives involve:

- building a networked society;
- building a learning society;
- building a partnership society;

Comment follows on these building blocks of a knowledge society, while the chapters of the report which follow comment on the policies which have been adopted involving the role of ICT in education and training in furthering these perspectives.

A key aspect, which is discussed in Chapter 3, is that the pervasive influence of ICT, in the context of globalisation and the new economy, is propelling government policy towards a search for whole-of-government strategies which can address the broad
spectrum of integrally connected issues. In this search, traditional sectoral barriers stand to be addressed.

**Building the Networked Society**

A key design element that emerges from an overview of policy for the information era, which is reflected in policy for ICT in education, is the notion that policy for ICT should be used to build a networked (or connected) society.

This policy thrust reflects both the opportunities provided by new ICT technologies to connect people and communities as never before, and the threats of exclusion, deprivation, or alienation of those, both individuals and communities, excluded from the benefits of the information age. In this way there is a convergence of social and economic objectives, which flow over into educational policy and objectives, in a society which “by its very nature cuts across traditional boundaries”.4

These considerations underpin the programs implemented by Canada under its Connecting Canadians policy, which is discussed in Chapter 3. These programs link technology with social, cultural, educational, and economic objectives in building a networked society that connects individuals and communities.

The concept of a networked society expresses and reflects the conditions of the knowledge era, with the capacity to generate, manage, and use new knowledge a prime condition for economic success, personal fulfilment, and social stability.

This concept is widely reflected, in various forms in policy development in the countries we studied. These developments include broad whole of government platforms such as Connecting Canadians and e Europe,5 and educational expressions such as the Virtual School and Virtual University in Finland, the European Schoolnet, Britain Online, and the development of comprehensive educational portals such as British National Grid for Learning and the Australian EdNA Online.

In addition to connecting people and communities and providing for access to information, networks can be a conduit for the flow of new ideas and hence a source of innovation and creativity. Linking technology with social innovation is central to realising this potential.

Network strategies are pervasive in the information and knowledge era and take many forms. In addition to the examples given above, strategies such as building learning communities of teachers and headmasters as communities of practice have become increasingly common across OECD countries, and are likely to increase in usage and sophistication as the knowledge era impacts more deeply on society and its institutions.

We discuss network platforms such as Connecting Canadians, e Europe and European SchoolNet in Chapter 3 which follows, and comment on other examples in the subsequent chapters.
Building the Learning Society

Lifelong learning is increasingly a part of Canada’s culture.

Canadian Government 1998

A further key design element that is reflected in policy in a number of the countries we studied, but not all, is the notion of actively fostering lifelong learning as an instrument to build a learning society which is responsive to the imperatives and conditions of the knowledge era.

Policy in Canada, Britain, Canadian provinces, Sweden, Finland, Ireland, the European Union, (and EU countries generally), OECD, and some Australian states reflects this imperative, with ICT generally seen as an instrument to advance lifelong learning in many contexts, and to link formal and non-formal learning contexts.

A useful portrait of a learning society may be found in the British Government’s 1998 Green Paper The Learning Age.6 While such a society is underpinned by the aspiration of lifelong learning for all, the individual learning revolution discussed in the Green Paper extends throughout society, including critical contexts such as learning at work. It therefore involves cultural change, as well as individual opportunity, so that values that support lifelong learning and achievement are fostered. For this reason learning community strategies are usually seen as a necessary underpinning. With the growing significance of knowledge in the economy and society, there has been a convergence of learning and knowledge strategies, with a learning capacity throughout society a necessary underpinning for the generation and application of new knowledge, and for innovation and creativity in adapting to changing circumstances.

The growing attention paid to lifelong learning since the mid-nineteen nineties has been driven, to a considerable extent, by recognition of the implications and requirements of the information society and economy.

OECD articulated this scenario in its 1996 report Lifelong Learning for All7 in which it outlined the transition to learning economies and societies in the context of broad trends in the economy, culture, and society.8 OECD work since 1996 has elaborated the implications of a lifelong learning approach.

UNESCO has also contributed to the development of an international body of knowledge on lifelong learning, in particular through its influential Delors Report of 1996 which articulated a vision of “learning throughout life as the heartbeat of society” and “an imperative for democracy.”9

The European Union has built on the work of OECD and UNESCO, and the Year of Lifelong Learning the EU celebrated in 1996, to develop by the end of 2001 an action plan for “a European Area of Lifelong Learning” following extensive consultations in EU countries.10

Like OECD and UNESCO, the European Union has recognised that lifelong learning is driven by social, economic, cultural, educational, and civic imperatives. This recognition
is built into the EU approach to a European Area of Lifelong Learning which is related to social, economic, employment, and educational objectives of the Community.

This broad cross-sectoral perspective is expressed in the definition of lifelong learning adopted:

All learning activity undertaken throughout life, with the aim of improving knowledge, skills and competencies within a personal, civic, social and/or employment-related perspective.11

This cross-sectoral approach is then reflected in the links made between a lifelong learning approach and a range of EU policy instruments. These include:

the European Employment Strategy; the European Social Agenda; the Skills and Mobility Action Plan; the eEurope Action Plan; the Concrete Future Objectives of Education and Training Systems; the White Paper on Youth.12

It is important to recognise that lifelong learning is seen by the European Union and OECD as underpinning key social and economic objectives such as maintaining the employability of the workforce in a world of exponential change, and building knowledge systems and capability to achieve economic objectives. Lifelong learning also underpins the new generation of EU education programs (Socrates, Leonardo de Vinci, Youth) which were given renewed mandates for the period 2000-2004.13

The process of developing EU policy on lifelong learning has obliged EU countries to address the issues thrown up by the lifelong learning agenda, in particular during the consultations undertaken during 2001 on an EU Memorandum on Lifelong Learning which led to the Commission decisions in November 2001 on an European Area of Lifelong Learning. Ireland illustrates the impact of EU processes on the development of national policy for lifelong learning in its August 2001 response to the EU Memorandum.14 EU policy on lifelong learning means that Member States “must develop and implement coherent and comprehensive strategies for lifelong learning”.15

The perspectives on lifelong learning developed through the work of OECD, UNESCO, and the European Union, have been reflected in the policies and strategies in a number of the countries we studied.

Canada was an early leader in this area, through the work of its Information Highway Advisory Council between 1994 and 1997, followed by Sweden, Finland (and the Scandinavian countries generally), Britain, and the European Union.

The Canadian Information Highway Advisory Council was established in 1994 to advise on the development and implementation of a Canadian information highway. The Canadian Government set out five operating principles to guide this process and the work of the Council. These principles were:

• an inter-connected and inter-operable network of networks;
• collaborative public and private sector development;
• privacy protection and network security;
• competition in facilities, products and services;
• lifelong learning as a key design element of Canada’s Information Highway.16

The recognition by the Canadian Government from as early as 1994 of lifelong learning as “a key design element” of the Information Superhighway influenced the work of its Advisory Council, and is reflected in its reports,17 and was subsequently reflected in Canadian programs to position Canada in the information age.

The long interest of the Scandinavian countries in lifelong learning easily connected to evolving policies for the information society, and is a feature of development in Sweden and Finland.

In the case of Britain, the change of government in 1997 gave an impetus to policies for lifelong learning with the approach and commitment of the British Government set out in its 1998 Green Paper *The Learning Age*.18 The interaction of policy for lifelong learning and for ICT in education has been a feature of British development since 1998.

The intimate connection of lifelong learning objectives to the role of ICT in the knowledge society is a theme discussed throughout this report.

**Building the Partnership Society**

Closely related to the concept of a connected or networked society, is the notion that policy for ICT skill contributes to building a partnership society featured by new forms of public and private partnership. This development is widely reflected in policy for ICT in education across the countries we studied and is expressed in various innovations we observed. It involves, by its nature, a redefinition of public and private roles in the information age and the forging of innovative strategies.

The pervasive interest in partnership development we observed reflects the reality that all stakeholders are partners in adapting the organs, instruments, and habits of society to the conditions of a new era. Nevertheless, there were differences across countries in the forms and intensity that partnership action took, reflecting cultural and other differences between these countries.19 Examples of innovative forms of public/private partnership, such as the University for Information (UfI) in Britain and the CEO Forum for Education and Technology are given throughout this report.

Partnership development takes on a particular flavour in a federal system such as the United States, Canada, and Australia where the challenge exists to adapt traditional federal structures and relationships to support new forms of partnership action directed at the conditions and imperatives of the information and knowledge era.

The Australian experience is of interest in this regard with a collaborative Education and Training Action Plan for the Information Economy20 developed by the Commonwealth, States, and Territories which covers schools, vocational education and training, and
higher education. Follow up on the Action Plan provides a good test of the capacity of a federal system to adapt to a radically different context in innovative ways.

Towards Seamless Interdependence and Whole of Government Strategies

The interplay of these strategic perspectives has influenced the development of policy for ICT in education in most of our sample countries in the context of a search for seamless interdependence and whole of government strategies in policy development. This has meant that policy for ICT in education is increasingly seen in the context of broader social and economic objectives, such as building a connected learning society and responding to the economic objectives, including learning and skill requirements of the knowledge economy. These relationships are discussed in Chapter 3.

The concept of the “seamless interdependence” of the economic, social, and cultural dimensions of the transition to the information and knowledge society was articulated by the Canadian Information Highway Advisory Council in its final report in 1997. This concept has influenced the broad approach that the European Union has taken to building an information society in Europe, and has impacted on policy in countries such as Britain, Canada, and Sweden. We discuss in Chapter 3, which follows, the interplay of whole of government strategies and frameworks and policy for ICT in education.

The role of ICT is central to this search for holistic socio-economic-educational strategies which reflect the seamless interdependence of policy in the information and knowledge age. How well, and how far, this search has progressed is the story of this report.

NOTES

5. The strategic frameworks are discussed in Chapter 3.
7. OECD 1996.
8. Ibid pp.29-45.
3. OVERARCHING STRATEGIES AND FRAMEWORKS FOR ACTION

The intention (of the e Learning Action Plan) is to involve education and training players, as well as relevant social, industrial, and economic players, in order to make lifelong learning the driving force behind a cohesive and inclusive society, within a competitive economy.


The pervasive nature of the impact of the information and knowledge society poses a fundamental set of new issues for government and other stakeholders.

It is becoming increasingly evident that traditional government processes and mechanisms are ill suited to the imperatives and conditions of the information age. This has led to a search for new approaches that fit the conditions and dynamics of the information age.

Education, by its nature, is positioned at the frontier of the transition to the knowledge society and is confronted by a series of dilemmas and challenges in re-defining the role and strategies of an education system in the information age. This challenge has led to widespread calls for re-engineering of the education system,¹ and to reform efforts from within education systems. Policy for ICT in education is intrinsically involved in this debate and action.

Across the countries we studied, certain common themes emerge. These include a search for whole of government solutions, the role of strategic planning and action plans in addressing the challenge of the information age, and the growing significance of partnership and network strategies in a range of forms. Cultural and other differences between the countries then impact on the forms the common themes take, and their implications for education policy for ICT.

Whole of Government Approaches

A number of governments, both national and state, have established mechanisms to guide their transition to the information society, and to provide a basis for strategic frameworks to co-ordinate action on a whole-of-government basis.

Examples of this role include:

- the work of the Canadian Information Highway Advisory Council and the subsequent Connecting Canadians program;
- the role of the Swedish IT Commission;
- the Australian Strategic Framework for the Information Economy and the role of the National Office of the Information Economy;
- the Queensland Smart State initiative;
• the European Union’s e Europe initiative;
• the Singapore Infocomm 21 Strategic Plan.

Each of the strategic frameworks involve broad cross-sectoral perspectives and strategies which carry implications for policy from ICT in education, and which have usually led to subsequent education action plans as, for example, with the European Union’s e Learning initiative and the Australian Education and Training Action Plan for the Information Economy.

In most cases, the existence of these broad whole-of-government (and whole-of-society) strategic frameworks has influenced education policy towards a strengthening of social and economic objectives, both in the formal education system and in community-oriented strategies, in such areas as fostering lifelong learning and building a learning society, and in ensuring that essential skills are acquired by all. Canada, Sweden, Finland, Britain, and the European Union illustrate this orientation.

**The Canadian Approach**

The Canadian approach in building a strategic framework for policy development is of particular interest in illustrating an approach in a federal system without a national education department or ministry so that national education perspectives have been incorporated through the roles of other portfolios.

Canada has had a long preoccupation with communication issues, and took an early initiative in 1994 in establishing the Information Highway Advisory Council to provide advice for Canadian policy. The Council operated up to 1997 and its reports over this period provide a rich source of information and ideas on the transition to an information society. Canada was an early leader in defining the attributes and requirements of a “society built on knowledge”.

Learning and training comprise an integral part of the knowledge economy. Canada will provide an environment for lifelong learning in which all Canadians will have access to the widest possible variety of learning opportunities and tools.

The 1995 report of the Council set the framework for much subsequent Canadian development in identifying 15 public policy issues to be addressed and 5 key operating principles which underpinned later developments. These principles were:

• an interconnected and interoperable network of networks;
• collaborative public and private sector development;
• competition in facilities, products and services;
• privacy protection and network security; and
• lifelong learning as a key design element of Canada’s Information Highway.

This action plan was built around four strategic thrusts:

- Building Canada’s Information Highway
- Growing Canadian content on the Information Highway
- Realising the economic and social benefits for all Canadians
- Getting government right as a model user and catalyst for Information Highway development across Canada.

The Government in its 1996 action plan accepted the advice of the Council that lifelong learning should be a key design element of the Canadian Information Highway with “lifelong learning both an ideal and a future necessity.” The Government’s plan also committed Canada to a national access strategy reflecting the IHAC guiding principles.

Following the 1996 Government action plan, the Council was reconvened to provide further advice which it did in its final report of 1997 (http://www.strategis.gc.ca). This report provides an excellent overview of the implications for government and the community of a “society built on knowledge”. Of particular significance is the emphasis placed on access as “the cornerstone of the information society” while lifelong learning was linked to necessary developments in the workplace.

This process of dialogue between the Canadian Government and its Advisory Council culminated in a Connecting Canadians program announced by the Canadian Government in 1998 which built on the philosophy and principles of the Information Highway Advisory Council, and other related developments in setting out a co-ordinated approach focussed around six main programs, and component programs within these areas, to achieve the vision of Canada as a connected information society (http://www.connect.gc.ca).

The six principle programs were:

- Canada Online: facilitating access and building infrastructure
- Smart Communities: using ICT to revitalise communities
- Canadian Content Online: realising the potential of converging communities
- Electronic Commerce: Canada’s role in the new economy
- Government Online: delivering information and services to Canadians via the Internet
• **Connecting Canada to the World**: Canada as a global centre of excellence.

From the perspective of this study, Canada Online and Smart Communities are the most relevant.

Canada Online consists of the following programs:

• **Canada’s SchoolNet**: making a difference to schools
• **CANARIE Inc**: Canada’s advanced Internet development organisation
• **Community Access Program**: access and connecting communities
• **LibraryNet**: changing the way we view libraries
• **SkillNet.ca**: beyond “help wanted”
• **The Student Connection Program**: bridging the gap
• **VOINet**: connecting Canada’s voluntary organisations to the power of the Internet.

A number of these programs, in particular SchoolNet and Smart Communities, are discussed in the chapters of this report which follow.

The Canadian approach and experience is significant in several respects:

• it illustrates an approach based on active promotion of a shared vision with programs then tied to this vision around the theme “Connecting Canadians”;
• it illustrates national programs which cross into the field of education in a country without a national education department and with no federal power in education.

The approach of actively promoting a broad social vision of an information society as a basis for action plans, was also followed in Britain and the European Union, and there is considerable similarity in the Canadian, British (since 1997), and European Union approaches. All these actively promoted a vision of an information (or learning) society underpinned by lifelong learning and active access strategies.

The federal question is particularly interesting in the Canadian approach. SchoolNet is a program for Canadian schools directed at connectivity for schools, access to computers, and associated teacher professional development, while Smart Communities has strong educational aspects.
A recent evaluation of SchoolNet by KPMG recognised that SchoolNet had operated “in an environment where jurisdictional sensibility is of paramount concern” but had been successful for a number of reasons. These included:

- “a clear sense that federal involvement in the form of a national connectivity strategy was both necessary and legitimate”;
- the mix of partnerships between federal, provincial, organizational and private sector actors;
- the sensible devolved administration of SchoolNet.12

In recognising the significance of partnership development to the success of SchoolNet, the KPMG report also observed that “given the constantly changing nature of knowledge and technology” this mix of partnerships “will require continued renewal into the future”.13 The KPMG report on SchoolNet is of interest in illustrating the issues and operations of a national program such as SchoolNet in a federal system.

**Administrative Arrangements**

A further feature of the Canadian experience of interest has been the administrative arrangements made for the Connecting Canadians programs in a country without federal education powers, or a federal education department.

Prime responsibility for the program has rested with Industry Canada so that this department has become more involved in education matters than is usually the case in countries such as Australia, the United States, and Britain.

In addition, an **Office of Learning Technologies (OLT)** was established in 1996 within Human Resources Development Canada as “a partner in building a culture of lifelong learning”.14

OLT defined its vision and mission in the spirit of the philosophy developed by the Information Highway Advisory Council.

- **Vision** – The vision of the OLT is to “contribute to the development of a lifelong learning culture in Canada”;
- **Mission** – The mission of the OLT is to “work with partners to expand innovative learning opportunities through technologies”.15

OLT administers programs such as New Practices in Learning Technologies, Community Learning Technologies, and Learning Technologies in the Workplace.

Overall, Canada provides an interesting case study in a federal system being adaptive to meet the challenges and imperatives of the information age with a clear vision to guide, and integrate, a co-ordinated set of programs.
European Union

There is much in the European Union experience that is similar to the Canadian approach. These aspects include:

- a similar concern to articulate a vision of an information society and a “Europe of Knowledge” to underpin economic, social, educational, and cultural development;
- a recognition of lifelong learning as a necessary design principle to underpin the vision and its achievement;
- the development of a comprehensive action plan in eEurope which was then elaborated through initiatives such as the e Learning Action Plan;
- the setting of targets to be achieved in progressing this vision and action plans.

These lines of development have proceeded simultaneously in the European Union over recent years with an increasing convergence of policy between the main thrusts:

- work on the information society and Europe of Knowledge over some years culminated in the e Europe initiative launched in 1999 as “An Information Society for All”\(^{16}\) and endorsed by the European Council in 2000;
- work on lifelong learning since the 1996 European Year of Lifelong Learning which culminated in 2001 in the adoption of a “European Area of Lifelong Learning”;\(^{17}\)

- the renewal of a new generation of education programs (Socrates, Leonardo di Vinci, Youth, Tempus) in 2000 to run over 2000-2006 underpinned by the principles of e Europe and the e Learning Action Plan.\(^{18}\)

The new generation of EU education programs are directed at supporting the transition to an information and knowledge society and have a greater emphasis on lifelong learning, the educational use of ICT, the dissemination of good practice, and the inclusion of disadvantaged people.\(^{19}\)

Funding includes 1 billion 700 Euros for SOCRATES over the period 2000-2006 while MINERVA has 8 million Euros for action in open and distance learning for promoting the educational use of ICT over the same period.

e Europe provides the broad framework for policies to promote the information society in Europe. In promoting the uptake of digital technologies in Europe three key objectives have been articulated.

- Bringing every citizen, home, school, business, and administration online;
- Creating a digitally literate and entrepreneurial Europe;
Ensuring a socially inclusive information society\textsuperscript{20} (http://www.europa.eu.int/comm/information_society/eeurope.htm).

The ten priority areas identified for action under e Europe go beyond the scope of this report. The most relevant initiative, the e Learning Action Plan, is discussed below.

**The British Approach**

The British approach has been to draw on a series of government Green and White Papers in setting a strategic framework and vision for the transition to an information society. While there is a considerable number of these, the most relevant are:

- *An Information Age: the Government’s Vision* (1998);
- *The Learning Age* (1998) which set out the vision of a learning society;

Within this framework of visioning statements, a comprehensive action agenda has been implemented in Britain which is discussed in the chapters that follow.

**The Australian Approach**

Australia has followed Canada and the European Union in devising a comprehensive action plan for the information age. However, this Strategic Framework for the Information Economy (http://www.noie.gov.au) differs to the Canadian and European Union Frameworks in its focus on the information economy rather than the broader concept of an information society which underpins the Canadian, British, and European Union approaches.\textsuperscript{21}

While the focus is on the information economy, the vision, mission, and values built into the framework range broadly across economic, social, educational, and cultural objectives, and the agency established by the Australian Government to promote this vision and framework (the National Office of the Information Economy) has taken an interest in access and equity issues as well as economic dimensions.

**Other Countries**

The four approaches outlined above illustrate general directions and policies in establishing whole-of-government frameworks to guide and co-ordinate policies in the transition to an information society and its new economy.

Approaches adopted by other countries in this study include:
• **Sweden** – The Government established an IT Commission in 1992 as its advisory body in the field of ICT. A series of Commission reports during the 1990s have articulated a vision of Sweden in the knowledge society and addressed specific issues such as infrastructure.\(^{22}\)

The Commission in its 1997 report argued that the education system was geared to an industrial society and advocated the need to re-engineer education\(^{23}\) ([http://www.itkommissionen.se/english/eng.html](http://www.itkommissionen.se/english/eng.html)).

• **Singapore** – Singapore announced its **Infocomm 21 Strategic Plan** in December 2000 as a blueprint to transform Singapore through the harnessing of infocomm technologies for national competitiveness as well as to foster a better quality of life for its citizens in the digital age.\(^{24}\) The blueprint sets out the vision, goals and strategies that would facilitate the development of the Singapore infocomm industry over the following five years. In addition to the economic objectives of the plan, there are social objectives which include the promotion of an e-lifestyle.

The strategic framework of the plan objectives relate to such aspects as fostering a knowledge-based workplace, infocomm education, and achieving adaptive and robust infocomm infrastructure.

**The Education Action Plans for ICT**

The concern of governments to build overarching strategies and frameworks for action has flowed across into policy for ICT in education where it has become common to develop education ICT action plans as an instrument to promote the effective use of ICT in education and training.

Most of the jurisdictions included in this study have developed such action plans, and some have been through several iterations of ICT education planning. Sweden and the United States are currently working on their third national plan for ICT in education with the progression of planning in these countries suggesting something of the progression of national policy for ICT in education through two phases of development with some countries focused on the threshold of a third phase of development which would entail a transformation in the way we learn.

The concept of two or three phases of development in the implementation of ICT into education has been widely noted. These phases are usually seen as:

- **Phase 1** – rolling out computers into schools and colleges with some professional development and content development;
- **Phase 2** – mainstreaming and integrating the role of ICT into education in a more strategic way with concern for objectives and with linkages forged to overall education strategies.

The European Union in a survey of ICT in education in Europe undertaken through its Eurydice program in 2001 saw the development of ICT in education in Europe in these
terms and noted that most EU countries had followed a **sequential approach** (facilities first and then objectives) rather than a **simultaneous one** (with facilities provided while goals are being determined).\(^{25}\)

The Eurydice report further observed that “with few exceptions, most countries are still involved in introducing ICT, to a greater or lesser extent, into their education systems”\(^{26}\)

This observation supports, in general, the conclusion we have drawn from this study that the countries studied have been implementing policies to lay the foundations for the role of ICT in education and in society (phases 1 and 2) and that no country has yet progressed to the third phase which would involve a transformation of the way we learn.

In addition to government agencies such as Eurydice, and countries such as Sweden, informed observers such as Bill Gates have suggested three phases (or steps) towards the integration of ICT into education to transform models of teaching and learning.\(^{27}\) We take up in Chapters 10 and 11 ways in which education systems might progress to the phase 3 of transformation based on insights gained across the sixteen jurisdictions in this study.

In order to illustrate the features of phase 2 action plans, we have provided overviews in Exhibits 1-10 of the ICT action plans adopted in the United States, Sweden, Finland, European Union, Ireland, Australia, Singapore, New Zealand and Malaysia. OECD work on ICT in education is also outlined. We then take up the question of the similarities and differences in these action plans, including the elements in some plans which could be drivers towards a third phase of transformation of learning. In addition to these overviews, we also comment on the action plans in California, Ohio, and Texas to illustrate strategic planning in a state system.

### Exhibit 1: United States e Learning : the National Education Technology Plan 2000

*E* Learning was released in December 2000 as the second U.S. National Education Technology Plan. The first plan of 1996 was focussed on what were seen as the four pillars for integrating ICT into education. These related to: (1) all teachers having training and support; (2) access to modern multi-media computers in classrooms; (3) all classrooms being connected to the information superhighway; (4) effective software and online learning resources being part of every school’s curriculum. Federal funding programs supported these objectives. A new National Education Technology Plan is required to be submitted to Congress by January 2003.

A review of progress in 2000 showed substantial progress in achieving these objectives so that the new plan of December 2000 set out more ambitious objectives. These were:

- **Goal 1**: All students will have access to IT in their classrooms, schools, communities and homes.
- **Goal 2**: All teachers will use technology effectively to help students achieve high academic standards.
- **Goal 3**: All students will have technology and information literacy skills.
- **Goal 4**: Research and evaluation will improve the next generation of technology applications.
- **Goal 5**: Digital content and network applications will transform teaching and learning.


The current Swedish National Action Plan is built around four guiding principles:

- Equality and quality for all pupils regardless of where they attend school.
- Promotion of development in schools.
- Supplement and reinforce planned and completed investments.
- Increase accessibility.

Objectives in the Plan include that schools should be connected to the Internet. Grants are given to increase existing connections, and a target exists for all students and teachers to have their own e-mail address by 2001. Training is being provided for 60,000 teachers with a focus on ICT as a tool for learning. Programs under the Action Plan are supplemented by existing activities such as the Swedish SchoolNet. The Ministry for Education is currently working on a new action plan to be released during 2002 which is seen as progressing to a third phase of development of policy for ICT in education.

http://www.itis.gov.se/english.html

Exhibit 3: Finland’s National Strategy for ICT in Education 2000-2004

Finland’s current National Strategy for ICT in Education follows up on the Information Society Program of the Ministry of Education implemented over 1995-1999. The Plan is linked to a vision of the opportunities inherent in the information society to improve quality of life, knowledge, social interaction as well as economic competitiveness. The new plan is seen as involving a progression from hardware to pedagogical renewal aimed at assisting people to acquire necessary digital age skills. The Plan is also based on a vision of “information society skills for all” (including free e-mail for all Finns by 2004).

Programs built into the Plan range across teacher training and professional development with three levels of proficiency defined, virtual university, virtual school, information development, digital content and the fostering of networks as learning environments. Social exclusion is seen as the most serious threat to the development of an information society. The desired state to be achieved by 2004 is defined in the Plan.

http://www.minedu.fi/julkaisut/information/englishu/index.htm
**Exhibit 4: Australia’s Education and Training Action Plan for the Information Economy - 2000**

The Australian Action Plan was developed as a collaborative Commonwealth/State project coordinated by the then Australian Department of Education, Training and Youth Affairs. The Plan is distinctive in containing separate sectoral plans for school, vocational education and training (VET) and higher education, as well as an overarching action plan. It is focussed around five action areas which are repeated in each of the sectoral plans. These are: 1 People; 2 Infrastructure; 3 Online Content, Applications and Services; 4 Policy and Organisational Framework; 5 Regulatory Framework.

The Plan provides a framework for collaborative Commonwealth/State action, as well as for action by individual jurisdictions. There is regular reporting on progress to the Ministerial Council for Education, Employment, Training and Youth Affairs (MCEETYA), and a number of collaborative projects are being funded to further the objectives of the Plan. A feature of the Australian approach is the annual Strategic Plans developed for the VET sector, funded by the Australian National Training Authority while various collaborative projects have been undertaken in the school sector.


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**Exhibit 5: The European Union’s e Learning Action Plan, 2001-2004**

The e Learning Action Plan was adopted by the European Commission in 2001 to give new communication technologies a greater role in education. This initiative is seen as a contribution to the broader e Europe action plan and is closely connected to EU policy on lifelong learning, the modernisation of European education and training systems, and the European employment strategy. Four strategic directions for action are identified: to equip schools with multi-media computers; to train teachers in digital technologies; to develop educational services and software; and to speed up the networking of schools and teachers.

Implementation of the Plan is being undertaken through EU programs (Socrates, Minerva, Youth) and action by Member States. The close links to lifelong learning objectives are expressed in the new generation of EU education programs mandated for the period 2000-2004. A broad concept of digital literacy underpins EU action.

[http://www.europe.eu.int/comm/e_learning](http://www.europe.eu.int/comm/e_learning)
Exhibit 6: The Irish IT 2000 Program

In 1997 the Irish Government acknowledged that it lagged significantly behind its European partners in the integration of ICT into schools. The Government responded by announcing a 250 million pound Education Technology Investment Fund and the Schools IT 2000 program as a policy framework to drive the integration of ICT into schools. This program had three key areas: (1) classroom resources and infrastructure; (2) teachers skills development and support; (3) policy and research.

In order to drive this program the National Centre for Technology in Education (NCTE) was established to implement the program. A significant aspect has been the School Integration Project with 48 projects across 228 schools exploring curriculum innovations for enhancing innovation in learning involving ICT. These projects have attracted substantial partnership support with 28 commercial partners and 58 partners from communities and other agencies. Scoilnet has had a key role in identifying multimedia content suitable for Irish schools. A new three year plan was announced in 2001 to follow up on the original plan with similar objectives.

http://www.irlgov.ie/educ/pdfs/strategy_statement.pdf

Exhibit 7: Singapore’s Masterplan for IT in Education 1997-2002

Singapore’s Masterplan for IT in Education is the blueprint for the integration of IT in education to meet the challenges of the 21st century. The Plan involves ambitious targets to be achieved by 2002 in areas such as infrastructure, teacher professional development, and the use of computers in schools which would make Singapore a world leader in the use of ICT in education.

There are four key dimensions in the Plan: curriculum assessment, content and learning resources, physical and technological infrastructure, human resource development. The Plan envisages that by 2002 pupils will spend 30% of curriculum time using IT. To achieve this, a pupil-computer ratio of 2:1 is targeted for every school by 2002. All schools will be linked through a Wide Area Network which will eventually be connected to the high speed backbone of Singapore One.

A four-tier fan model of professional development was to be put in place to train teachers in every school by 1999. The fan approach generates a multiplier effect enabling the sharing of expertise and cultures between schools. The ambitious Singapore Masterplan illustrates the possibilities for systematic ICT development in a compact area.

http://www.moe.edu.sg/
Exhibit 8: OECD Work on ICT in Education

While OECD does not have an action plan for ICT in education, it has been active for some years in examining the role in ICT in education. This work has included 1996 CERI projects on Adult Learning and Technology in OECD Countries and Information Technology and the Future of Post-secondary Education.

More recently, a three year CERI project on ICT and the Quality of Learning was conducted over the period 1998-2001 with a focus on schools. This led to publications on ICT in Schools, the Digital Divide and E-learning: The Partnership Challenge. The CERI project also included 93 case studies in 23 countries. Much other OECD work is relevant including the continuing work on lifelong learning and the current project on Learning Science and Brain Research.

http://www.oecd.org


The ICT Strategy for Schools 2002-2004 sets out a vision for schools, principles and goals, and summarises action plans. The Strategy includes an assessment of the impact of ICT on schools and summarises the findings of surveys conducted in 1998-99. An appendix to the Strategy describes existing initiatives.

A useful review of ICT in New Zealand schools over the period 1993-2001 was produced by the Learning Centre Trust based on a survey conducted in 2001 and is available from the Trust’s web site.


Exhibit 10: Malaysian Policy for ICT in Education

Malaysian policy for ICT in education has been developed in the overall context of Malaysia’s aspiration to develop as a knowledge-rich society. Vision 2020 sets out the national agenda and goals to be achieved while a series of Industry Plans have driven the supporting projects, such as the Multimedia Suped Corridor.

Education initiatives to support these goals include the Smart School initiative directed to enhance learning in schools through a Teaching-Learning process of curriculum, pedagogy, assessment and teaching-learning materials. Smart School Integrated Solutions have been developed for use in schools. A network of exemplar schools support other schools in making effective use of ICT.

http://www.ITISC.com.my/mdc/flagship/ss.asp
http://www.msc.com.my/mdc/msc
Common and Distinctive Components in Action Plans

An examination of the action plans outlined above, points to the fact that certain core or common components appear in all plans, supplemented in some cases by some distinctive components which either reflect the culture and values of the country, or progress towards a further phase of development.

The core of these common components resides in what the 1996 United States National Plan for ICT in Education regarded as the “four pillars” of its policy. These pillars were hardware, connectivity, software, and professional development.28

While the American four pillars were repeated in most action plans in some form, it also became common to add ICT skills for all as a further core component and, in some cases, meeting the ICT skill needs in industry.

The comparability and progression of action plans is reflected in the following analysis of common and uncommon components.

A. Common Components in Action Plans
   - Infrastructure (hardware and connectivity)
   - Professional development of teachers
   - ICT skills for all
   - Online content and services

B. Components in Some Plans Only
   - Equity and access and combating social exclusion (Sweden, Finland)
   - Research and development (USA 2000)
   - Policy, organisational and regulatory framework (Australia)
   - Transformation of teaching and learning (USA 2000).

A tentative conclusion follows from this analysis that the common components in list A are the pillars of the foundation stage of integrating ICT into education and training (Phases 1 and 2) while the components in list B are mainly components that might be found in a Phase 3 transformation stage. The progress made by the United States between 1996 and 2000 suggested that the United States was on the threshold of progression to a Phase 3 transformation of teaching and learning. This is reflected in the transformation goal 5 of the 2000 Action Plan.

While the policy and organisational and regulatory frameworks were included in the 2000 Australian Action Plan, not much follow up has occurred in these areas, and these are largely action areas for the future as policy progresses to the transformative phase 3 and roles and relationships are changed.
State and Provincial Action Plan

In the federal systems included in the study, in addition to national action plans for ICT in education, it is usual for similar State or Provincial plans to be developed. Some examples are:

  http://www.tea.state.tx.us/technology.html
- California Master Plan for Educational Technology 1992
  http://www.cde.ca.gov/edtech/mplan
- South Carolina Education Technology Plan
  http://www.sde.sc.us/sde/educator/techplan/
  http://www.meq.gov.qc.ca/STAT/indicOO

A feature of the American scene is that often commissions were established to undertake public consultations in the development of state ICT plans. Examples include the Californian Commission on Technology and Education and the Ohio SchoolNet Commission. This approach has the merit of involving the community in consultations on strategic planning and promoting awareness in the community of the issues involved.

The Concept of a Third Phase of Development

While all countries included in this study have progressed through start-up and mainstreaming phases in policy for ICT in education, several systems appeared to be on the threshold of progressing to a third phase of development. While the initial two phases are essentially foundation phases, the third phase will be focussed on the transformation of education and training to fit the conditions of the information and knowledge society.

As noted above, there are some elements of a transformation phase in the United States 2000 National Action Plan. However, the concept of a third phase has been most explicitly articulated in Swedish policy for ICT in education.

The concept of three phases of development in Swedish policy for ICT in education was articulated by the Swedish Minister for Education and Science in a speech delivered at a European Union forum on 23 April 2001. In this speech the Minister articulated the three phases in Swedish ICT development in the following terms.29

Phase One

This phase was dominated by the public sector with the initial roll out of computers in schools and with pilot projects to test the role of computers. The central question was seen as “Why should we have computers in the school?” There was little co-operation between the public and private sectors.
Second Phase

The second phase started in the early 1990s and is still in progress in 2001. This phase focussed on questions When, Where and How. When should ICT be used in teaching and how should it be used. The pedagogical implications of ICT were explored to establish ways in which the integration of ICT could best be promoted. Good practice was identified.

Third Phase

Sweden was seen as moving towards the third phase.

Here the role of ICT in schools is not only changing, but the whole view of learning and the school as an institution is also changing. Learning is increasingly regarded as something for each and everyone throughout the course of their lives. Traditional school boundaries are being removed, classrooms are being opened up and at the same time new groups are starting to use school resources eg through learning at the workplace, while the school itself is increasingly using resources in society for educational purposes.30

The Swedish Ministry for Education and Science has initiated consultations on proposals for a new Action Plan. The report of a working party setting out proposals was released for comment on 15 May with proposals to be finalised by 1 October this year. The issues flagged for comment include the question of whether digital literacy skills should be introduced as a fourth basic skill in the school curriculum alongside the ability to read, write and perform arithmetical calculation. Strengthening research and overall co-ordination of effort is also proposed.31

Other systems are also giving attention to the characteristics of a further phase in policy for ICT in education which will transform the way people learn and we comment further on this question in Chapter 10 below where statements from Britain and Ontario are cited.

In addition to Sweden, the other countries of the ICT League32 (Nordic countries, Canada, Netherlands) are collaborating to explore ways of progressing to the third phase of policy for ICT in education.

This overview of overarching government strategies and education frameworks for action points to the nature of the challenge confronting education systems in keeping pace with technological, economic, and social change in the information era. The key role of strategic planning in co-ordinating action is evident, while at the same time the need to move policy on is a key feature of the policy landscape over the past decade. This has been marked by a broadening of the educational, social, and economic considerations that bear on policy for ICT in education and by the strengthening of linkages between education policy and whole-of-government strategies for the information society and its new economy. These issues are starting to come into focus in the emerging international debate on the characteristics of a third and transformative phase in ICT policy.
We return to this subject in Chapters 10 and 11 below.

NOTES

2. Saul 1997, p.425. Saul asserts that new ideas about communication in the 20th century came more often from Canada than anywhere else.
3. See, for example, the 1997 Final Report of the Council.
5. Ibid, p.5.
7. Ibid, p.3.
8. Ibid, p.5.
10. Ibid.
13. Ibid, p.i.
15. Ibid.
19. Ibid, p.3.
20. European Commission 2001b, p.3.
30. Ibid.
32. See Appendix 3 for information on the ICT League.
4. PEOPLE ASPECTS: ENSURING ICT SKILLS FOR ALL

*A society of information have-nots’ would not just be unfair – it would also be inefficient. Competitiveness depends on the skills and creativity of the whole workforce.*


Policy in all countries studied has given prominence to people aspects in the role of ICT in education. With the evolution of policy through the phases discussed in Chapter 3 above, the concerns of policy have also broadened from an initial focus on professional development of teachers to broader social and economic objectives involving ensuring ICT skills for all and meeting the skill needs of the information and knowledge economy.

With the broadening of social and economic objectives in policy, certain key issues have come to the fore. These include addressing the so called “digital divide” in society, and identifying and meeting the essential skills and attributes involved in the concept of digital literacy in an information society. These are complex issues, and it is not surprising that a range of responses have emerged in the countries studied.

In the case of the digital divide, much of the policy initiative is taking place in agencies outside education portfolios so that a key issue relates to the interface between policy in these agencies and education policy. This question brings to the fore the role of whole-of-government strategies and frameworks in addressing broad social and economic issues in the context of the information society, and the linkages with education policies and strategies.

In the context of these considerations, there are three key thrusts in policy across the countries we studied. These are:

- enabling all citizens to use ICT confidently and creatively;
- ensuring adequate numbers of people with specialist ICT skills are produced to meet the needs of the economy; and
- ensuring that the education and training workforce is able to take full advantage of ICT.

These policy thrusts raise a complex spectrum of issues that we discuss below and in the following two chapters. The second and third of these policy thrusts are discussed in Chapters 5 and 6 which follow.

Ensuring ICT Skills for All

The objective of ICT skills for all underpins national action plans across the countries we studied and involves two basic thrusts:

- ensuring that all school students acquire basic ICT skills and are able to apply them confidently and creatively; and
• assisting adults without these skills to acquire them.

Both these objectives have raised major policy issues which have attracted considerable attention and debate across countries. These key issues are:

(i) What is involved is “digital literacy” and how is it best acquired?
(ii) How can the “digital divide” in society best be addressed?

We comment on policy action in respect of these issues below.

**Digital Literacy for all School Students**

While it is widely accepted that all students should acquire basic ICT skills, the broader policy debate has focussed on the question of what is involved in a concept of essential digital literacy in a globalised knowledge society. This issue has attracted attention across most countries we studied.

There are two aspects to this issue:

(i) ensuring all students acquire basic or technical ICT skills
   - this involves the ability to use computers and the Internet; and

(ii) ensuring the broader components in the concept of digital literacy which go to the capacity to use ICT for educational, social, and economic purposes, and which involve reasoning, problem solving, and other skills.

While there is broad agreement on the necessity for (i), the boundaries of (ii) have raised a range of issues across OECD countries with some proponents making a distinction between digital literacy and a broader concept of essential 21st century skills. In this way, discussion of the required ICT skills for all is inevitably caught up in the broader debate on what are the essential skills required by all in the knowledge society.

The nature of the issues involved has meant that a range of policy instruments have been used to achieve the objective of ICT skills for all students. These have included:

(a) National testing of ICT skills;
(b) incentive schemes for students (and teachers);
(c) programs to increase the number of computers in schools, Internet connectivity and to raise the quality of content and online content;
(d) strategies for professional development of teachers.

**National Testing and Monitoring of ICT Skills**

Australia is a leader in this area following a decision by the Ministerial Council on Employment, Education, Training and Youth Affairs (MCEETYA) in July 2001 to
endorse a framework for national assessment and reporting of students’ ICT Skills. Ministers authorised the development of assessment instruments and key performance measures with a view to a first field assessment taking place no later than 2003.5 The national monitoring of ICT skills and knowledge will be undertaken for Year 5/6 and Year 9/10 students by means of a two or three yearly sample assessments.

Some Australian States have already commenced action in assessing the ICT skills of school students with New South Wales an early leader in conducting computer skills assessments in Years 6 and 10.

In addition to national testing schemes, some countries have adopted annual monitoring arrangements to assess progress. Britain provides an example of this approach in the further education sector where an annual survey is undertaken to assess progress by further education colleges under the Information and Learning Technology (ILT) initiative.4 Under the ILT programs, colleges are required to develop an ILT strategy and to report regularly on progress. This is discussed in Appendix 4.

Incentives for Students

In addition to national testing and other monitoring schemes, a range of incentive schemes have been established to provide incentives for students to foster their ICT skills. These include the European Drivers Licence scheme and the range of attractive interactive materials that we discuss in Chapter 6 below.

Computer and Software Programs

A further policy approach is to increase the number of computers in schools and to raise the quality and interest of online content. While all countries are aiming to improve student/computer ratios, Singapore provides the most aggressive example with its policy to achieve a 1:2 student/computer ratio by 2002 under its National Action Plan with 30 per cent of instruction to be by ICT by 2002. We discuss quality and interest issues in Chapter 6 below.

Professional Development Strategies

A further key policy instrument resides in the use of teacher professional development strategies to foster student ICT skills. This aspect is discussed below.

Components of Digital Literacy

A central issue that most countries studied have addressed lies in the question of what comprises digital literacy in the context of the information and knowledge society. We found considerable comment on this question in both North America and Europe, and substantial agreement that digital literacy involves more than technical competence in the ability to use computers and the Internet.

OECD and the European Union have both taken an interest in this question. OECD in a publication resulting from its three-year CERI project on Information and
Communication Technology and the Quality of Learning articulated a perspective that we found widely reflected across the countries in this study.

Just as “conventional” literacy is more than a basic ability to read a sequence of words, digital literacy is more than the ability to use a computer in simple ways, and both are fundamentally important. It implies a sophisticated set of competences pervading workplace, community and social life, including information-handling skills, and the capacity to make judgments about relevance and reliability when searching on the Internet. Digital literacy is a vital part of the foundations for lifelong learning and must have a high priority within the curriculum.

OECD 2001b, p.15

OECD in its work on competencies for the knowledge economy (including its DeSeCo Program5) has attempted to identify the required essential competences.6

The European Union has adopted a similar broad approach that goes beyond technical computer and Internet skills, and which links the new essential skills to lifelong learning.7

The European Union approach involves both a reaffirmation of the foundation skills of reading, writing, and mathematics, as well as learning to learn and the “new skills” endorsed by the European Council at its Lisbon meeting.

The “new skills” endorsed by the Council at Lisbon comprised IT skills, foreign languages, technological culture, entrepreneurship, and social skills.8 In this way IT skills are seen as part of a continuum of essential competencies required by all in the context of the knowledge society and its new economy.

While EU countries are taking this approach, so too is Singapore. In the statement of philosophy underpinning its Masterplan for IT in Education, the Singapore Government observes that “education should continually anticipate the future needs of society, and work towards fulfilling those needs.”9

The skills required for the future will centre on thinking skills, learning skills, and communication skills. IT-based teaching and learning will be one of our key strategies for equipping our young with these skills.10

In some cases, a distinction is made between digital learning and the “new skills” required by 21st century conditions. The American CEO Forum on Education and Technology in its four year program of follow-up on the 1996 American National Technology Education Plan articulated this concept in its 2000 report on digital learning and digital content where a distinction is made between:

• digital learning which is seen as the educational approach that integrates technology, connectivity, content, and human resources to create productive and engaging learning environments;
• **21st century skills** include demonstrating technological literacy, communication skills, the capacity to access and use information to draw conclusions, and make generalisations, become self-directed learners, collaborate and co-operate in teams, interact in ethical ways.\(^{11}\)

There is a consensus across these countries that basic IT skills cannot be seen in isolation, but rather as a component in a broader concept of “digital literacy”, “new skills” or “21st century skills” which is directed at the essential cognitive, interpersonal/social skills, and personal attributes and values required by 21st century conditions. In this context, ICT becomes a tool for fundamental educational and learning objectives required by 21st century conditions.

This connection is also made in the Australian National Goals for Schooling where the requirement that all students should be confident users of new technologies is linked to broader goals of schooling.

**ICT Skills for All: Addressing the Digital Divide**

> Social exclusion from various causes and social inequality pose the most serious threats to the development of an information society.


Beyond the role of the formal education system in providing a platform of essential ICT skills and knowledge for all students, lies the more complex and intractable policy issue of addressing the needs of the adult population lacking basic ICT skills. This involves addressing a broad spectrum of forms of disadvantage which are summed up in the term “digital divide”.

The philosophy that all citizens should have opportunities to benefit from the information society is pervasive across most countries in this study and is reflected in programs such as Canada’s *Connecting Canadians* and the European Union’s programs discussed in Chapter 3.

The term “digital divide” has emerged in international usage to refer to the “gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies, and to their use of the Internet for a wide variety of purposes”.\(^{12}\)

The digital divide has been widely studied in government reports in the countries we studied. The most influential reports in providing insights into the nature of the problem and possible solutions have included:

- UK Report by Policy Action Team 15 2000, Closing the Digital Divide
There is considerable common agreement across these reports on the nature of the problem, and the general lines of solutions. It is widely recognised in these reports, and elsewhere, that “the digital divide is, in effect, a reflection of existing broader socio-economic inequalities”\textsuperscript{13}, so that the problem is complex and can’t be fully resolved without addressing the root causes of socio-economic inequality. Policy in countries such as Britain has been based on this principle.

There is also considerable agreement across the reports that the most relevant indicators of the digital divide are level of income and education\textsuperscript{14}, a conclusion repeated in recent Australian research\textsuperscript{15}, so that addressing poverty and educational failure and under-achievement are prime requirements. These have been key objectives in policy responses.

An aspect of concern that is repeated in both the American Falling Through the Net and British Policy Action Team 15 reports, is that the digital divide has in fact widened in recent years despite progress extending ICT infrastructure across both countries.\textsuperscript{16}

The British Policy Action Team 15 in its March 2000 report recognised that “Britain faces the problem of a society divided socially and economically” while “the gap between the worst off and the rest of the country has increased over the last two decades.”\textsuperscript{17} This assessment has influenced the broad policy approval adopted by Britain in addressing the problem.

An enquiry of particular value in defining the problem and possible response was undertaken by the Digital Opportunity Task Force of the G8 Heads of State. The Task Force was established by the G8 leaders following adoption of the Charter on Global Information Society at the 2000 Kyushu – Okinawa meeting of the Group.\textsuperscript{18} The Task Force involved 48 high level officials and experts with its report providing an international perspective on the problem, and leading to the proposed Genoa Plan of Action.

The analysis of the Task Force included the following key points:

- The digital divide is threatening to exacerbate the existing social and economic inequalities between countries and communities so the potential costs of inaction are greater than ever before.
- The problem can’t be addressed in isolation from the root causes of socio-economic inequality and exclusion.
• Novel forms of partnership are needed to address the problem.
• There is an urgent need for a multi-faceted and multi-layered effort by all stakeholders.\textsuperscript{19}

The British Policy Action Team\textsuperscript{15} reached much the same conclusions in its March 2000 report with its proposals guiding broad British whole-of-government responses. A particular feature of the British approach has been the concept of “joined up government” (or joined up policies) so that particular attention has been paid to co-ordinating action across broad sectors of government in a comprehensive social exclusion agenda.\textsuperscript{20}

The nature of the analysis outlined above has influenced a spectrum of policy responses with the most common being:

(a) reducing the cost of ICT for poor communities, families and schools;

(b) developing a network of community access points such as the American Community Technology Centres and British Online Centres;

(c) implementing comprehensive regeneration programs in poor areas with “joined up” policies with ICT seen as a tool for community regeneration;

(d) information strategies and monitoring programs.

Comment follows on these strategies.

i. **Reducing the Cost of ICT for Poor Communities and Schools**

The best example of this approach has been the American E-rate scheme which provided US$5.676 billion between 1998 and 2000 to facilitate access to ICT by poor schools and libraries.

The Universal Service program for schools and libraries commonly known as the E-rate, is a federal initiative that provides discounts on telecommunication and Internet technologies to elementary and secondary schools, and public libraries, across America. The program provides discounts ranging from 20 to 90 per cent, with the poorest schools and libraries receiving the greatest discounts. The discounts apply to Internet, telecommunications, and internet connection services.\textsuperscript{21}

The E-rate program was authorised by Congress as part of the Telecommunications Act of 1996 to bring affordable access to the Internet, distance learning, and other
telecommunication-based learning technologies to America’s school students and library users.\textsuperscript{22}

The program is built on the concept of universal service, previously applied in making telephone services widely available and affordable across America. The program is administered by the Schools and Libraries Division of the Universal Service Administrative Company. Expenditure is capped at $2.25 billion a year in discounts.

A preliminary analysis of the program by the Urban Institute for the US Department of Education showed that the bulk of funds had gone to the poorest schools and that the program had brought benefits to rural, urban, private schools and libraries.\textsuperscript{23}

In addition to the E-rate, a number of American departments have funding programs for poor communities to access technology. These include Broadband Connections, Internet Hire Access Program, Technology Opportunities Program.

Other countries have provided assistance to disadvantaged communities, in particular in rural and remote areas, through grant programs such as the Australian Networking the Nation program with its focus on infrastructure. Canada in 1997 set the bold target of making “the information and knowledge infrastructure available to all Canadians by the year 2000” with the Connecting Canadians programs discussed in Chapter 3 the main instrument for this objective.

An initiative of particular interest in the United Kingdom is being undertaken through the national e-Learning Foundation. The national e-Learning Foundation is to receive £1m from the DfES to assist in the provision of ICT for schoolchildren in Wired up Communities areas and ultimately throughout the UK. The national e-Learning Foundation is a recently formed charity which aims to promote the use of ICT in education and, specifically, to ensure that every pupil in the UK has an ICT device as a tool for learning and living. The provision of personal ICT devices will assist pupils in their studies and raise their levels of ICT literacy, enhance their personal job prospects and reduce skills shortages to benefit the UK economy, and place young people at the centre of developments to promote connected communities.

\textbf{ii. Developing a Network of Community Access Points}

A second strategy which is common across most countries is to establish networks of community access centres. The strategy is found in American Community Technology Centres, the Canadian Community Access Program (CAP), the UK Online Centres, Irish Community Media Centres, and the Australian telecentres and Community Technology Centres.

These are generally developed as extensive national networks with centres to be located in most communities.
• The UK Online Centres will provide a network of 6,000 centres by 2005 with all government services to be online by that year.

http://www.dfes.gov.uk/ukonlinecentres

• The Canadian Community Access Program aims to establish up to 10,000 affordable public access Internet sites throughout Canada. 4,000 sites have already been set-up in rural and remote communities, and a further 5,000 urban sites are to be established.


Both the British and Canadian networks of centres aim to allow client groups the opportunity to access the Internet and learn about it. The British centres are situated in a range of contexts (eg libraries, schools, LEAs and community organisations) and are funded from the Capital Modernisation Fund. The UK centres may also be learndirect centres and deliver programs of the University for Industry (UfI).

The American Community Technology Centres serve the same objective of providing access to ICT skills and services for communities, in particular in urban and rural areas and economically distressed communities. However, a fewer number of centres have been funded to date, and the centres also aim to develop model programs that demonstrate effective ICT programs in a range of community contexts. Some are located in federally-designated Empowerment Zones aimed at regenerating distressed communities, or in designated Enterprise Communities.

The Australian approach differs to these three national networks in that telecentres and community technology centres are run by State agencies although some have been established with Commonwealth Networking the Nation funds. There appears to be an issue for the States and Commonwealth to consider as to whether the issues to be addressed are national requiring a national approach as has occurred in Canada, the United States and Britain.

iii Implementing Comprehensive Community Regeneration Programs

A third approach, which is found in countries such as Britain and the United States, is to address the digital divide as an aspect of comprehensive community regeneration strategies directed at poor communities. This approach is responsive to the need identified in the reports discussed above for “joined-up policies” and for a “multi-faceted and multi-layered effort by all stakeholders”. The strategy is also based on recognition that the digital divide cannot be addressed in isolation for the root causes of socio-economic inequality and exclusion.

While British and American community regeneration programs illustrate this approach in its strongest form, there are elements of this approach in programs such as Canadian Smart Communities and British and Australian Learning Communities where equality and participation and usually key objectives. All these programs are directed at community regeneration and revitalisation through community action, although in the British and American community regeneration programs higher levels of government funding are provided.
The broader community regeneration programs take forms such as American Empowerment Zones and a range of British programs such as Excellence in Cities, Wired Up Communities, and British City Learning Centres. Britain has sought to co-ordinate “joined-up government” through the role of the Single Regeneration Fund.

Most of these programs illustrate innovative forms of public/private partnerships, where the role of government is usually to serve as a catalyst and supporter of community action. The outcomes of these strategies, as evaluations of programs such as the Canadian Smart Communities and British Wired Up Communities, become available, should be of considerable interest in devising further comprehensive strategies to address the digital and learning divide.

iv Information Strategies and Monitoring Progress

The fourth policy thrust we observed involves the role of information strategies and monitoring progress as adjuncts to policy. In most cases, promotion of ICT skills is caught up in broader campaigns and strategies to promote learning as in the British Campaign for Learning, and general promotion of lifelong learning.

Nevertheless, information strategies have also focussed on the digital divide as in the information aspects of the work of the Australian National Office of the Information Economy and American promotion. The American information strategy includes the role of a dedicated Closing the Digital Divide website (http://www.digitaldivide.gov) where reports, statistics, press releases, a newsletter enables policy makers, and other interested parties, across agencies and elsewhere to keep up to date on progress.

In addition to the United States, Britain has also adopted ongoing monitoring to assess progress in closing the digital divide with the Department of Education and Skills required to report annually on progress in line with a recommendation of Policy Action Team 15.

People with Disabilities

While there are few specific references in national ICT action plans to meeting the needs of people with disabilities, these needs are generally brought within the ambit of the inclusion principle that all should benefit from the application of ICT to education and training.

The goal of universal access is present in various forms in the United States, Finland, and Swedish action plans.25 In the United States plan it is reflected in goals that all students will have access to ICT in their classrooms, schools, communities, and homes, and that all students will have ICT literacy skills.26

These goals are elaborated by the principle that ICT applications should be directed to “better meeting students’ individual needs”.27 This thrust towards individualisation as a strategy for inclusion is based on a recognition that “access alone is insufficient if other barriers to the effective use of technology manifest themselves.”28
We must be vigilant in ensuring that teachers use technology to create classroom environments that are inclusive and engaging for students with varying backgrounds, languages, cultures, abilities, disabilities, interests, and motivation.\textsuperscript{29}

This thrust of policy brings with it a consequent interest in learning strategies that are responsive to these requirements, and hence an interest in the strategies for building an innovation system and culture which are discussed in Chapter 11 of this report, and which are reflected in approaches to teacher professional development, research, and other aspects. Some of the learning strategies discussed in the United States\textsuperscript{30} and other action plans, such as building virtual communities of learners, are clearly relevant to the particular needs of people with disabilities.

The similar strong thrusts in the Finland and Swedish action plans towards equity and inclusion also carries a similar interest in pedagogical renewal as a necessary instrument for achieving inclusion objectives.\textsuperscript{31} The European Commission has a similar interest in its e-Learning Action Plan in fostering a European research area for new learning environments which takes account of individual differences in learning and special needs.\textsuperscript{32} There is a similar interest in virtual networks for co-operation and collaboration.

It is evident that there is an unfinished agenda in this area which needs to be brought into strategies for pedagogical innovation and the strengthening of relationships between research, policy, and practice.

### General Comment

The objective that all students and citizens should have ICT skills and competence and be able to benefit from, and contribute to, the information society is ambitious and will only be achieved in the longer term. The objective with respect to school students is more feasible in a shorter time-scale, and most education systems are taking action to achieve this objective. While there is a strongly held view across countries that more than technical ICT skills in acquiring computer and Internet competence is required, and that a broad concept of digital literacy is necessary, there is not yet a consensus on what comprises digital literacy, or the broader concept of essential 21st century skills required by the information and knowledge age. This is an area that requires further work.

Australia is well placed in the action taken to ensure ICT skills for all school students, including national testing and monitoring, but compares less well with international action taken in leading OECD countries in addressing the digital and learning divide in the adult community. A number of Australian States have recognised the seriousness of the problem,\textsuperscript{33} but a comprehensive national approach has not yet emerged, and the role of adult and community education to date has been limited.

While supply side measures taken to extend infrastructure to rural and regional Australia through programs such as Networking the Nation have been valuable, far less has yet been done nationally in developing demand side policies to influence the attitudes and motivation of disadvantaged groups, and to build a desire for skill and learning, than has occurred in Britain, Canada, and the United States. The absence of a comprehensive national policy for lifelong may operate as a barrier.
The experience of Britain, Canada, and the United States with community-oriented strategies holds a number of useful insights and lessons, as does the longer experience of the Scandinavian countries in building strategies for lifelong learning and adult education.\(^3\) Australia does not yet have a national system of online centres (such as exist with UK Online, the Canadian Community Access Program, the American Community Technology Centre, and the and Irish Community Media Centres) although State systems of telecentres and community technology centres exist across the country.

There is an issue emerging from this analysis as to whether a comprehensive national strategy is required to address the digital and learning divide in Australian society, as most countries included in this study have recognised in their policy development.\(^35\)

The issue is not only social, but is also economic as the British Policy Action Team 15 recognised, for a society of information have-nots is not only unfair but is also inefficient. “Competitiveness in the information age depends on the skills and creativity of the whole workforce.”\(^36\)

**NOTES**

2. Current OECD work on key competences for the knowledge society is of interest. See OECD 2001c, pp.99-118 for a useful overview. Kearns 2001 provides a research review in this area.
12. OECD 2001d, p.5.
15. NATSEM 2000.
19. Ibid, pp.3-5.
22. Ibid.
28. Ibid, p.36.
Ibid, p.36.


European Commission 2001b, p.9.

See, for example, statements by New South Wales and Western Australia which are discussed in the Australian report (Kearns and Grant 2002) in Chapter 4. WA estimates that around 400,000 people lack basic computer skills, while NSW estimates that nearly one third of the adult population cannot use a computer and more than half lack the skills to use the Internet.

Kearns and Papadopoulos (2000) for an analysis of the Swedish situation. The Nordic countries are included in the top tier in a recent OECD analysis of performance towards lifelong learning.

Space has precluded a discussion of the policies adopted in Sweden and Finland, and the Scandinavian countries generally. There is an overview of Swedish policy in Kearns and Papadopoulos 2001.

5. PEOPLE ASPECTS: MEETING THE ICT SKILL NEEDS OF THE ECONOMY

The second key thrust in education policy directed at people aspects of the information society involves meeting the ICT skill needs of the economy.

This issue has been given prominence by the rapid expansion of the information and knowledge economy, the exponential pace of change, and by the emergence of new roles in business and industry requiring different combinations of skill, knowledge, and personal attributes, and overall a complex pattern of skill needs. The dilemma confronting policy makers is well summed up by the title of a recent American report on the digital workforce: “Building Infotech Skills at the Speed of Innovation.”

The policy dilemma has been addressed in a series of reports across OECD countries which have demonstrated that “there is no silver bullet solution to the IT workforce challenge, rather the answer lies in many stakeholders undertaking a wide range of initiatives, both large and small.” This conclusion is widely held and has set the framework for the policy development and strategies we observed in the countries studied.

The issue of meeting the skill needs of the information and knowledge economy involves both meeting the quantum of demand, and also issues of quality and relevance so that students are well prepared to prosper and survive in the conditions of the knowledge economy. These issues raise broader questions of the attributes and skills of knowledge workers and the components of digital literacy, which OECD, among others, have addressed. The question of digital literacy is discussed in Chapter 4 above.

This spectrum of issues has been addressed in a number of reports across OECD countries. These have included:


There is a good deal in common in the analysis of each of these reports. Each pointed to the growth of demand in business and industry for ICT skills, including specialist ICT skills, so that supply side measures were needed in the education system to match the growing demand. All concurred with the conclusion of the Department of Commerce report, that there was no silver bullet, but rather a range of responses was required.

In meeting industry demand, these reports all recognised certain common barriers. These included:

- the dated image of the industry which served as a barrier to able young people, especially girls, wishing to enter the industry; and
the inadequate flow of current information on jobs in the industry to schools;

while the American report also recognised the need to strengthen mathematics and science education in schools as a foundation for ICT careers. Addressing these barriers were the major themes in the US Department of Commerce report.

The British ITCE Skills Strategy Group came to much the same conclusions recognising the need to address the image problem, careers information, and to strengthen the base of generic skills. While the American Department of Commerce report had a focus on science and mathematics as a foundation for ICT careers, the British report emphasised rather broader generic skills along the lines of existing key skills and the emerging concepts of digital literacy.

A further theme common to each report is the need for collaboration between all stakeholders in addressing the identified needs and barriers, with the industry role significant.

Directions for Policy Responses

The main directions for policy responses have, in general, followed the lines of the analysis cited above. There is no silver bullet, but rather a spectrum of measures is needed. These have included:

- various forms of industry/government/education partnership;
- action to raise the knowledge and skill base in schools through a range of action including testing, promoting concepts of digital literacy, professional development of teachers etc.
- improved careers information and measures to address the image of the industry.

The Australian States and Commonwealth have been active in this area. At a national level an IT Skills Hub has been established to bring together industry and education and training providers to ensure industry ICT skills needs are met. The Hub provides information and resources for all stakeholders: students, teachers, employers. It serves as a meeting place that links stakeholders, and generally functions as an open community of people interested in careers in ICT. The Hub has particular value as a rich source of information on issues, trends, events, and strategies (http://www.itskillshub.com.au).

A number of Australian States have also been active in developing policies to meet ICT skill needs. The New South Wales Skills Action Plan provides a good example with the plan developed in close consultation with the ICT industry with the Skills Consultative Group having a key role in its development. The Action Plan is based on partnership between government and the ICT industry with the industry giving a number of commitments to support the action proposed by government. In this way it typifies the forms of partnership action that are emerging in policy responses to the information economy.
The ten action areas under the plan involve both short-term action and longer-term measures to ensure that the skill needs of ICT industry are met. Some of these measures relates to action in schools directed at the ICT skills of teachers and students ([http://www.olt.nsw.gov.au/publications/fact/SkillingPeople.html](http://www.olt.nsw.gov.au/publications/fact/SkillingPeople.html)).

There are similar strategies in other Australian States and Territories. These include the Queensland Communication and Information Strategic Plan for 1999-2004 and the Victorian strategy of November 2001.6

**Canadian Can Connect**

Can Connect is a national network of partners helping Canadian youth and their communities develop and showcase ICT skills. IT complements the Connecting Canadians initiative by inviting all sectors of society to work together at the local, regional and national levels to find innovative solutions to ICT skills challenges. Through the website, partners are able to interact with a wide range of ICT stakeholders using a Database of Opportunities, a listserver and a discussion board. In these ways, Can Connect has some of the features of the Australian IT Skills Hub.

**Initiatives by Industry**

A feature of the scene in both Europe and North America has been the initiatives taken by networks of firms to support the development and strengthening of ICT in education. In some cases these initiatives have led to innovative forms of public/private partnership. In both Europe and North America these business networks have taken a broad and long-term approach to the development of ICT in education, beyond short-term objectives in meeting ICT skill needs, that has supported government policy for strategic development of the ICT role in education.

In Europe a Task Force of five companies convened the European e-Learning Summit held at Le Hulpe in Belgium on 10-11 May 2001 to discuss ways of furthering the objectives of the EU e-Learning Action Plan. The Summit attracted over 350 participants from both public and private sectors including policy makers from national ministries of education and employment, senior officials of the European Commission, and representatives from a range of industries.

The Summit Declaration which contained 10 recommendations has been widely circulated in Europe. The original five companies (IBM, Cisco, Nokia, SanomaWSOY, and SmartForce) have been joined by a further 25 other companies on a Steering Group to take forward the Summit conclusions [http://www.ibmweblectureservices.com/eu/elearningsummit](http://www.ibmweblectureservices.com/eu/elearningsummit).

In America the CEO Forum on Education and Technology performed a similar role in marshalling business support for the objectives of the 1996 National Education Technology Plan. Founded in 1996 as a unique four year partnership between business and education leaders in support of the National Education Technology Plan, the Forum produced annual reports up to 2001 in its monitoring of progress towards integrating ICT in America’s schools.
Like their European counterpart, the Forum adopted a broad strategic approach to the task of integrating ICT in American schools that went beyond short-term requirements in meeting the ICT skill needs of business. This approach is reflected in the Forum’s reports on digital learning and digital content and raising student achievement through effective use of ICT. 

http://www.ceoforum.org

A Lifelong Learning Perspective

Sustained IT&T skill development can only occur in a lifelong learning context.

Queensland Department of Communication and Information, Local Government, Planning and Sport 2000.

The pace of change in the context of the information economy and the dynamic character of the ICT industry, means that ICT skill needs in the future are to a considerable extent not predictable. This means that a lifelong learning perspective is necessary to ensure that workers in ICT and other knowledge-based industries are able to maintain the currency of their knowledge and skill, and hence their employability.

These considerations underpin the approach adopted by the European Union, and by Member countries such as Britain. This approach involves a broad base of skills and competence from general education, including digital literacy and key generic skills. Strengthened workplace learning, with e-learning a key element, is widely seen as a component in a flexible approach to meeting the skill needs of industry for ICT specialists.

With improved dialogue and partnership between industry and the education sectors, along the lines discussed in the examples above, the education system will be well placed to contribute to the specialist ICT skill needs of industry.

General Comment

Policy in this area is characterised by a growing partnership between education and industry, as in the Australian IT Skills Hub, the American CEO Forum and the European business task force which convened the European eLearning Summit. While measures have been taken to improve careers advice for students and to address the image of the industry, the general thrust of policy has been towards long term objectives in raising the platform of digital literacy of all students so that specialist ICT skills can more readily be fostered on this base. This approach has been supported by business leaders in America and Europe. It has not been possible to cover aspects such as the role of workplace learning in this report, and the respective roles of government and industry are likely to continue to evolve in the dynamic context of the Information Society.

The growing significance of innovative forms of public/private partnership, as discussed in Chapters 11 and 12, is likely to be a key influence on policy in this area in the future.
NOTES

2. A range of OECD work is relevant including its studies on Knowledge Management in the Learning Society (1999) and Competences for the Knowledge Economy 2001c, pp.99-116.
6. PEOPLE ASPECTS: ENSURING THAT THE EDUCATION AND TRAINING WORKFORCE HAS ICT COMPETENCE

*Current data indicates that the United States has a long way to go in improving teacher training in technology*

*Professional Development and Technology: Too Little, Too Basic, Too Generic.*

*The more EALP has examined the issues around ICTs the more convinced the working group has become that the integration and expansion of ICTs in education necessitates a holistic professional development strategy.*
Report of British Columbia Educators as Adult Learners Project, 2001

With the growing significance of ICT in education, there has been an increased interest across all countries studied in the question of how best to foster the skills, knowledge, and motivation of the education and training workforce in the use of ICT in education.

However, we also found the view commonly expressed in the literature in both North America and Europe that professional development of teachers and other educational personnel has not kept pace with the impact of technology, so that a strengthened and more focussed effort is required.

OECD has reported this view\(^1\) and it is reflected in the report of the United States Web-based Education Commission,\(^2\) in a report prepared by the United States Department of Education in 1999 for an APEC meeting, and in a 2000 report by the American Centre for Education Statistics on Teachers’ Use of Technology.\(^3\)

The American Web-based Education Commission in its report to Congress took the view that professional development of teachers to use ICT effectively was “Too Little, Too Basic, and Too Generic”.\(^4\) As the role of ICT in education was changing and deepening, professional development of teachers needed to be upgraded around a new paradigm built around a vision that encouraged teachers to “think with technology in order to approach old problems in new ways”.\(^5\) In British Columbia we found this new paradigm described as “a holistic professional development strategy.”\(^6\)

The Web-based Education Commission noted that of the US$42 billion that K-12 schools spent on technology in 1996 in the United States, only 6% was for the training of teachers. By 1999-2000, this amount had risen to 17% while some national education bodies such as NEA were asserting that schools should devote 40% of their technology budgets to teacher training.\(^7\)

In addition to the quantum of training, the quality and relevance of training has drawn considerable criticism. OECD reflected the Web-based Education Commission in reporting the same deficiency in teacher preparation.”\(^8\)
Against this background of comment, we found a diverse range of policies and strategies adopted as governments searched for ways to ensure that the teaching service was enabled to use ICT with confidence, and in imaginative ways, to achieve the promise of ICT in transforming education and training in the knowledge era. We also observed an intensification of effort in recent years as systems everywhere gave more priority to professional development of teachers for ICT.

The strategies adopted included mandating standards of competence, traditional course based approaches, providing incentives for teachers, systems of support services, whole-of-school strategies, and whole-of-system strategies directed at the whole teaching service. The last two approaches in this list went in the direction of a holistic strategy noted in the British Columbia report cited above.

i. Mandating Standards of Competence

This approach is most common in the area of pre-service education of teachers, and has been applied less commonly with the serving teacher service.

Britain and a number of American States have adopted this approach to pre-service preparation with ICT skills built into requirements for licensure or certification.

Britain adopted this approach in 1998 to give effect to its goal that all new teachers should be competent in the use of ICT. An ITT National Curriculum now exists which provides benchmarks for the standards required for the award of Qualified Teacher Status. Trainee teachers completing their training after 1 May 2002 were required to pass computerised skill tests in ICT in addition to skill tests in literacy and numeracy which had been in operation since September 2001 (http://www.canteach.gov.uk).

A number of American States have also mandated that new teachers should have received some degree of ICT training for licensure or certification. A U.S. Department of Education report to APEC in 1999 pointed out that about half the States had standards for ICT preparation for new teachers although only three States at that time required participation in ICT training as a prerequisite for license renewal. The Department observed that more States would need to enact rigorous licensing requirements in ICT if teachers use of technology was to improve.

Texas and California provide examples of States which have imposed mandatory requirements.

Texas has imposed mandatory standards for ICT applications, knowledge and skills. These are tested in the New Examinations for the Certification of Educators. New teachers are able to find assistance and resources in the Texas Beginning Educator Support System (http://www.tea.state.tx.us/technology/staff.html).

California has also mandated by law that new teachers must demonstrate basic competency in the effective use of computers prior to receiving a Preliminary Credential. Teachers are also required to demonstrate an understanding of advanced computer-based technology, including effective use of technology in educational settings, prior to receiving their Professional Credential.
These requirements are supervised by the Commission on Teacher Credentialling while Proficiency Profiles, with performance indicators, have been established at the Preliminary and Professional levels to assist teachers preparing to meet these requirements (http://www.tcoe.k12.ca.us/techprof/proficiency.html).

Ontario provides a further example of mandated testing to become certified as a teacher. All new teachers will have to take a qualifying test before they can teach in Ontario schools. To maintain certification, courses must be taken throughout a teachers’ career (http://www.edu.gov.on.ca).

The novice level of basic proficiency is common across Europe and is viewed by the European SchoolNet as “a kind of ICT licence that indicates what skills a teacher must possess to deal with ICT in a technically and didactically sensible way.”

The European Computer Driving Licence is commonly used across Europe and sets a standard for basic computer proficiency. While the Driving Licence is voluntary in most countries (e.g., Ireland, Netherlands, Germany), in some cases it sets a standard for required digital skills. In the Netherlands, for example, the Computer Driving Licence sets the standard for digital skills in vocational and adult education.

ii. Grading Levels of Competence

The Californian system illustrates a strategy that has been adopted in a number of countries and State systems of identifying a number of levels of competence to provide for incentives and progression in teachers acquiring more advanced skills in the educational uses of ICT.

Finland has adopted this approach which has been built into its National ICT Strategy for 2000-2004.

In the Finland approach three levels of proficiency have been identified:

1. **Ope.fi I**: the basics of ICT in education.

2. **Ope.fi II**: First level plus basic understanding of the design and production of learning materials and learning environments in ICT.

3. **Ope.fi III**: Second level plus design and production of learning materials and environments in ICT, maintenance and training skills.

Targets built into the National ICT Strategy involve:

- all teachers will attain the first level;
- 50% will attain the second level;
- 10% of teachers will attain the third level.
In this way a cadre of teachers in advanced applications of ICT in education is being built up. The municipalities are responsible for Level 1 training while courses in Levels II and III are offered in the Further Training centres of universities.

In addition to California, other American States have implemented similar schemes based on grading levels of ICT competence. Ohio provides a further example with state proficiency tests existing at levels. The novice level is to be attained by all teachers and priority in professional development is being given to the Novice level. A professional development model which aligns curriculum, pedagogy, and technology has been developed. By December 2001, 39,529 teachers had received approximately 87,336 Novice Certificates. In addition 11,118 certificates had been awarded to 3,558 pre-service teachers.¹⁶ This involved a significant proportion of the Ohio workforce.

A number of Australian States have implemented policies to assist teachers to acquire the necessary skills by providing templates or minimum standards for the required skills, and advice on ways of acquiring them. Some examples follow:

- **Victoria** adopted this approach with its Teachers Capabilities Statement and Skill Development Matrix which was distributed to schools in 1998 to support school and teacher professional development planning. Three skill stages were identified with related professional development. Self paced packages were made available to assist teachers in acquiring identified skills.¹⁷


### iii. Providing Incentives for Teachers

In addition to graded systems of ICT competence, other incentive schemes have been implemented to encourage teachers to enhance their ICT skills, knowledge, and capacity for innovative opportunities. A common strategy across countries has been to provide computers and e-mail addresses for teachers for their personal use.

Sweden and Britain have implemented schemes of this nature. In the British Computers for Teachers scheme which ran up to 2001, teachers were offered a subsidy of 50 percent of the cost of a computer (up to a maximum of 50 pounds). Following evaluations of the scheme in 2001, a further 50 million pounds over three years is being made available by the government.

The Swedish scheme is linked to the targets of the National ICT Plan, and to participation by teachers in professional development activities. The Plan includes a target of 70,000 teachers (about 50% of all teachers in schools) participating in ICT training over the period of the Plan with teachers completing the training receiving a personal multi-media equipped computer for personal use. The computers come with software selected by the
manufacturers. The Ministry for Education imposes conditions on manufacturers for the scheme.

iv. Whole-of-School and College Strategies

The concept that professional development of teachers should be integral components in holistic strategies for school and college development, as noted in the British Columbia report cited above, has led to growing whole-of-school and whole-of-college strategies in which ICT professional development is integrated with overall strategies for the development of the school or college.

Victoria provides a good example of this approach under its Learning Technologies in Victorian Schools strategy for 1998-2001 which focussed on school-based planning within a whole-of-school framework.

This approach involved:

- the development of a Learning Technologies Plan by every school;
- an agreed Implementation Strategy to accompany the Plan;
- the provision of a Learning Technologies Planning Guide and associated development support materials and services for schools including a Skill Development Matrix to guide professional development of teachers;
- the setting of specific objectives to be achieved by schools over the three year period commencing with specific objectives for 1998.¹⁸

In this way professional development of teachers was integrated with curriculum, infrastructure and the aspects of the development of the individual school in line with its strategic planning for the three year period. This approach involved schools setting their targets to be achieved over this period with performance monitored by the school and the Education Department. All teachers were expected to achieve Stage 1 of the goals on the Skill Department Matrix.

A similar whole-of-college approach has been adopted for British further education colleges (FE) whereby each college is required to develop an Information and Learning Technology (ILT) strategy. This system was instituted by the former Further Education Funding Council and is now managed by Becta on behalf of the Learning and Skills Council. A feature is the focus on college learning strategies so that colleges are required to move beyond technology aspects and include a vision for ILT and the learning implications in the work of the college. Guidelines with seven major headings assist colleges in developing their ILT strategies.

The ILT system has been linked to the provision of additional funding and resources for FE colleges under the National Learning Network with provision of a college ILT strategy a condition for benefiting from the National Learning Network initiative. ILT strategy exemplars of good practice are identified by Becta and disseminated through the
Ferl networks. These British FE arrangements are outlined in Appendix 4 and may be searched in the database (http://www.ferl.becta.org.uk/ILT).

v. Whole of System Strategies

A further approach adopted by a number of systems involved a whole-of-system strategy with detailed planning for the outcomes to be achieved over the period of a strategic plan.

This approach is common in the Scandinavian countries and was adopted by Sweden and Finland. It was indicated above how Finland set targets to be achieved at the three levels of ICT proficiency for teachers over the period 2000-2004 and developed training arrangements to achieve these targets.

Sweden also set targets over the period of its ICT Strategic Plan to 2002 with about 50 per cent of all teachers in schools (some 70,000 teachers) taking part in the National Action Program.

However, the most ambitious whole of system strategy was adopted by Singapore in its Masterplan for IT in Education over the period 1997-2002. This plan involved a “four-tier fan model” being put in place to train all teachers in every school by 1999.19

The four-tier fan model involved:

- 60 senior instructors form the first tier of training which was completed in late 1996;
- these instructors then trained schools in Phase 1 of the implementation comprising 22 demonstration schools;
- selected personnel from the Phase 1 schools then adopted and trained 3 to 4 schools each in Phase 2;
- then schools in turn then trained other schools in the final phase of training.20

This four-tier model was seen as generating a multiplier effect enabling the sharing of expertise and cultures between schools. The teacher training plan accompanied ambitious targets to place computers and bandwidth in schools over the period of the plan.

A further intensive effort to bring serving teachers up to a set base level may be seen in the approach adopted by Britain.

Britain has adopted the policy that serving teachers should be given the opportunity to achieve the level of ICT competence now expected of all newly qualified teachers who enter the profession. This intensive effort is being funded by 365 million EUR from the New Opportunity Fund (NOF) in a program known as the Learning Schools Program (LSP).

More than 125,000 teachers had registered to receive training under the program by 2001 and 84,000 had commenced training. LSP is run by the Open University and RM.21
The Department of Education and Skills in a report to the European Union SchoolNet observed that teacher response to the LSP had been positive, with over 85% of schools completing their training report stating that the program had increased teacher competence in the use of ICT and encouraged them to extend their use of ICT in the classroom (http://www.canteach.gov.uk).

2001 statistics cited by the Netherlands Ministry of Education, Culture and Science in a recent report show considerable variations between European countries in the percentage of teachers receiving training on the computer and Internet. In some cases, current policies are raising the proportions significantly in both categories.

Table 1: The percentage of all teachers that have received any official training in the use of computers or internet in teaching in selected countries.

<table>
<thead>
<tr>
<th></th>
<th>Computers</th>
<th>Internet</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>51%</td>
<td>34%</td>
<td>46%</td>
</tr>
<tr>
<td>Denmark</td>
<td>68%</td>
<td>59%</td>
<td>31%</td>
</tr>
<tr>
<td>Germany</td>
<td>35%</td>
<td>22%</td>
<td>63%</td>
</tr>
<tr>
<td>Finland</td>
<td>76%</td>
<td>56%</td>
<td>24%</td>
</tr>
<tr>
<td>France</td>
<td>44%</td>
<td>29%</td>
<td>53%</td>
</tr>
<tr>
<td>Ireland</td>
<td>74%</td>
<td>49%</td>
<td>25%</td>
</tr>
<tr>
<td>Italy</td>
<td>58%</td>
<td>33%</td>
<td>42%</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>62%</td>
<td>35%</td>
<td>35%</td>
</tr>
<tr>
<td>Sweden</td>
<td>63%</td>
<td>52%</td>
<td>36%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>74%</td>
<td>56%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Total per row may exceed 100% since the first two columns are not mutually exclusive.


vi. Support Services and Centres of Excellence

As an adjunct to professional development strategies, systems for support services to assist teachers were established in most jurisdictions, while some systems have established centres of excellence as a catalyst to raising standards and performance.

In some cases national action was involved as, for example, with the Network of Regional Technology in Education Consortia (RTEC) funded by the United States Department of Education.

The RTECs were designed to assist and support teacher professional development and generally to promote the effective use of ICT in education. Ten RTECs were funded under the Technology for Education Act of 1999 (http://www.rtec.org/).

State education systems have commonly set up similar systems providing information and support services for teachers. Texas, for example, established twenty education service
centres (ESCs) to provide school districts with information and services. Technology professional development is a cornerstone of the services provided by the ESCs. A range of technology workshops are offered by each ESC throughout the year to meet the varied needs of school districts (http://www.tea.state.tx.us/technology).

Somewhat akin to the RTEC and ESC strategy, is an approach found in a number of Australian States involving the establishment of a centre of excellence to provide a catalyst to fresh thinking on strategies for teaching and learning in the information age.

- This approach is found in the South Australian School of the Future which has a key role in the professional development of teachers in that State.

- New South Wales also has a School of the Future with multiple roles. These include professional development of teachers, careers advising, a student learning exchange, and a showcase for new technologies with active relationships with hardware, software, and multimedia producers.

- Tasmania has also established a centre of excellence in online learning now called e-magine, to link professional development of teachers with units providing online learning materials, library and information services, and generally fostering the use of ICT in learning.

vii. Fostering Innovation and Lifelong Learning

In the search for a new paradigm to underpin teacher professional development in an ongoing basis, some systems have adopted a lifelong learning perspective and piloted schemes that provide for ongoing learning and professional development for teachers. This approach has usually gone along with encouraging schools to develop as learning communities or learning organisations. In some cases virtual communities of teachers have been developed across schools so that teachers can share ideas with fellow teachers in other situations.

British Columbia has been an early leader with this approach through its innovative Educators as Adult Learners project.

This project was based on the assumption that a new approach was required for teacher development based around the view that a holistic professional development strategy was required which would forge close links between education policy, research, and professional development.23

The project followed up on an earlier report, Early Soundings, which canvassed the challenges and opportunities confronting teachers in an information rich culture. The implications of the new context for the ongoing professional development of teachers were then examined in the Educators as Adult Learners project.

The view that teachers should be regarded as knowledge workers and adult lifelong learners has fundamental implications for a new approach to the professional development of teachers that goes beyond the traditional attend a few courses approach.
Some systems are encouraging this approach by establishing dedicated web sites for teachers which provide information, new ideas, and which seek to link teachers in communities of practice. The web site of the British Teacher Training Agency (http://www.canteach.gov.uk) provides an ongoing source of information for teachers while schemes such as the European SchoolNet link teachers across European Union countries so that new ideas flow easily between schools and countries. A current SchoolNet project to build a database of case studies of 5,000 innovative schools illustrates this general approach.

In addition to the web site of the British Teacher Training Agency, there are a number of other dedicated web sites for teachers which bring information, advice, and resources for teachers to support the ongoing professional development of teachers.

These sites include:

- **Virtual Teacher Centre** which provides news, support for professional development, and assistance in accessing the rich resources across the National Grid for Learning (http://www.vtc.ngfl.gov.uk).

- **Teachernet** which provides information and resources across broad areas relevant to the work of teachers including professional development, research, management, teaching and learning, and education overviews (http://www.teachernet.gov.uk).

Both these sites provide a rich access to resources to assist ongoing professional development of teachers as lifelong learners. Teachernet offers resources such as:

- lesson plans which have been evaluated by teachers;
- case studies of good practice including case studies and web sites from ICT in Practice Award winners;
- the resources of the Teachers Online Project (TOP)
- access to the Standards site with its resources on particular issue areas: gender and achievement, literacy, numeracy, parental involvement, homework, Excellence in Cities etc.

It is likely that web sites such as these will become increasingly important as the underpinning paradigm for professional development of teachers shifts increasingly to that of viewing teachers as motivated, self-directed lifelong learners responsible for their own professional development throughout the course of their career.

The United States Web-based Education Commission noted the importance of the Internet as a tool for on-going teacher learning and commented on the change that was occurring in teacher professional development.

> Traditional one-size-fits-all professional development workshops are giving way to a new, more teacher-centred, self-directed model of teacher learning. Through the Internet teachers have access to
high quality online professional development opportunities beyond what the local school or district is able to offer.\textsuperscript{24}

This is a universal trend across all countries included in this study although systems are at various stages in supporting this new approach. The Internet has great potential and value in ending the traditional isolation of teachers and in opening up rich learning opportunities so that continuous professional development becomes the hallmarks of teachers as adult learners.

The European SchoolNet is progressively building communities of teachers and professionals which extend across national boundaries. At present the following communities exist:

- Virtual School Board
- eSchoolNet Virtual School History Community
- Virtual School – English Department
- European Principals Online

All these communities are accessed through the European SchoolNet web site (http://www.eun.org).

**Developing Principals as Leaders**

A particular area of interest in which a lifelong learning approach is being applied is in the development of school principals as leaders. Britain and the European Union illustrate innovative development in this area.

The European SchoolNet has established a community of European School Principals which is serviced and supported by a web site, European Principals Online. The web site is accessed through the SchoolNet web site (http://www.eun.org). This program aims to foster the professional development of principals through exchanges of information and ideas and good practice. As a community of learners, principals encourage and support each other so that continuous professional development as leaders becomes normal practice.

The European Principals Online web site provides for chat forums, hints for beginners, letters and bulletin boards. This approach opens the professional development of principals to international perspectives and sources of new ideas.

Britain has also sought to develop principals as leaders and has established a National College for School Leadership (NCSL). The College, in partnership with Becta, BfES, and Ofsted, is piloting a new ICT training program for principals. In this way the necessary leadership for school principals is seen as a key element in driving enhanced uses for ICT in education.
General Comment

Overall, the landscape of professional development of teachers across the countries studied reveals a transition situation in which the old and the new are inextricably mixed. Nevertheless, two dominant trends may be observed:

1. Policies to ensure that all teachers attain a basic platform of competence in the use of ICT in education; and

2. Policies to encourage continuous professional development of teachers and principals as adult learners so that a culture of learning and continuous improvement is forged in schools with schools as learning communities connected to other learning communities elsewhere.

The latter trend is using the potential of the Internet to end the isolation of teachers and to open up rich professional learning opportunities for teachers and to build communities of practice across boundaries. The work of European SchoolNet cited above illustrates this trend although similar examples exist elsewhere.

The former trend has been usually built into strategic action plans with varying degrees of intensity and ambition. The policies adopted by Singapore, Britain, Finland, Sweden, Victoria, California, and Texas outlined above illustrate this direction for policy in various forms.

In some cases, as in Finland and California, several levels of proficiency have been identified, and built into certification and training arrangements. Britain has adopted a similar approach with the novice level, now mandated for new teachers to attain, the platform for the large scale Learning Schools Program which is reaching 125,000 teachers.

There are grounds for believing that the two trends noted above are complementary and together provide the platform for a contemporary approach to ensuring that all teachers achieving a platform of competence in the uses of ICT in education while also encouraging and supporting the continuous professional development of teachers as lifelong learners. The innovative models emerging around the world should provide a stimulus to the latter policy thrust.

Adopting a holistic approach to the professional development of teachers in respect of ICT also means that this dimension of education development cannot be viewed in isolation from other key aspects of education development. We take up in Chapter 11 below the question of necessary components in an innovative system designed to bring about the transformation of education to fit the conditions of the knowledge society.

NOTES

5 Ibid, p.40.
7 NASBE 2001.
8 OECD 2001a, p.27.
16 Ohio SchoolNet Commission 2001, p.3.
17 Education Victoria 1998.
18 Ibid.
20 Ibid, p.5.
21 Department of Education and Skills 2001b.
22 Ibid, p.4.
24 Web-based Education Commission 2000, p.44.
7. THE INFRASTRUCTURE CHALLENGE

There has been a desire in human society for one person to be connected with another and for one country to be connected with another across all barriers of time and geography.


All countries included in this study have been confronted by the challenge of meeting the rising demand of education systems and their institutions for appropriate infrastructure as the sophistication and extent of use of ICT in education grows.

This challenge has focused, in particular, in meeting the growing demand for bandwidth at affordable costs.

This challenge was noted by Canada in a report to OECD where it was pointed out that although the cost of bandwidth was falling, school demand was rising at a faster rate.¹

In this context we observed a spectrum of government responses, with varying balances of national, state, and local action, and with significant differences between the sectors of education.

The challenge confronting government is exacerbated by the pace of technological advance, so that new opportunities arise which require innovative solutions if the opportunity is to be seized. Examples are given in this chapter of such innovations which appear to be most common in the higher education sector, although there are some examples around the world of cases where innovative approaches to meeting the bandwidth requirements of schools and vocational education and training (VET) sectors are emerging.

Across all sectors, we observed examples of demand aggregation strategies where the cost of access to bandwidth is reduced by increasing the volume of demand. However, these strategies take a number of forms such as whole-of-government schemes, education sector programs, and local and regional “bandwidth islands”. There is considerable debate on the relative merits of these approaches which we discuss below.

Although the discussion of strategies for affordable bandwidth has tended to dominate the infrastructure area, a feature of policy has been the steady increase in the number of computers in education institutions as computer/people ratios have fallen. Progress in this area across all systems is important in opening up new opportunities for pedagogical innovation in the use of computers in education.

Higher Education

The dominant feature of the higher education scene is the role of consortia of universities and other partners addressing their infrastructure requirements on a collaborative basis. These consortia are also typically involved in the development of advanced network systems for their members, so that member institutions benefit from ongoing technological advance. The consortia also provide a mechanism to broker partnership
arrangements with other relevant organisations, so that the role of these consortia is one that fosters innovation, partnership, and technological advance.

Typical consortia arrangements in the countries we studied involve:

- **CANARIE** in Canada;
- **JANET** in the United Kingdom;
- **Internet 2** in the United States;
- **CENIC** in California;
- **AARNet** in Australia.

While these consortia have much in common, there are also differences between them in such areas as sources of funding, research role, and other functions. We comment on these roles and differences below.

**CANARIE**

CANARIE Inc is Canada’s advanced Internet development organisation, established in 1993 which works with government, industry, and the research and educational communities to enhance Canada’s advanced Internet infrastructure, operations, development and use.

CANARIE’s mission is to accelerate Canada’s communications infrastructure and to stimulate next-generation products, applications and services. CANARIE is distinctive in that it also serves as a cornerstone of the Canadian Government’s Connecting Canadians program so that it has a broad national societal role in addition to its more commercial role in meeting the needs of its members.

The organisation is supported by Industry Canada and has 120 members and over 500 project partners. It is governed by a 26 member board with equal public and private sector representation.

A key aspect of the CANARIE role is to stimulate the development and use of advanced Internet infrastructure in Canada. It collaborates with many partners in undertaking this role. A key aspect of this role focuses on the development of its state-of-the-art national optical Internet network CA*Net3 which has received government funding.

CANARIE has succeeded in enhancing Canadian research Internet capability by a factor of about one million since 1993 and has funded over 2000 advanced Internet applications (http://www.canarie.ca).

**JANET**

JANET is the British equivalent of CANARIE and AARNet serving British universities, further education colleges, and research bodies. JANET is administered by a consortium of members which trades under the name UKERNA and which operates under a Service
Level Agreement from the Joint Information Systems Committee (JISC) of the UK Higher and Further Education Funding Councils. The FE Funding Council role has now been replaced by the new Learning and Skills Council which funds further education in Britain.

This is a complex structure which reflects the fact that JANET receives funding from both the higher education and further education funding bodies. The fact that British further education colleges participate in both JANET and JISC is distinctive when compared with the Australian situation where the Australian equivalent of further education colleges (TAFE) has not been enabled to participate in the AARNet scheme up to now, with some minor exceptions.2

The UKERNA objectives, as set out in its Memorandum of Association, are somewhat similar to those of CANARIE in that it is responsible for the networking program of the education and research community in Britain, as well as to research, develop and provide advanced electronic communication facilities for use in that community and in industry.3

The Joint Information Systems Committee (JISC) has adopted a strategic approach to its task which is reflected in the JISC Five Year Strategy for 2001-2005. This has included funding research and development to ensure that the higher education, research, and further education communities have a very high bandwidth network through JANET connecting all institutions.4

In undertaking this role JISC builds and extends partnerships, including extending partnerships with commercial Internet suppliers and the telecommunications industry in furthering its vision of “a single, world-wide information environment.”5 This ongoing development work has produced Super JANET 4 directed at the particular needs of the research community for very high bandwidth6 (http://www.jisc.ac.uk).

**Internet 2**

Internet 2 is the American equivalent of the British and Canadian developments discussed above. It is a consortium led by 180 universities working in partnership with government and industry to develop and deploy advanced network applications and technologies accelerating the creation of future Internet technologies. This network extends across all American States.

In addition to building leading edge network capability and revolutionary Internet applications, the mandate of Internet 2 also includes ensuring the rapid transfer of new network services and applications to the broader Internet community. This mission is significant in that the benefits of technological advance will flow down to all sectors of education.

Internet 2 has received government funding for its development and is envisaged as the world’s fastest and most advanced research network. Various private firms have collaborated with the consortium in the development of Internet 2 (http://www.i2x.org).
CENIC

CENIC (The Consortium for Education Network Initiatives in California) is another consortium model which links California’s universities and research communities in “achieving robust, high capacity, next generation Internet communication services.” This consortium includes Stanford, the University of California, California State University, California Institute of Technology, and Information Sciences Institute.

As the first step in reaching its vision of the next generation of data connection services, CENIC built the California Research and Education Network (CalREN-2) as the most cost-effective advanced communication service available to all Californian higher education.

The CENIC model and CalREN-2 is significant as CalREN-2 is now being extended to all Californian schools under the Digital California Project which commenced in 2000. The Californian initiative, which is discussed below, illustrates how the benefits of higher education/research consortium initiatives can be extended to schools and VET (http://www.cenic.org).

AARNet

AARNet is the Australian equivalent of the higher education/research consortia discussed above. It is, however, distinctive in that it does not receive direct government funding but is funded by its Members who include most Australian universities and the national research organisation, CSIRO.

AARNet operates through regional hubs located in each State and Territory with Regional Network Organisations (RNOs) responsible for development within the areas covered by each hub, and for the delivery of services to members.

Up to recently, TAFE and other VET institutes have not been members or clients of AARNet. However, with changes to regulations under the 1997 Telecommunications Act, AARNet now holds a carrier licence under the Act, and the previous restrictions on VET access, or that of schools no longer apply. AARNet has an access policy with decisions on access taken by the Board.

There are current indications of AARNet broadening its client base with a current initiative in Canberra including the Canberra Institute of Technology (a TAFE institution) and the Australian War Memorial and with Australian Archives and the National Library due to connect shortly using fibre connections put in place by AARNet using its carrier status. The Canberra development has many of the characteristics of the “bandwidth island” approach discussed below.

AARNet shares the capacity of CANARIE and JANET to innovate and evolve so that the role of AARNet in meeting the bandwidth requirements of Australian education and training appears part of the necessary agenda for discussion (http://www.aarnet.edu.au).
Role of the Consortia Model

The evolving roles of consortia such as CANARIE, JANET, Internet 2, CENIC, and AARNet demonstrates the value of having partnership arrangements where the costs of the research and development effort are shared, and where a mechanism exists to foster innovation and collaboration. Bringing stakeholders together is one of the chief merits of this model, as well as the role of keeping stakeholders informed of technological advances.

The option of the benefits of consortia initiatives flowing down to other sectors of education and training is demonstrated by developments across these consortia:

• British further education colleges are already participants in JANET, and receive bandwidth for this source;
• Canadian and American community colleges participate in the CANARIE and Internet 2 schemes;
• It is intended that the benefits of Internet 2 will flow down to the whole Internet community, including schools;
• The CENIC CalREN-2 network is now being extended to all Californian schools under the Digital California Project.

The developments suggest that Australian national policy to extend bandwidth to schools and VET should take account of the AARNet role and the developments overseas discussed above.

Australia, up to now, has not had a nationally-focussed research and development capability for advanced network development along the lines present in the Internet 2, CANARIE, and JANET models. This situation is now changing with the establishment of the new ICT Research and Development Centre. While this body is not yet in operation, it will provide a necessary R&D focal point for initiatives. The extent to which these benefits flow down to all sectors of education and training will be a key question for future development.

Meeting the Bandwidth Needs of Schools and Communities

While there are certain common developments across the countries studied in higher education and research, the situation in meeting the bandwidth needs of schools is more complex and a range of approaches may be observed.

Because of the geographic spread of schools, meeting the bandwidth needs of schools is intimately linked to meeting the bandwidth requirements of communities overall, and a number of national enquiries have been launched by governments into community bandwidth needs and options. We comment below on the national bandwidth/broadband enquiries undertaken in Canada, the United States, Sweden, and Australia.

While the most common approach to securing bandwidth for schools in the countries studied is through purchasing managed capacity from carriers, usually under bulk-buying
arrangements, a number of initiatives have emerged which throw up options for Australia. These include:

- broadband islands in defined geographic areas;
- national bandwidth networks along the lines proposed by bandwidth enquiries in Canada and Sweden.

In the context of these trends, we discuss policy directions in the countries studied.

**The Bandwidth Enquiries**

National bandwidth/broadband reports have been produced in recent years in Canada, the United States, Sweden, and Australia as governments have sought guidance on ways to bring the benefits of the information society to all communities and citizens.

The Canadian enquiry is of particular interest as an attempt to develop a strategy to achieve the Canadian Government’s ambitious declared goal that broadband services will be available to business and residences in every Canadian community by 2004.8

Similarly, the Swedish IT Commission in its 1999 report developed a proposal for “a future-proof IT infrastructure for Sweden” which would provide a nation-wide broadband network in order to achieve the Government’s aim “of all households, enterprises, organisations and authorities in Sweden having access at reasonable cost, to a thoroughly adequate broadband digital infrastructure.”9

The Canadian and Swedish broadband reports involve ambitious attempts to devise strategies to bring the benefits of bandwidth to all communities and their schools.

**The Canadian National Broadband Task Force**

The National Broadband Task Force was established in January 2001 by the Canadian Minister for Industry and reported in June 2001. The main job of the Task Force was to map out a strategy for achieving the Canadian Government’s goal of ensuring that broadband services were available to business and residents in every Canadian community by 2004.

The Task Force considered what broadband standard entailed and concluded that a minimum two-way, or symmetrical transmission speed of 1.5 Mbps per individual user was required to meet this standard. It also noted that in the future much higher speeds will be required to handle emerging opportunities, such as video file sharing.10

The Task Force undertook an analysis of the significance of broadband for Canadian society and concluded that using broadband to help bridge the economic and social gaps that currently separate Canadian communities was both a policy imperative and a necessary vision for Canadian society. The recommendations of the Task Force were therefore focused on strategies to make broadband service available for geographical communities that were unlikely to be served by market forces alone.
The key recommendations of the Task Force included:

- All Canadian communities should be linked to a national broadband network via high-capacity scalable transport links capable of supporting an aggregate of 1.5Mbps symmetrical service to each end user, as well as higher bandwidths to institutions;
- Proposals for models to ensure partnership and collaborative action;
- Strategies for implementation involving both a community aggregator model and infrastructure support model.

As at February 2002, the Canadian Government had not announced its response to the proposals of the Task Force. However, the Government did confirm in its most recent budget in December 2001 that there would be broadband connectivity across the country by 2005 (http://www.broadband.gc.ca).

**Swedish IT Commission Report**

A further national strategy to extend broadband across the country was developed by the Swedish IT Commission in its 1999 report to government which set out a proposal for a nation-wide broadband network.\(^{11}\)

This proposal was developed by the Commission’s Observatory for IT Infrastructure in response to the Government’s aim that all households, enterprises, organisations, and authorities in Sweden should have access at reasonable cost to a “thoroughly adequate broadband digital infrastructure”.\(^{12}\)

The Commission recommended that a fine-meshed fibre optic network should be constructed throughout Sweden so that all households, enterprises and authorities could obtain a direct network connection at low cost within five years.\(^{13}\) This vision included the notion of “5 megabits for all at the same monthly cost as a local bus ticket”.

The Commission in its report noted that a “digital elevation” was occurring throughout Sweden with the emergence of a number of high-speed urban networks, municipal networks, and local area networks. It concluded that these “broadband islands” needed to be joined together in a structured, inexpensive and viable manner through the systematic development of a nation-wide fibre optic structure.\(^{14}\)

The Swedish Government responded to these proposals in 2000 with a modified approach. It decided that 2 megabits was sufficient broadband, rather than 5 megabits recommended by the Commission, and took the position that private industry and market process would handle most of the realisation of the Commission’s vision. The Government’s role would be to support the provision of broadband in sparsely populated areas with low market demand. This reduced the Commission’s estimated cost of 60 billion SEK to about 8 billion.

In August 2000 the Government commissioned the state owned power company Svenska Kraftnat to construct a high capacity fibre-based trunk network reaching all Swedish
municipalities by 2002. By the end of 2001, about 190 of 289 Swedish municipalities (66%) were connected to the trunk network serving 4.8 million of the Swedish population (88%).

This national initiative is supplemented by local initiatives. At the local level municipalities, local power companies and other stakeholders are active in constructing city area networks. These efforts are supported by government subsidies, subject to certain conditions and criteria. However, these initiatives vary widely between regions and there is an absence of national co-ordination so that there is no guarantee that the different local approaches will lead to a compatible national high capacity network as envisaged by the IT Commission in its 1999 report.

Nevertheless, the Swedish approach illustrates a mix of public and private roles, with local initiatives in developing broadband islands significant. The outcome is that most Swedish education institutions either have broadband access now, or will have access in the near future. This extension of broadband across Sweden provides a foundation for the Government’s planning to progress Sweden to a third and “transformation” phase in the role of ICT in education with the new ICT Education Action Plan due to be released during 2002 (http://www.itkommissionen.se).

American and Australian Bandwidth Enquiries

While the United States and Australian governments also set up bandwidth enquiries, neither advanced concrete proposals for a national approach as was the case with the Canadian and Swedish reports. Nevertheless, each report has contributed to the evolving knowledge base on options for extending bandwidth to the whole community in the digital era.

The United States report on Advanced Telecommunications in Rural America was a joint effort of the Department of Commerce, NTIA and Department of Agriculture focussed on the issue of bringing broadband service to all Americans, and hence the status of efforts to bridge the digital divide.15

The report documents the range of approaches across America and the status of various initiatives. The differences between urban and rural areas in the use of technologies such as broadband over cable (in urban areas), and cable modem and digital subscriber line (DSL). The conclusion is that the slower deployment rate in rural areas is economic driven although technical issues also exist. The conclusions of the report include that access strategies, such as the E-rate, should continue to be expanded and that the Federal Communications Commission should reconsider the definition of the universal service principle and new funding mechanisms to ensure that residents in rural areas have comparable access to telecommunications and information services16 (http://www.ntia.doc.gov/reports.html).

The Australian National Bandwidth Inquiry similarly considered strategic issues in the provision of bandwidth in the context of government telecommunications policy. The analysis of the report is based on a concept of three stages in the evolution of communication markets in Australia with the current Stage 2 “the stage of complex transition” with a wider range of technologies and players, and with new possibilities still
emerging.” Stage 3 is seen as “the new order of the data world” with services connected under a “bandwidth cloud.”17

General Comment

This overview of bandwidth enquiries in Canada, Sweden, United States, and Australia points to the fluid nature of the situation with technological advance “with new possibilities still emerging”. This points to the need for flexibility in policy responses and the need for mechanisms, such as the higher education consortia discussed above, which are able to seize emerging possibilities in innovative ways and broker the necessary partnerships in building upon the emerging opportunities.

The four reports also document the range of options for extending bandwidth to schools, colleges, and communities which we discuss below. These include a national strategy, such as proposed in Canada and Sweden, aimed at extending bandwidth access to all communities and citizens, and the mix of market driven policies, supported by access programs such as E-rate, discussed in other reports.

In this context, we will examine the policy approaches for schools in communities in the countries studied.

Policy Options for Schools and Communities

The principle policy approaches in the countries studied appear to be:

1. Demand aggregation strategies of various kinds including whole-of-government purchasing schemes, dedicated school and education schemes, higher education/research consortia schemes, and local “bandwidth islands”;

2. National strategies such as those proposed in Canada and Sweden where the needs of schools would be met through national strategies directed at bringing broadband to all communities and their schools.

While the policy approaches may be grouped in this way, the reality is that a complex interaction of public and private initiatives exists across most countries, for example in Sweden where a national policy to extend broadband to all communities exists along with considerable local initiatives to establish broadband islands.

The national strategy approaches in Canada and Sweden are discussed above and we comment below on various demand aggregation strategies.

Demand Aggregation Strategies

These include whole-of-government purchasing schemes, dedicated education schemes, and local bandwidth islands. While whole-of-government purchasing schemes are common in the Australian States and elsewhere, the main innovations which appear to hold promise of meeting the growing bandwidth requirements of schools and community
are in the areas of dedicated school (or education schemes) and bandwidth islands. These are discussed below.

While the Digital California Project illustrates a whole system scheme funded by government, local and regional schemes, such as bandwidth islands, involve a case by case approach – often subsidised by government – that depend on local circumstances. This approach seems most relevant when there are strong local bodies able to co-ordinate the initiative.

**The Digital California Project**

The Digital California Project (DCP) provides an example of a dedicated education scheme designated to meet the needs of schools, colleges, universities, and the research community for advanced network services so as to serve the entire K-20 spectrum.

This multi-million project is based on partnership between CENIC (the Corporation for Education Network Initiatives in California) and the Californian Government. CENIC is a consortium of the five major Californian universities established to meet the advanced networking requirements of the member universities. CENIC has developed a high performance advanced services network called CalREN-2 for its own members’ use, which will now be made available for Californian schools under the DCP, together with the 4CNet developed by the inter-connected Californian State University wide area network.

The DCP initiative will draw upon all these resources together with the existing network infrastructures supported by County Offices of Education and local school districts. Under the DCP network plan, the CalREN-2/4CNet infrastructure backbone will be extended to all 58 counties of the state under a scheme involving regional DCP hub sites strategically located throughout California, as well as primary and secondary access nodes in each county. These county-based access nodes will be positioned to take advantage of existing country, district, and school networks.

DCP has five major goals:

1. To provide a statewide network communications infrastructure for the K-20 systems in California;
2. To facilitate access to rich content resources for teaching and learning in K-12;
3. To create an environment that facilitates collaboration between California’s K-12 and higher education communities;
4. To provide a conduit for educators to access Information Age tools and enhance the skills required to use technology effectively in the classroom; and
5. To provide an ongoing mechanism and the technical support required to sustain a cohesive and reliable K-20 statewide education network.
DCP is being implemented in five phases from 2000 under a Plan released by CENIC in 2000. The Californian Government is contributing $31.6m annually to fund the scheme.

DCP will enable Californian schools to access next generation Internet technology with CalREN-2 the Californian component of the national Internet 2 initiative. This scheme is seen as providing a basis to transform the work of schools.

The high performance network offers unprecedented access to a new generation of rich digital resources – and challenges the way we envision the school experience.\(^{18}\)

The Digital Californian Project illustrates a number of desirable features of schemes to extend access to affordable bandwidth for schools and VET.

1. It is based on resource sharing so that all the resources of a jurisdiction are pooled across sectoral boundaries.

2. It is driven by vision and leadership provided by CENIC.

3. There is careful strategic planning so that existing resources are brought into the plan for the whole state.

4. Cross-sectoral collaboration enables all stakeholders to benefit.

5. It is linked to state-of-the-art technology development with schools having access to Internet 2 technology through the use of CalREN-2 as the Californian component of Internet 2.

6. An educational vision accompanies the development of technology as set out in the “An Invitation to Dream” document.

The DCP is supported by industry and the “An Invitation to Dream” visionary document was produced by a consortium including Apple Computer, Apex Learning, Classroom Connect, Brainium Technologies, Bigchalk.com, and Chancery.\(^{19}\)

Other Provincial and State Schemes

Several Canadian provinces have also developed province-wide schemes, usually serving all sectors of education and sometimes other public sectors as well. The British Columbia Provincial Learning Network, costing $123 million over six years, will serve 1,700 schools, 22 post-secondary institutions and 20 community skill centres.\(^{20}\) The Alberta government in 2000 awarded a contract to a consortium of companies to build a condominium fibre network throughout the province. This will provide for a low cost 10 and 100 Mbps Internet service to all schools, hospitals and other public sector institutions.\(^{21}\)
Bandwidth Islands

While DCP and the Provincial Learning Network illustrate strategic whole-of-state planning and development, another key development involves innovative partnership initiatives at a local level where communities take responsibility for providing the bandwidth they need rather than being totally dependent on telecommunication carriers. These local initiatives are often termed bandwidth islands, and have emerged in areas of the United States, Canada, Sweden, Britain, supported by governments to varying extents.

Kelso in a recent study of innovative bandwidth arrangements undertaken for the Department of Education, Science and Training defined bandwidth islands in the following terms:

A municipal government and/or a group of schools combines resources to invest in its own private wide area network, or WAN, comprising a number of “dash fibre” standards for aggregating their combined traffic, yet serving only a limited geographic reach for sufficient financial viability.

A key influence driving bandwidth island development in the countries studied above is the role of local authorities across broad areas of social, economic, and educational development, including responsibility for local schools. Unlike the Australian situation, schools in the United States, Sweden, and Britain are operated by local authorities: school districts in America, local education authorities (LEAs) in Britain, and municipalities in Sweden. This provides an incentive for local initiatives to meet the bandwidth needs of the whole community.

While funds for these initiatives come substantially from local sources, central governments often subsidise these developments in various ways. The Swedish Government, for example, provides grants to the municipalities to increase the capacity of existing connections, or to expand local area networks.

The British Government also makes funds available to LEAs for networking infrastructure to enable schools to connect to the National Grid for Learning from the Standards Fund and other funding sources, and institutes a careful monitoring and evaluation of Grid development.

The British Government has set a target for high speed connections with 20% of schools to have two megabytes by the end of 2002 financial year (March 2003). For the period 2000/2001 79.2 million EUR has been taken from the National Grid for Learning budget to set up regional broadband consortia. In a 2001 report to the European SchoolNet, the Department for Education and Skills observed that the consortia were behind in fulfilling the target. The Department further noted that all schools should be on board by 2004.

Becta in its Corporate Plan for 2001-2004 noted that broadband access had increased in the school sector with 22% of secondary schools, 23% of primary schools and 23% of special schools now having broadband access. As indicated above, British further
education colleges are now part of the JANET system for bandwidth with 2Mbps of bandwidth set to be achieved by March 2001.\textsuperscript{27}

The British approach of supporting regional broadband consortia has meant that local and regional schemes like the London Grid for Learning have emerged linking groups of schools and usually involving other institutions such as libraries and cultural institutions.

**Computers in Schools**

A feature of the ICT scene in education across the countries studied has been the steady increase in the number of computers in schools, coupled with planning in some cases to increase the number further.

OECD in a 1999 report on Technology in Education noted that the number of students per computer had fallen to the following levels in leading countries in the period 1996-1998.

- **Primary schools:** United States 8, Finland 11, New Zealand 12, Sweden 12.
- **Secondary schools:** Norway 6, Sweden 6, Finland 7, New Zealand 7, United States 7, Ireland 8.\textsuperscript{28}

The strong performance of the Scandinavian countries stands out.

Country statistics show even more vividly the extent of the improvement. United States statistics show that at the start of the 1990s there was one instructional computer for every 20 students, by 1998 this had fallen to more than one instructional computer for every six students.\textsuperscript{29}

The planning targets of some countries show even more dramatic improvements. Singapore is the leader in this area with a target built into its Masterplan for IT in Education 1997-2002 of a pupil to computer ratio of 2:1 to be achieved in every school by 2002.\textsuperscript{30} Britain has set the following targets to be achieved by 2002: primary schools a computer to pupil ratio of 7.5:1 and for secondary schools 5:1.\textsuperscript{31}

Schemes for providing equipment for schools, pupils and teachers are described elsewhere in this report. The Swedish and British Computers for Teachers schemes are discussed in Chapter 6. In a number of countries, such as Sweden, grants are made from the national government to local authorities for the purchase of equipment to supplement purchases made by local authorities (municipalities, LEA, school districts) from their own resources. In Britain finding is provided from the Standards fund for hardware, software, and training in enabling schools to connect to the National Grid for Learning. The “Equipment” item may be consulted in the database for further examples of policies adopted in providing equipment for schools.

**General Comment**

This overview of infrastructure policies in the countries studied shows a range of approaches to the central issue of meeting the rising demand of education institutions for bandwidth in affordable ways.
These include:

- Collaboration of higher education institutions in consortia such as CANAIRE, Internet 2, CENIC, JANET, and AARNet.

- National strategic planning to extend broadband to the whole community, including education institutions, as in the Swedish and Canadian approaches.

- Resource sharing across the education sectors with strategic planning as in the California Digital Project.

- The inclusion of further education and community college institutions, as equivalents to TAFE, in the higher education schemes.

- Developing local and regional consortia to meet local needs as in the bandwidth island initiatives in Sweden, Canada, United States, and Britain.

These strategies are not mutually exclusive, and they may be combined in various ways as, for example, in Sweden where a national approach to extending bandwidth to communities goes along with support for local initiatives in building bandwidth islands.

A key feature of the evolving bandwidth scene are resource sharing arrangements as in the California Digital Project, and innovative forms of public and private partnership.

Each of the strategies discussed is directed at meeting the rising demand for bandwidth in affordable ways. A number of them link consortia arrangements with the development of the next generation of advanced technology for the benefit of members. The California Digital Project illustrates how Internet 2 advanced technology is being made available for Californian schools through access to CalREN-2 under the CENIC arrangement.

The California Digital Project illustrates how the benefits of advanced networking arrangements can be extended to schools through strategic planning and resource sharing. This is a win:win situation for the whole community.

A point of interest is that a best practice international benchmark, in the present state of technology, appears to be emerging in the Canadian, Swedish, and British developments. Each of these developments involves bandwidth targets of around 1.5 – 2.0 megabits. This is the target recommended by the Canadian National Broadband Task Force, adopted by the Swedish Government (although the Swedish IT Commission recommended 5 megabits), and set as a target by the British Government to be achieved by 20% of schools by 2002. Given the dynamic state of the technology, this is likely to be a shifting target.

However, the observation of Kelso, in his recent report on innovative bandwidth arrangements, that most Australian schools are connected to the Internet with no more than 64 Kbps of bandwidth, suggests that Australian schools (and probably TAFE) are falling behind the emerging international good practice benchmark.
Australian TAFE is disadvantaged by lack of access to advanced networking arrangements as exists for British further education institutions and American and Canadian community colleges, and the development of TAFE in the information age will be impeded unless this deficiency is rectified. While some TAFE campuses do well, the overall situation is patchy.

Overall, there appears to be a strong case to develop a national strategy to meet the rising demand of schools, TAFE, and communities for affordable bandwidth as a pre-requisite to achieving the benefits of the information age for all Australians.

NOTES

1 OECD 2001b, p.64.
2 This is discussed in The Enabling Pillars 2002, pp.45-46.
3 UKERNA 2000.
7 Kelso 2001, p.23.
9 Swedish IT Commission 1999: The Commission defined broadband as involving an actual bandwidth of 5 Mbit/s and upwards end-to-end.
12 Ibid, p.3.
13 Ibid, p.4.
14 Ibid, p.4.
16 Ibid.
19 Ibid.
20 Advisory Committee for Online Learning 2001, p.70.
21 Ibid, p.70.
22 Kelso 2001 p.xi.
24 EUN Briefing for National Policy Makers 2001b, p.5.
26 Becta 2001, p.5.
27 Ibid, p.15.
28 OECD 1999.
31 EUN Briefing for National Policy Makers, 2001b.
33 There are some emerging minor exceptions to this situation with the Canberra Institute of Technology now linked to the AARNet in Canberra.
8. **ONLINE CONTENT, APPLICATIONS AND SERVICES**

*Powerful tensions exist between traditional curricula based on well-defined content and rules for students to learn and to be able to reproduce – and the open, skills-based, student-centred approaches supported by ICT.*

OECD 2001b, p.15

A common theme across the countries we studied was to articulate the implications for an approach to content responsive to the emergence of the learning and knowledge society. We found, in some cases, that content took on a new meaning in an environment where everyone was seen as both a consumer and producer of knowledge, and where schools were envisaged as knowledge generating institutions with teachers as knowledge workers and lifelong learners, and students engaged in laying the foundations for lifelong learning.

The shifts we observed were expressed in different ways. Finland’s National Strategy for ICT in education saw a shift “from curricula to information strategies”\(^1\) with content taken out of the classroom into open learning environments.\(^2\)

The Finnish National Strategy further defined open learning environments in the following terms:

> In an open learning environment, learning is active and communal and utilises a variety of media. Openness is also linked to the opportunity for networking in learning situations, the mobility of learners, and partial independence of time and place. Options support the self-directed learning and motivation of the student.\(^3\)

Content was therefore seen in terms of the opportunities provided for active self-directed learning in open communal and learning environments so that students acquired the attributes, skills, and habits of lifelong learners and knowledge workers able to network in learning situations. Finland is examining these themes over 2000-2004 in its work on the network as a learning environment under the National ICT Strategy for 2000-2004.

The notion of taking content beyond the boundaries of school into open learning environments and networks was common in the strategic statements we examined.

In some cases, this included the notion of virtual communities of learning, as in the American 2000 National Education Technology Plan,\(^4\) and the concept of a virtual school. Finland, among other countries, has developed planning for the virtual school as a component of its ICT national strategy.\(^5\)

A related vision was articulated by the American CEO Forum on Education and Technology focussed on the concept of digital learning.\(^6\) Digital learning was seen in the following terms:

> The educational approach that integrates technology, connectivity, content and people. When implemented correctly, digital learning builds on the unique, dynamic characteristics of digital content to
foster productive and engaging learning. This in turn both supports and promotes the essential skills students will need in education, life and work in tomorrow’s world.\(^7\)

This approach linked content organically with the concept of “digital learning” and with the notion of digital learning and 21\(^{st}\) century skills that the Forum subsequently articulated in its final report in 2001.\(^8\)

In these ways content is intimately linked to a vision of the role of education in a knowledge and learning society, and to learning strategies and objectives necessary to advance that vision. The openness of digital learning environments is a key characteristic we observed, commonly linked to problem and project centred approaches that were collaborative, communicative, customised and creative.\(^9\) In these ways, digital age content becomes an instrument for pedagogic renewal and for fostering essential digital learning literacy for all.

ICT is widely seen as a key instrument in these changes for, as OECD observed “as ICT gains acceptance in schools, it may become both the driver and facilitator of the necessary curriculum change.”\(^10\)

Against the background of shifting pedagogic and curriculum objectives and strategies, we found that six key themes have influenced and been reflected in policy development relating to on-line content, applications and services in the countries studies. These themes were:

1. fostering a viable market for the generation of quality online curriculum content including meeting market gaps;

2. developing collaboration and partnership to support these market objectives, including innovative forms of public/private partnership;

3. stimulating grassroots initiatives;

4. ensuring quality and acceptable standards;

5. providing information and support services;

6. promoting the excitement of learning;

7. promoting technical standards and interoperability.

Comment follows on these themes.

i. Fostering a Viable Market

The small size of many of the education systems studied, and the fragmentation of the market for online materials in terms of factors such as age and grade, raises a spectrum of issues relating to the cost of online materials in relation to the size of the market, and shifting educational requirements. This imperative has led to increased interest in
collaboration and partnership which has been a significant policy response across all countries.

While all countries have sought to develop a viable market for online content, there are significant differences between countries in the extent to which development has been market driven (and facilitated by government in various ways) and the extent to which direct government initiatives have been taken. These differences are influenced by such factors as language, the size of the market, and national cultural policies.

Finland, for example, faces a situation where the market is small and there is no international market in the Finnish language. Canadian policy has been strongly driven by a perceived need to foster Canada’s cultural identity in its North American environment.

While educational markets for online content are fragmented in a number of respects, they are also expanding with the pressures for lifelong learning which are creating new markets for adult learners which are likely to erode over time sectoral market boundaries in the context of the emerging learning society.

A recent OECD report on e-learning identified a four-way breakdown of the emerging lifelong learning education market. This involves:

1. the early years and compulsory school cycle where e-learning is likely to bring significant changes in terms of unit costs, efficiency, and reach, and to address issues of quality, standards, diversity, and inclusion;

2. initial tertiary (VET in Australia) and the higher education level, usually regarded as ages 18-24, where still rising participation rates have moved most OECD countries from elite to mass systems, and where continuing high demand raises pressures for cost containment. In terms of student participation, a feature is a learning and earning clientele with part-time employment common;

3. the adult or continuing education market where massive growth is already occurring and where further exponential growth is widely predicted. As most clients are in employment, this is an earning and learning market;

4. a fourth market or clientele, ultimately possibly the most important but also the least tangible and predictable, is the whole of society learning nation. The ultimate vision of lifelong learning and the learning society will see a rapid growth of this market. The rapid development of diverse modes of e-learning in some OECD countries points to the development of this market.11

Policy in the countries studied differs in the extent to which it is focussed across these markets. British policy to develop Britain as a learning society has brought with it an interest in each of these markets whereas Australian policy is focussed on the first two. The large American market for adult learning is commercially driven by the growing
demand from “free agent learners”. Cultural differences between countries are a significant influence on policy.

Finland’s policy for online content strikes a chord that is common across countries. This is that:

- materials will be produced on a commercial basis where the numbers of pupils and other users makes this feasible;
- educational authorities will step in to fill the gaps in fields where commercial production is not feasible.\(^\text{12}\)

We found this principle widely applied across countries. Canadian policy adds a third principle, which is echoed in countries such as Australia, that government intervention is justified to promote national cultural identity.

British policy for online content was set out by the British Educational Communications and Technology Agency (Becta) in its Corporate Plan for 2001-2004. This is focussed around the following principles:

- government and its agencies should not be the originators of most educational content;
- government can, however, develop policies that support the development and use of quality content such as the National Grid for Learning and National Learning Network;
- government should assist the commercial sector to understand the needs of the education sector and the development of viable educational markets;
- government agencies can assist teachers and learners to locate quality materials through instruments such as search engines and annotated authoritative sites.\(^\text{13}\)

These principles have been applied by the British Government in the development of the National Grid for Learning.

The National Grid for Learning “is the UK’s main educational gateway to the information highway, providing learners of all ages with high quality, educationally valuable content”\(^\text{14}\). The Grid incorporates a wide range of linked separate websites such as the Virtual Teacher Centre, and now comprises over 5,000 pages of hosted content and 300,000 pages of indexed content.\(^\text{15}\)

While there was an initial focus on the needs of schools, the Grid spans all levels and sectors of education and learning in line with the lifelong learning philosophy of the British Government. There has been collaboration with the commercial sector in the development of the Grid as the market for learning has expanded with the development of the Grid and associated policies such as the national network of UK Online Centres and the University for Industry (Ufi) and its learmdirect provision and centres. The combined impact of this spectrum of policies has been to grow the national market for learning and
online content so that the viability of commercial production of online content has been strengthened (http://www.ngfl.gov.uk).

Britain also facilitates the operation of the software market through the role of the Becta Educational Software Database (BESD). Software publishers are invited to provide information on their products for the database which can be searched by subject area, phrase, platform, format or keyword. Where available, product descriptions are linked to reviews of the product on the TEEM (Teachers Evaluating Educational Multimedia) website (http://www.besd.becta.org.uk).

A further significant dimension of market policy for online content in some countries has been the promotion of national cultural identity through online content.

Canada best exemplifies this theme which has been significant in Canadian policy throughout the decade. The reports of the Canadian Information Highway Advisory Council emphasised the need for “an integrated proactive policy” to “reinforce Canadian sovereignty and cultural identity.”

The Canadian Government has built this perceived national imperative into its Connecting Canadians program through the Canadian Content Online initiative under the program. This initiative confirms four program strands:

- **Digital Collections** which pays young people to create Web sites featuring Canada’s vast Informational resources;
- **Aboriginal Digital Collections** is a program to preserve, celebrate and communicate Aboriginal heritage, languages, business and economic development in the Internet;
- **Franc Communistes Virtuellers** serves and celebrates Canada’s French speaking community;
- **SchoolNet Multimedia Learnware and Public Access Applications Program** supports partnership between Canada’s new media.

These programs combine to give a significant boost to Canadian identity through online learning (http://connect.ca.ca/en400-C.htm). The European Union has also sought to promote European languages and cultures through programs supporting online learning.

The Netherlands is another country which has seen ICT as a major tool in fostering and sustaining a national cultural identity. This link is described in the following terms in a recent report.

> *ICT and culture are nowadays closely connected since ICT can disclose many cultural sources and make the cultural heritage available to education.*

Australia has also built expressing Australia’s unique cultural identity through online content into the Education and Training Action Plan for the Information Economy, and
has sought to advance this objective through programs such as The Learning Federation which is discussed below.

ii. Promoting Collaboration and Partnership

Promoting collaboration and partnership in the development of online content is a common theme across all countries. Policy in this area is often closely related to the market development strategies adopted by agencies, and may take a number of forms.

OECD has recognised the significance of “the partnership challenge” in its three-year program on ICT in education, and adopted partnership as one of the three main strands in the program leading to a recent publication on this subject which provides a useful overview of themes and issues.19

We found that partnership in the development of online content took a number of forms across the countries studied. These included:

- collaboration between education systems;
- forms of public/private partnership;
- partnerships between schools, teachers and students.

Collaboration between Education Systems

The Australian Learning Federation initiative provides a good example of this form of collaboration. This initiative involves collaboration between the Commonwealth, States, and Territories to develop a national pool of online curriculum resources that address national priorities, support cultural identity, and nurture innovative skills in young people. The initiative also contributes to the development of supporting mechanisms for sharing resources across school systems and to advancing the development of a national market in quality-assured Australian online school resources.

The Learning Federation is described in more detail in the companion Australian report20 and is included in the policy database (http://www.edna.edu.au) (http://www.socci.edna.au).

European Union policies in education are underpinned by collaboration between Member countries. A typical example in the area of online learning is provided by the European SchoolNet which links national networks and schools across Europe.

European SchoolNet supports collaboration between schools and systems in various ways. Initiatives include collaborative projects like myEUROPE which helps schools to work together on curriculum development projects (http://www.myeurope.eun.org) using tools like the SchoolNet’s community space (http://community.eun.org).

SchoolNet projects form part of the Joint Educational Multimedia Call framework which comprises 17 sub-projects across a number of EU countries (http://www.eun.org).
Public/Private Partnerships

There has been a growth of public/private partnerships in growing online educational markets. Such partnerships take a range of forms with frameworks such as the British National Grid for Learning typical. A common objective is set out in the British Becta corporate plan for 2001-2004: that government should assist the commercial sector to understand the needs of the education sector and the development of viable educational markets.21

Public/private collaboration has been stimulated by the fact noted by OECD that “the educational market, while potentially huge, has developed only slowly”,22 and by concerns at the poor quality of much early online content for schools where online content “have not necessarily matched well with the curriculum objectives and pedagogy.”23

Like Britain, Singapore is a further country that has recognised that the software industry should be actively involved in developing and offering content and related services, such as in developing CD-ROMs and materials for the DMRs, identifying and mirroring relevant Internet sites, and sourcing off-the-shelf software from abroad.24

Collaboration between Schools, Teachers, and Students

A third form of collaboration and partnership promoted by ICT education policy, involves collaboration between schools, teachers, and students in the development of online content. This form of collaboration has been fostered under programs such as the European, Swedish, and Canadian SchoolNNet program, and is discussed below.

iii. Stimulating Grassroots Initiatives

The trend to foster open learning environments that motivate and enable students to become self-directed lifelong learners as citizens of a knowledge society, has stimulated considerable interest across the countries studied in policies and strategies to encourage grassroots initiatives at the level of individual schools involving students, teachers and school communities. These initiatives have often been encouraged under programs such as European, Swedish, and Canadian SchoolNet programs.

The Canadian SchoolNet program provides a typical example with grassroots initiatives encouraged under two programs:

- the SchoolNet Virtual Products program; and
- the SchoolNet Grassroots program.

SchoolNet Virtual Products Program

This program supports SchoolNet users in mounting products and services onto the SchoolNet server. Proposals come from school boards, education associations, other non-profit organisations, and provincial ministries. Funds are provided for selected proposals.
SchoolNet Grassroots Program

The Grassroots Program provides funding to schools to fund interactive classroom learning projects on the Internet. Funding allocations are normally $300, $600, or $900 per project, depending on the type of project. More than 10,000 Grassroots projects have been funded across Canada enabling students to acquire practical experience in IT skills and content development. An evaluation of the SchoolNet program by KPMG concluded that SchoolNet was seen as having played an important role in developing online educational and library resources as well as providing valuable ICT experience for students25 (http://www.connect.gc.ca/en/210.e.htm).

In addition to Canada, similar grassroots content projects are an aspect of SchoolNet programs in the European Union, Sweden, and elsewhere. The EU has actively encouraged and supported co-operation between schools in Europe across national frontiers. Collaboration curriculum development projects involving schools such as myEUROPE were mentioned above (http://www.myeurope.eun.org). The EU Comenius program also encourages schools to collaborate internationally around curriculum topics (http://comenius.eun.org).

iv. Ensuring Quality and Acceptable Standards

The world of e-learning is relatively new in education so that there is considerable experimentation as systems grapple with a new set of quality issues. OECD in comment on systems for quality evaluation noted that the relatively short history of formal evaluation shows attempts to reconcile a variety of interests and concerns.26

OECD has suggested that the following dimensions of quality should be built into processes for evaluating quality:

i. educational purpose  v. added value
ii. mode of use  vi. cultural relevance
iii. needs of individual learners  vii. avoidance of stereotypes
iv. robustness and user friendliness  viii. affordability and mode of delivery

The systems adopted so far have generally adapted peer assessment methods to the online environment. Examples are provided by the Californian Instructional Technology Clearinghouse, the British Teachers Evaluating Educational Multimedia (TEEM) scheme, and the Swedish Foundation for Knowledge and Competence Development.

California Instructional Technology Clearinghouse

The Clearinghouse is funded by various state and federal agencies and operates in 19 evaluation satellites throughout the State, each specialising in a particular subject area. It employs 900 trained and experienced evaluators. For acceptance, a product must receive a favourable verdict from at least two evaluators, and only then is purchase authorised for State schools.
Detailed criteria for evaluation have been developed by the Clearinghouse since 1982 with digital content criteria in five areas: curriculum content, instructional design, program design, assessment, and instructional support materials (http://clearinghouse.K12.ca.us).

Other American states have similar assessment systems. Ohio, for example, has a software library for teachers which is accessed through its eClearinghouse with the materials in the library evaluated using a software evaluation protocol designed by teachers for teachers. This protocol was developed as part of the SchoolNet Software Review Project (SSRP) (http://imrc.osn.state.oh.us/imrc/home).

British Teachers Evaluating Educational Multimedia (TEEM)

TEEM has been developed since 1998 as a public/private partnership with support from government and industry. The main purpose is to provide an information service for teachers although the TEEM process also involved professional development objectives. As in California and Ohio, evaluation criteria were developed from technical, curricular, and pedagogic issues, as questions rather than statements to be met. By May 2001, TEEM carried 200 evaluations with the TEEM web site visited over 5,000 times a day. The TEEM frameworks are also seen as relevant to developers (http://www.teem.org.uk/).

Swedish Foundation for Knowledge and Competence Development

The Foundation, which operated as a public/private partnership, has launched a database for educational material using publishers’ promotional material and teachers’ reviews. The database holds reviews of over 450 products from 86 different publishers and has 100 teachers registered as reviewers.

v. Providing Information and Support Services

There has been a very considerable expansion of information and support services for teachers and students. A particular feature has been the development of online information sources and services such as the assessment sources in respect of online materials discussed above.

A key development has been the growth of education portals which guide teachers, students, administrators, and the stakeholders in accessing information and advice across broad areas.

The British National Grid for Learning, the Australian EdNA Online, and American Gateway to Educational Materials provide examples of comprehensive portals at a national level which enable users to navigate and access large amounts of information. The British Grid comprises a series of linked specialised web sites, such as the Virtual Teacher Centre, where information and services are organised for particular categories of users.
The American Gateway to Educational Materials functions in a similar way to the British National Grid for Learning. GEM provides access to more than 140 web sites and covers a wide range of educational materials including lessons, instructional units, and educational materials by grade (http://www.ngfl.gov.uk) (http://www.edna.edu.au) (http://www.thegateway.org).

In some cases, dedicated information and support systems have been developed for particular sectors of education. An example is the British Ferl system (Further Education Resources for Learning) which was developed for further education colleges. This system is funded by the Learning and Skills Council and managed by Becta.

Ferl provides information and resources in the following areas: People and Practice; Technology and infrastructure; Learning and Teaching Resources; Training and Skills; Current issues and key documents.

Ferl resources include guidelines for ICT strategies in FE colleges, case studies of good practice, guidance on curriculum based software and web sites (http://ferl.becta.org.uk).

In Australia, education.au limited has been innovative in extending a range of services for Australian education through EdNA Online and the other initiatives of the company. These services include about 15,000 evaluated education and training resources, 330,000 serviceable web pages, and over 500 discussion lists. The links that the company provides to international sources is an important part of their role. EdNA Online as a knowledge hub aggregates information and knowledge from contributing state and territory education systems and is able to deliver consolidated knowledge back to these systems.

In addition to national portals and web sites, a trend in Britain is for local communities (towns and cities) to have web sites for learning information, usually linked to development as learning communities. Birmingham, Bristol, and Devon provide typical examples (http://www.bgfl.org/bgfl) (http://www.bristol.lea.org.uk) (http://www.devon_cc.gov.uk/eal/).

vi. Promoting the Excitement and Joy of Learning

A key objective that may be observed across most countries studied, is to promote ICT in ways that build motivation in students for lifelong learning, and which foster habits of independent research and enquiry, and the sense that learning is fun and exciting. This objective is given effect through interactive strategies that engender the joy and excitement of learning in students, and which are directed at fostering creativity in students and higher-order skills. This objective also brings the requirement that there should be software to facilitate and stimulate new forms of learning.

We noted a range of instruments used for this purpose. These included European SchoolNet initiatives, Canadian SchoolNet including the Grassroots project initiative, the Singapore edu.Quest, the Swedish SchoolNet and Interactive Institute, and the British Grid Club.
The Singapore edu-Quest, Swedish Interactive Institute and British Grid Club may be taken as typical of these initiatives.

**Singapore edu.Quest**

edu.Quest is a collaborative venture between the Singapore Government and Apple. It is described as “an exciting IT ride into the world of possibilities” which aims at excellence and excitement in learning through the use of technology. edu.Quest encourages students to design their own learning and to research subjects of their choice in ways that enables technology to best cater to creative abilities (http://www.moe.edu.sg/eduquest/).

**Swedish Interactive Institute**

The Interactive Institute also aims to encourage new ideas and creativity in users. Creativity is encouraged through components of the Institute such as the Interactive Tent, Games Studio, and Memory Theatre.

The Institute also combines a research capability with its other activities. The Emotional and Intellectual Interfaces Studio is a research group at the Institute that specialises in interactive environments and interfaces between the senses and digital technology with the aim of promoting the development of a new tradition in digital communication. This will focus on technologies in everyday use with an emphasis on experience and understanding.

The Institute in 2000 signed a collaborative agreement with the Artificial Intelligence Laboratory at MIT to enable the resources of the two organisations to focus on bridging the gap between cutting edge technology and people-oriented design (http://www.interactiveinstitute.se).

**British Grid Club**

Somewhat similar to the Singapore edu.Quest is the British Grid Club which is restricted to children aged 7 to 11 years. Like edu.Quest, Grid Club provides games, puzzles, and a range of fun activities for children in this age range, as well as collaborative projects together with professionally mediated virtual clubs supported by a Virtual Library of references and educative interactive games. All activities are linked to the British National Curriculum at Key Stage 2.

Also like the Singapore edu.Quest, Grid Club is being delivered by a public/private partnership comprising DfES and O4 Media which is a consortium including Channel 4, Intuitive Media and Oracle (http://www.grid.club.com/).

**vii. Standards and Interoperability**

A few systems we studied have commented on issues relating to standards and the increasing demand for improved interoperability between systems. In the case of Britain, Becta in its Corporate Plan for 2001-2004 noted that the development of infrastructure, software and protocols that enable digital connectivity has been piecemeal. Becta saw
this as resulting from competition between a range of commercial providers, which has limited the development of common standards.

Becta noted that a demand had now risen for improved interoperability systems. This included a demand for transparent connectivity between government systems with e-government development and educational networks such as the National Learning Network, and within the education system itself.\textsuperscript{31}

This issue was now being addressed through the Information Management Strategy project which aimed to establish common protocols for collecting and sharing educational information. The objectives of the project include achieving agreed standards for school and LEA software and hardware and for technical software support, as well as achieving agreed standards for electronic information collection and transfer. The project also aims to set up effective mechanisms for handling future changes to the agreed information management strategy.\textsuperscript{32}

The common basic data set (CBDS) provides the basis for establishing standards for transferring data between sites and between different suppliers’ systems. Software systems were required to be compliant with the CBDS definitions needed for pupil transfer by March 2001. A target for software exchange has been established and over 40 LEAs have been involved in tracking the electronic collection of the annual school census.\textsuperscript{33}

While standards issues do not usually appear in national ICT plans, in the case of Singapore a number of supporting strategies have been included. These include system integrators with a number of pilot programs built into the framework of the national action plan (http://www/moe.edu/sg/iteducation/masterplan).

Singapore has been active in addressing these objectives. An Information Technology Standards Committee Plugfest 2002 (ITSC) has been established which is addressing subjects such as IMS Meta-data and Question and Test Interoperability specifications.\textsuperscript{34} An IMS Asia Centre has been established and is contributing to this work in Singapore.

Fostering interoperability is also an objective of some higher education bodies in working towards an “international information environment”.\textsuperscript{35}

This is seen as an objective of the British Joint Information Systems Committee (JISC) in its Five Year Strategy for 2001-2005 where the vision of a single, world-wide information environment is seen as a necessary goal in providing most of the information needed by scholars and researchers for their day to day work.\textsuperscript{36}

JISC recognises that this vision will be difficult to achieve with the barriers such as the lack of universally accepted protocols and methods of cataloguing, indexing, digitising, and preserving information to guarantee conformity and interoperability remaining to be addressed.\textsuperscript{37} JISC sees the need to work in partnership with other organisations, in Britain and overseas, in working towards achieving the vision of an international information environment.

There has also been considerable activity in the United States where a Schools Interoperability Framework (SIF) consortium has produced a specification for the major
components of the infrastructure supporting US K-12 education. A recent paper on the American situation pointed to the challenge of sustaining standards activity in keeping pace with e-learning implementation.

**General Comment**

This brief overview of developments across the countries studied in the areas of online content, applications and services shows a dynamic scene of change and development as systems seek to harness the power and potential of ICT in building open learning environments that link education institutions and the resources of their communities in innovative ways. Emerging concepts such as digital literacy and digital learning are influencing these developments which are characterised by new forms of collaboration and partnership as governments seek to influence market development so that the needs of institutions for high quality materials are met. The grassroots initiatives, and services for institutions, are particularly significant as systems endeavour to apply ICT to enhance teaching and learning in institutions.

While there has been considerable activity, the extent of progress towards online content appropriate for the information society remains problematic. Becta in its Corporate Plan for 2001-2004 observed that most of the content is static information and concluded that “we are still at the early stages of development of online resources that interact with learners” and “there are few viable commercial models”. This suggests the need for a stronger research effort in this area as the German Government has recognised with its investment of 205 million Euros over four years in an extensive research program on new media in education. This investment is directed at the German ambition to become the leading country for educational software.

We take up in Chapter 10 the impact of these developments and outcomes for students and schools.

**NOTES**

1 Ministry of Education Finland 2000, p.17.
2 Ibid, p.16.
3 Ibid, p.17.
5 Ministry of Education Finland 2000.
7 Ibid, p.5.
9 See, for example, the CEO Forum 2000 on the characteristics of digital learning environments: CEO Forum, 2000 p.9.
10 OECD 2001b, p.15.
14 Ibid.
EUN Briefing for National Policy Makers 2001b, p.3.
Information Highway Advisory Council 1997
DETYA 2000, p.28.
OECD 2001a.
Kearns and Grant 2002, pp.56-57.
OECD 2001b, p.37.
Ministry of Education Singapore 1997, p.3.
KPMG 2000.
OECD 2001b, p.48.
Ibid, p.52.
Ibid, p.50.
Becta 2001, p.12.
Lim Kin Chew 2002.
Becta 2001, p.31.
Netherlands Ministry of Education, Culture & Science 2002b, p.36.
Ibid, p.36.
9. THE POLICY, ORGANISATIONAL AND REGULATORY FRAMEWORK

We are entering the 21st Century with antiquated regulations of educational policy and inappropriately restrictive copyright laws. It is as if we tried to manage the interstate highway system with the rules of the horse and buggy era.

United States Web-based Education Commission, 2000

Compared with many other sectors, education has been slow to make changes in organisational practice and culture through the adoption of ICT.


We found that debate on the impact of ICT in education in the countries studied frequently brought forward calls for radical changes in the way education is organised, funded, and administered in order to fit the conditions and opportunities of the information age.

The Swedish IT Commission is typical of this line of comment in its 1997 report Sweden Enters the Information Society.  

In this report the Commission argued that “for over one hundred years, the education system has been geared to an industrial society… We have acquired the knowledge needed in an industrial society. But the problem is that today’s students will be facing a new society when they complete their education.”

The Commission therefore argued for educational renewal directed at lifelong learning with new teaching methods and strategies so that students were prepared for the Information Society.

The United States Web-based Education Commission took a similar view in arguing in its report to Congress that there was a need for a radical re-thinking education regulation to remove “antiquated regulations of education policy.”

The American National Association of State Boards of Education (NASBE) in a national report on e-learning policy also argued to “re-engineer the system” to fit the conditions of the digital world.

This analysis was based on the conclusion that the dynamics and pace of change were outstripping educational policy.

However, the uncomfortable reality is that education leaders are not currently driving the policy agenda. Rapidly moving trends are outpacing the ability of policy makers to keep up.

NASBE therefore proposed re-engineering the education system to revise learning standards, streamline policies, empower families, bring state assessments online, and
progress beyond geographic boundaries in order to assure equality and deliver quality instruction for learners.

OECD has added its voice to this body of criticism in the reports emerging from its three year study of ICT in schools. OECD noted that the emerging more open approaches desired in schools, which are strongly supported by the role of ICT, “require a radical change for delivery in a timely effective way.”

In addition to these calls for change from outside education systems, initiatives have been taken and proposed from within education systems directed at transforming the way learning occurs. These aspects are discussed in Chapters 10 and 11 which follow.

While the need to transform education systems is frequently articulated, we found that policy and organisational and administrative change was seldom built into national action plans for ICT in education, with Australia the main exception to this situation.

The Australian Education and Training Action Plan for the Information Economy devotes two of the five action areas in the Plan to the organisational and regulatory framework for the role of ICT in education. These action areas are:

- Action Area 4 : Policy and Organisational Framework
- Action Area 5 : Regulatory Framework

Action Area 5 does not include education regulation, but is rather focused on the regulation of aspects such as copyright, privacy, and telecommunications which are administered outside education portfolios, but which bear on the use of ICT in education.

We consequently found little evidence of changes in the policy, organisational, and regulatory frameworks for schools and the other education sectors to accommodate the imperatives of the information age. This was also a conclusion of Venezky and Davis in their overview report on the outcomes of 93 case studies conducted in 23 countries in an OECD international study. Venezky and Davis noted that while governments wanted ICT skills acquired by all students, national curriculum and examinations were not changed. The long term impact of national performance measures and testing, as in Australia, is not yet clear.

The situation may reflect divided responsibilities between levels of government, not only in federal systems but also in unitary systems where schools are operated by local authorities. These local authorities include British LEAs, American school districts, and municipalities in Sweden. As these local school systems were excluded from the scope of this study, any changes in their policies and organisation for schools have not been caught up in this study.

A further influence may be that most policy examined in this report is essentially concerned with laying the foundations for the use of ICT in education rather than fostering the role of ICT as an instrument to transform the system. As systems progress to a third or transformative phase of policy for ICT in education, organisational and administrative issues are likely to assume greater significance in a systemic approach where the interdependence of all aspects of the policy framework for education is
recognised. The changes that accompany the announced third phase of policy for ICT in education in Sweden with the new Swedish national ICT plan will be of interest in this regard.

Regulatory Framework: Copyright

While there was little evidence of shifts in the policy, organisational, and regulatory framework for education because of the impact of ICT, the area of regulation that has attracted considerable debate across the countries studied is the regulation of copyright. Copyright law and regulation is widely seen as a key issue in access by education institutions to learning content, both online and in other forms, in the digital era. This has led to attempts to update copyright law and regulation to fit the conditions of the information age.

The application of traditional approaches to copyright in the digital era has been widely criticised. The American Web-based Education Commission saw “inappropriately restrictive copyright laws” as an impediment to realising the power, and potential of the Internet for learning,10 and there have been similar criticisms in Europe and Australia.

However, the issues are complex in terms of balancing the competing interests of the producers of intellectual property, national interests in terms of national cultural heritage and identity, and those of learners desiring to access these materials, and amendments to law and regulation have inevitably involved compromises which have not fully satisfied education systems and their institutions and students.

Finland, like Australia, is one country that has built copyright issues into its national strategy for ICT in education.11

In its national ICT strategy, Finland notes that examination of copyright issues related to digital technology and information networks was currently under way at both national and international level in the European Union, and the World Intellectual Property Organisation (WIPO) with Finland actively involved in each of these bodies.12

Finland’s Ministry of Education was, during 2000, engaged in a national survey on the effects of digital technology on copyright legislation, reflecting similar action being taken at the EU level. The Ministry noted that the requirement for proper security of works in digital and other formats meant that copyright legislation had to be adapted to the demands of the new technology with “adequate and uniform rules for the distribution of digital material in international information networks.”13

The action to be taken by Finland towards these objectives included:

- the development of simple and functional contract and licence systems for digital materials; and
- promoting knowledge and understanding of copyright issues.14

Australia is another country where copyright in the digital era has been under active consideration. Developments in Australia have included:
• the Copyright Amendment (Digital Agenda) Act 2000 which extended the statutory licence provisions of the Copyright Act to cover electronic uses;

• the development of AE ShareNet as an electronic management system for the VET sector which streamlines licensing transactions for training packages and other VET material as a step towards rationalising copyright ownership within the sector.

While the Copyright Digital Agenda Act was a major development which opened up the possibility for education institutions to scan works, email copies of works, and install works on an intranet for use by students, copyright issues in the digital era are not yet fully resolved in Australia or elsewhere, and this is an area that will require ongoing monitoring.

**Telecommunications Regulation**

Education in the digital era is also strongly influenced by the terms of telecommunications regulation. There has been a trend across all OECD countries to open up the telecommunication market to competition as a means of improving service and driving down costs, with varying effects for education users.

It is also common for telecommunications legislation to include a “universal service” principle, and the way this principle is interpreted can be significant for education users of telecommunication services, in particular in remote areas.

The United States Telecommunications Act of 1996 states that “access to advanced telecommunications and information services shall be provided in all regions of the Nation” at rates that are “reasonably comparable” to rates in urban areas. This principle has been applied in the United States to fund the Universal Service Program for Schools and Libraries (known as the E-rate) which provides discounts for schools and libraries in accessing telecommunication services. Similar schemes do not exist in other countries studied although the principle of universal service at reasonably comparable rates may come into focus in the commitment by the Canadian government to provide access to broadband for all Canadian communities by 2005.

Like copyright, telecommunications law and regulation is complex and beyond the scope of a study concerned with education policy for ICT. However, the implications of such regulation for education are significant and require ongoing monitoring to ensure that education interests are reflected in policy decisions.

**General Comment**

While the area of organisational and regulatory change is not strongly reflected in national and state policy and strategic planning for ICT in education, this area is likely to become increasingly significant as education systems progress beyond a foundations phase of policy and planning for the role of ICT in education, to a phase of transformation in the way we learn. Achieving such a transformation is likely to throw up a broad spectrum of organisational and regulatory issues, requiring the removal of regulatory barriers, and the establishment of organisational structures and incentives that encourage
and support flexible and open learning systems across a learning society. This phase will have profound implications for the organisation and roles of education institutions, and for administrative systems that nurture and support their role. For this reason, this is an area requiring ongoing monitoring and examination, with international experience a useful input.

We take up key aspects of these broader issues in Chapters 10 and 11 which follow.

NOTES

1 Swedish IT Commission 1997.
2 Ibid, p.11.
3 Ibid, pp.10-12.
6 Ibid, p.4.
7 OECD 2001b, p.88.
8 Venezky and Davis 2001, p.35.
12 Ibid, p.46.
13 Ibid, p.47.
14 Ibid, p.47.
16 See Chapter 7.
10. ICT AND EDUCATIONAL OUTCOMES

We are on the verge of a learning revolution.
Ontario Knowledge Network for Learning 2001

This report illustrates that ICT has established a new complementarity between formal learning in school and informal learning outside.
OECD 2001

The Commission on Technology and Adult learning foresees a future in which e-learning allows learning to become a continuous process of inquiry and improvement that keeps pace with the speed of change in business and society.
United States Commission on Technology and Adult Learning 2001

The growing size of the investment by education systems in ICT, and the mainstreaming of policy for ICT in education, has gone along with an increased interest in the educational and community outcomes from this investment. While research on the outcomes is still at an early stage of development, there is nevertheless a growing body of information and knowledge on the outcomes for students, institutions, systems and communities.

We comment on key aspects of these outcomes in terms of student achievement, impact on schools and teaching, and outcomes for communities, and point to an emerging international discussion of “transforming the way we learn”.

Outcomes for Student Achievement and Attitudes

Analysis of the outcomes of the role of ICT in schools has generally focussed on two main aspects: the impact on student achievement and on the attitudes and motivation of students towards learning, and hence their capability as lifelong learners.

In the context of the strong American effort to raise standards in school achievement, in particular in core science and mathematics subjects, the United States Department of Education has taken a close interest on the impact of ICT on student achievement. This is reflected in the Department’s 2000 National Educational Technology Plan which reflects, and builds on, the outcomes of the preceding National ICT Plan which was implemented over the period 1996-2000.

In the 2000 Plan, the Department summarised research findings on the impact of ICT on student achievement. The Department concluded that “studies have demonstrated that with technology student achievement increases, students can learn more in less time and undertake more ambitious school projects, and that students have a more positive attitude towards classes that use technology.”
The Department cited thirteen research studies undertaken during the period of the 1996-2000 National Plan which supported this conclusion. These studies included the following:

- a report on the use of technology in Illinois public schools which showed, when controlling for a school’s poverty level, a small but significant impact on student achievement.

- a study in Miami Dade County schools which showed that innovative programs were enhancing student learning;

- a study in West Virginia schools which showed significant gains in reading, writing, and mathematics with the technology program accounting for 11 per cent of the students’ improvements in the Stamford-9 from 1996-1998;

- a study on the impact of educational technology on student achievement in mathematics which showed that technology use by students was positively related to academic achievement, especially when used to teach higher-order thinking skills.

The other nine studies cited by the Department show similar outcomes. These are impressive.

The British Department for Education and Skills (DfES) and Becta are also carefully monitoring the impact of ICT in schools on student achievement. This research includes:

- a major three year longitudinal study (1999-2002), titled ImpaCT2 involving 60 schools in England which is directed at the question of whether the impact of networked technologies affects the educational attainment of students aged 8-16 years (http://www.becta.org.uk/Impact2);

- an investigation of linkages between ICT and attainment in the School of the Future reports (http://www.becta.org.uk);

- studies under the NGfL Pathfinders evaluation, which began in 1999, which centres on ten LEAs identified as having innovative ICT strategies.

The British approach emphasises the need for longitudinal studies to trace the impact of ICT on student achievement over time. While the final report on the longitudinal ImpaCT2 study will not be available until around the middle of 2002, emerging findings from the study provide useful insights into the impact of ICT on student achievement.

The emerging findings for the ImpaCT2 study show the widespread use of ICT across all school-age children, in particular at home, but with a continuing strong relationship between access to computers and socio-economic status. Examination pressures, and other organisational pressures, act as the barriers to innovative use of ICT in learning and teaching so that overall ICT is not being used to its full potential to transform learning and teachers need opportunities for reflective practice to embed innovation and change.
Other studies published by Becta showed that schools that were using ICT well had generally outperformed those that were not by achieving Government targets for achievement in English and Mathematics, and achieving better attainment in GCSEs in 1999.7

Useful insights also came from the four year study of ICT in education undertaken by the American CEO Forum on Education and Technology. The Forum concluded in its final report in 2001 that while the impact of technology in education was still in its infancy, “evidence indicates that educational technology changes the processes of teaching and learning. Technology transforms the learning environment so that it is student-centred, problem and project centred, collaborative, communicative, customised and productive.”8

The Forum asserted in its final report that technology should be focussed on the key building blocks of student achievement in “assessment, alignment, accountability, access, and analysis”.9 The Forum concluded from its study that the definition of student achievement needed to be broadened to include the 21st century skills that would be required for students to thrive in the future.10

There is evidence, noted by OECD, that ICT has particular value in fostering higher-order thinking and reasoning skills, although the emerging findings from the British ImpaCT2 study indicate that teachers often focus on basic rather than higher order thinking and reasoning skills.11

Overall, a mixed picture on educational outcomes emerges from the United States and Britain. The potential and power of ICT in education, when well applied, is demonstrated in the research cited by the US Department of Education, while the British and OECD studies point to the early stage of development in most institutions in reaching that potential with a range of barriers still to be overcome. However, new concepts of learning and teaching are emerging in best practice schools which are likely to have a profound influence in the longer term on the transformation of teaching and learning.

Impact on Schools and Teaching

While the research cited above provides useful insights into the impact of ICT on schools, teaching, and learning, a further source of particular value is to be found in a set of 93 case studies conducted in 23 countries by OECD over the period 1999-2001 under its three year program on ICT: School Innovation and the Quality of Learning.

The research and evaluation strand of this program attempted to make a systemic assessment of the impact of ICT on school innovation, and on teaching and learning. These issues were examined in the case studies which were hypothesis driven, focussing on critical issues related to:

- the relationship between ICT and school innovation and reform;
- how ICT diffusion takes place through a school;
- the variables that determine the implementation of ICT;
the impact of ICT on the quality of education, taking account of the digital divide.\textsuperscript{12}

Reports on the individual case studies are available on the OECD web site (http://www.oecd.org) while reports on the country case studies are available for some countries (including Britain, United States, and Australia) and an overview report on the program was produced by Venezky and Davis for OECD.\textsuperscript{13}

The case studies overall show that the impact of ICT on schools and teaching is complex with a wide range of variables influencing the implementation of ICT, and with cultural differences between countries significant.

OECD summed up some of the key findings from the case studies in the following terms:

- The adoption of ICT in schools follows the pattern of other educational innovations - without special interventions diffusion throughout a school will take a number of years;
- ICT by itself will not act as a catalyst for major change, rather it is the interaction of ICT with other key change influences that is critical;
- Teacher competence and motivation are crucial;
- Under-performing students can be helped by ICT to achieve higher levels.
- Each country needs to undertake its own comprehensive and ongoing program of research and evaluation into the impact of ICT on school innovation and on student learning.\textsuperscript{14}

The conclusion that the adoption of ICT in schools followed the pattern of other educational innovations was supported by most, although not all, case studies. In their analysis of this pattern, Venezky and Davis cited stage models of the diffusion of innovations in education including the model developed by Mandinach and Cline (1994) who identified four stages of diffusion: survival, mastery, impact, and innovation.\textsuperscript{15} These were seen to apply in the staged development towards a learner-centred classroom with Venezky and Davis concluding that few of the cases had reached the innovation stage, and only a few had reached the impact stage.\textsuperscript{16}

The positive impact of ICT for handicapped students was reported in a number of the case studies, and was noted by Venezky and Davis.\textsuperscript{17}

The complexity of this process of diffusion of ICT innovation was also observed by a team from the University of Minnesota and SRI International in their report on the American case studies.\textsuperscript{18} This team summed up the key factors that were critical to success in the following terms:

\textit{The systemic factors that appear in our cases to have been most critical to the success of the schools in the past were shared vision, strong leadership, shared with teachers, both private and public}
sector partnerships, professional development that is both institutionalised and extensive, quality technical and instructional support, a cultural climate supportive of the reforms, and a commitment to take advantage of relevant advances in technology.\textsuperscript{19}

In addition to these systemic factors, this report also noted personal factors which bear on successful outcomes.

The findings of the OECD case studies point to the need to consider the interaction of systemic factors in devising strategies to drive the successful implementation of ICT in education so as to achieve learning outcomes necessary for the Information Society. We comment on this question further in Chapter 11 which follows, in discussing the elements of innovation strategies observed in the countries studied.

**Impact on Communities**

OECD in its 2001 report on ICT in Schools noted that ICT had established a new complementarity between formal learning in schools and informal learning outside.

The critical relationship between home and school – that stimulate learning when they work well – became more important with the advent of ICT.\textsuperscript{20}

OECD concluded from its three year study of ICT in schooling that school, home and community have new opportunities for partnership.

\textit{ICT encourages – and ultimately requires – a rapprochment between formal education and the learning that takes place outside school.}\textsuperscript{21}

Not much is yet known about the ways in which this “rapprochment” and “new complementarity” between formal and informal learning is best achieved. Raising ICT skills in the community has been widely promoted through programs such as the British Online Centres and American Community Technology centres, but little is known about the impact of such programs on learning in schools.

OECD has recently completed a three year study of learning cities and regions which provides some insights in its analysis of relationships between individual learning, organisational learning, and community learning.\textsuperscript{22} This analysis of learning cities and regions as systems of innovation carries the implication that learning rapprochment occurs best where innovation takes place simultaneously in the community and its education institutions so that there is strengthened interaction between school, home, and community with ICT a key agent for change in each of these contexts.

There are few programs in the countries studied directed at each of these contexts in ways that heighten interaction and innovation. British “Wired-up Communities” and Canadian Smart Communities provide examples, but evaluation evidence is not yet available from these programs.
The Canadian Smart Communities program is an ambitious three year program with a budget of $60 million which is supporting community development initiatives using ICT as a catalyst in twelve communities across Canada. A number of the projects are in remote areas of Canada such as Newfoundland, Labrador, and Nova Scotia, in some cases in areas that are economically depressed with significant numbers of disadvantaged groups. The Smart Communities program is using ICT as a catalyst for the regeneration and revitalisation of these communities.

The Smart Labrador project typifies some of the key characteristics of this program. A population of about 30,000 people live in 32 isolated settlements across five distinct cultural and economic regions of Labrador. ICT is being used across broad areas of social, cultural, economic, and educational development with initiatives such as the promotion of e-commerce, further development of telehealth solutions including Labrador Health Online service, a virtual courtroom service, a Virtual Museum, and a Labrador Heritage Web site (http://www.smartlabrador.ca/).

The Smart Communities program will run for three years and will be evaluated in the third year. Evaluation of this program should provide valuable information on ways in which community oriented ICT programs can be linked to fostering reform in education systems through the role of ICT and the “new complementarities” noted by OECD between formal and informal learning (http://smartcommunities.ic.gc.ca/demoprojects/).

**Outcomes Overall: the Pace of Change**

While there are clearly innovative initiatives around the world in which the use of ICT has led to enhanced educational outcomes, there is substantial evidence of disappointment across OECD countries at the slow pace of change.

The Netherlands Ministry of Education, Culture and Science, in a recent review of policies for ICT in education in ICT League countries reported that “internationally there is concern about the relatively slow pace of change” while a European SchoolNet conference in March 2000 reached the following conclusion:

> We are facing a situation in which traditional methods of helping schools and teachers to adapt may not provide the changes needed... Increasingly, education risks being left on the runway as ICT fully takes off in homes and the wider consumer and business communities.

OECD in its report on e-learning in schools reached a similar conclusion as did the Federation of American Scientists in an international survey of ICT research and development. The Netherlands Ministry of Education, Culture and Science in its review of policies for ICT in education concluded:

> There seems consensus internationally that it is much harder to integrate ICT in education and to realise e-learning than was generally thought a couple of years ago. And there is a broad awareness that the developments need to be speeded up.
This situation has led the ICT League countries to conclude that the need exists to move forward to a third phase in policy making for ICT in education in order to accelerate the pace of change and to keep education in alignment with the sweeping changes occurring in work and in society.  

**Transforming the Way we Learn**

While we found considerable disappointment across the countries studied at the slow pace of change, a persistent theme was the desire to progress ahead so that ICT could truly become a catalyst to transform the way we learn, and to lead to a successful, cohesive, and just information society.

This vision of the future was present in the intention of Sweden to progress to a third and transformative phase in the role of ICT in education, in the vision of the American CEO Forum and the 2000 United States National Education Technology Plan, and in recent statements from Britain and Ontario on the transformation of learning.

The Swedish vision of a third phase in the role of ICT in education and society is discussed in Chapter 3 above. This is envisaged as not only involving a change in the role of ICT in schools, but beyond this the whole view of learning and the school as an institution. The philosophy of learning everywhere is seen as underpinning this new social vision with traditional school boundaries removed, and classrooms opened up to a richer world of learning experience for students.

There are similar visions of a transformative phase in the learning revolution in recent statements of strategic directions issued by Ontario and the British Government. As noted above, the ICT League countries have taken considerable interest in the third phase in policy making for ICT in education which will transform the way people learn.

The Ontario Knowledge Network for Learning in its June 2001 statement on Strategic Directions for ICT in Education set out a vision based on transforming the way we learn in the 21st century. This statement included a vision and guiding principles and goals for ICT in education set in a framework of providing lifelong learning opportunities for all. The principles enunciated included:

- students come first;
- technology is a tool to enhance lifelong learning, rather than an end in itself.

The British Government also took its policy development for ICT to a further stage of development in late 2001 when the Department for Education and Skills (DfES) released a vision paper on the future of ICT in schools titled *Transforming the Way We Learn*.  

The vision statement in this paper was based on a review of innovative practice and a consideration of emerging research and evaluation evidence, including the studies discussed above. The paper noted that while considerable progress had been made, schools were at various stages in adapting to the information age. There was therefore a need to keep looking ahead to ensure that the momentum continued.
Achieving Government goals for schools (including ICT goals) was seen as an ongoing revolution that would deliver new opportunities for schools and communities, including laying the foundations for effective lifelong learning.

Directions for future development included:

- new opportunities to personalise learning;
- new opportunities to nurture and express creativity;
- providing opportunities for students to gain key skills for the knowledge economy including
  - being able to apply knowledge in new and creative ways;
  - having high-level learning, thinking and reasoning skills such as conceptualisation and problem solving.

While digital literacy is seen as essential, the paper includes an interesting distinction between digital and visual literacy with visual literacy seen as including the effective interpretation and production of visual imagery.32

In personalising peoples’ programs of study, delivery will need to become increasingly flexible in order to accommodate a variety of teaching and learning styles in a number of locations. Emerging technology tools, such as Managed Learning Environment Systems (MLEs) were seen as useful aids to this objective.33

The statements discussed above articulate a view that the potential of ICT for education is so fundamental, that when realised it will change the way we learn, and in doing so will change education systems and their relation to society.

The implication that there is a need to “rethink the whole learning enterprise” was set out in a report of the Canadian Advisory Committee for Online Learning, a senior committee comprising Presidents and Vice Chancellors of Canadian universities, in a report for the Council of Ministers of Education Canada in the following terms:

The changes now underway have so many ramifications for education that they have created a need for rethinking the whole learning enterprise – both the respective roles for learners, instructors and institutions and their relationship to the society and the economy as a whole. If we are to succeed in a global knowledge-based society we must understand this new learning reality and our respective positions in it.34

**General Comment**

While the evidence to date of outcomes from the investment by governments in ICT in education is mixed, there is a clear commitment by a number of governments to a further stage of implementation which will transform the way we learn in a knowledge society. We take up in Chapter 11 the nature of the innovation strategies which are being used by leading governments to bring about this transformation.
NOTES

1  This was a joint initiative of the American Society for Training and Development and National Governors’ Association.
3  Ibid, p.21.
5  Ibid, pp.22-23.
6  Department for Education and Skills (UK) 2001c.
7  Department for Education and Skills (UK) 2001c, p.6.
8  CEO Forum 2001, p.5.
11  DfES 2001c, p.12.
12  Venezky and Davis 2001
13  Ibid, p.10
14  OECD 2001e, p.11
16  Ibid, p.21.
17  Ibid, p.23.
21  Ibid, p.17.
22  OECD 2001g.
23  See Appendix 3 for the ICT League countries
24  Netherlands Ministry of Education, Culture & Science 2002b, p.16.
25  OECD 2001b.
28  Netherlands Ministry of Education 2002a, p.16
29  Ibid, p.17.
31  Department for Education and Skills (UK) 2001a.
32  Ibid, p.10.
33  Ibid, p.11.
34  Advisory Committee for Online Learning 2001, p.18
11. **BUILDING AN INNOVATION SYSTEM AND CULTURE**

*Build a new research framework of how people learn in the Internet Age. We call upon the federal government to create a comprehensive research, development and innovation framework for learning technology.*

United States Web-based Education Commission, 2000

*A considerable gap separates the education technology now in use from the incredible potential offered by these technologies. To close this gap, education systems must continue to innovate.*

Federation of American Scientists, 2002

*The overarching issue is the need to accelerate the speed of pedagogical and institutional change – many aspects of our education systems need to be re-evaluated.*

Summit Declaration, European eLearning Summit, May 2001

Looking across the countries studied, two key directions for policy may be observed which interact, in varying balances, as countries progress towards their national objectives for the role of ICT in education and in society.

These key directions for policy are:

1. laying the foundations for the effective use of ICT in education;

2. devising and implementing innovation strategies to drive change to achieve national objectives in adapting to the conditions and imperatives of the information age.

There is much in common in the countries we studied in the foundation phase with a focus on hardware and infrastructure, professional development of teachers and laying the foundations for ICT skills for all, and ensuring that appropriate online content is available for institutions.

The United States 1996 National Education Technology Plan is typical of this foundation phase with the “four pillars” underpinning the plan seen as: hardware, connectivity, software, and professional development.¹

While these pillars of the ICT role in education are essential, they are not in themselves sufficient to bring about the desired transformation of education to fit the conditions and imperatives of the information age. As systems progress in achieving their “foundation” objectives, the policy focus shifts to the broader question of the necessary policies to bring about innovation and cultural change so as to transform the ways we learn in the information age. Cultural and other differences become significant in this stage.

Leaving aside the foundation “four pillar” policies, the directions for policy set out in Exhibit 11 appear important in action taken to foster innovation in adapting to the conditions of the information age.
Exhibit 11: Strategies to Foster Innovation in Extending the Role of ICT in Education and Society

1. Fostering vision and leadership.
2. Strengthening and focussing the research and development role and linking this more closely to policy and practice.
3. Building networks to stimulate the flow of new ideas.
4. Developing and promoting models of good practice.
5. Implementing whole-of-community strategies directed at cultural change and maximising interaction between formal and informal learning contexts.
6. Innovation in new forms of partnership.

Comment follows on these strategies.

1. Fostering Vision and Leadership

The most innovative countries studied place considerable emphasis on fostering a shared vision of the desired condition of the country in the information age. This aspect is particularly important in the countries where the focus of the vision is on a social vision of an information society with educational, economic, cultural, civic, and social aspects integrated in this vision.

This approach can be seen in Canada, the European Union, and the EU countries included in this study (Britain, Ireland, Sweden, Finland).

The focus on a vision of an information society brings with it in every case an emphasis on lifelong learning as the essential underpinning of an information society. This is reflected in the European social model endorsed by the EU at the Lisbon European Council.

The intention is to involve education and training players, as well as the relevant social, educational and economic players, in order to make lifelong learning the driving force behind a cohesive and inclusive society, within a competitive economy.


We believe that education is a lifelong learning process and that we must continue to strive to create a learning society in which the acquisition, renewal, and use of knowledge are cherished.

Canadian Council of Ministers of Education, Victoria Declaration 1999
Sweden is now moving towards the third phase. Here the role of ICT in schools is not only changing, but the whole view of learning and the school as an institution is changing. Learning is increasingly regarded as something for each and everyone throughout the course of their lives.

Minister for Education and Science, Sweden 2001

In linking the role of ICT with the aspiration to build a learning society with lifelong learning for all, it is also common in these statements to relate these aspirations to building a knowledge-based society. Finland is typical in this regard in the vision set out in Finland’s National ICT Strategy for 2000-2004.

Finland is progressing towards a knowledge-based society...
Finnsociety will develop and utilise the opportunities inherent in the information society to improve quality of life, knowledge, international competitiveness and interaction in an exemplary, versatile and sustainable way.

In some cases the vision of an information society with lifelong learning opportunities for all is given focus through a comprehensive whole-of-government program structure. The European Union’s e-Europe fulfils this role, as does the Canadian Government’s Connecting Canadians program.

This initiative consisting of six major programs and a large number of sub-programs, is built around the theme of connecting Canadians to each other and to the world, so that an articulated social vision underpins a broad spectrum of program action ranging across social, educational, civic, cultural, and economic domains. Initiatives, such as SchoolNet, Smart Communities, and the government commitment to all Canadian communities having access to broadband by 2005 fit easily into this framework and vision in an organic way.

Accompanying the role of a shared social vision to give impetus and coherence to a range of government initiatives, is a concern to promote leadership in various ways as a key driver of innovation. This essential ingredient of innovation is being promoted at various levels including community and school levels.

The Canadian Smart Communities program aims to foster local community leadership as a driver of community regeneration and revitalisation, as do British Learning Cities and Wired-up Communities, while both the European Union and Britain aim to strengthen leadership by the headmasters of schools. These initiatives are discussed in Chapter 4.

The key role of vision and leadership is likely to be clarified as evaluation evidence becomes available on innovative programs such as Smart Communities and Wired-up Communities, and from the growing number of case studies of innovation at the school level.

This shift in orientation and focus to fostering local leadership may be observed in the three phases of ICT policy development identified by Sweden, in some components of
the 2000 United States National Education Technology Plan, and in the broad spectrum of “joined-up” policies adopted in Britain.

The strategies adopted in Britain, Sweden, and Finland suggest that as countries progress towards comprehensive innovation strategies, their policies become increasingly systemic and holistic.

This characteristic appears to go along with, in the case of European Union countries, a convergence of policy for lifelong learning and for ICT education, as is happening in the European Union.4

OECD in a recent analysis of the distinguishing features of the lifelong learning approach, noted four key features:

1. it offers a systemic view of learning as a connected system covering the whole lifecycle and comprising all forms of formal and informal learning;
2. the centrality of the learner;
3. an emphasis on the motivation to learn;
4. it takes a balanced view of the multiple objectives of education policy relating to economic, social, cultural, and civic outcomes.5

ICT may be seen as a tool of each of these purposes, which are reflected in the policy directions adopted in countries such as Sweden, Finland, Canada, Ireland and Britain.

2. Strengthening and Focussing the Research and Development Role and Linking to Policy and Practice

The need to strengthen and focus the research and development role in supporting innovation and the transformation of learning is widely recognised in strategic planning and policy initiatives in the countries studied. This goes along with the theme that research should be linked more closely to policy and practice, and various strategies are being implemented to progress this objective.

Examples of the recognition of this need to strengthen research and development include:

- the United States 2000 Educational Technology Plan where this objective is one of the five goal areas of the Plan;
  
  Research and evaluation will improve the next generation of technology opportunities for teaching and learning.6

- the research policies implemented by the British Educational Communication and Technology Agency (Becta) and the Department for Education and Skills;

- policies in state jurisdictions such as Ontario where research and development is one of six goal areas.
• policies of the European Union associated with its e-Learning Action Plan.
• the conclusions of the Federation of American Scientists international survey of investment in ICT research and development.

A significant aspect of policy to strengthen the research role, is the aim to strengthen the linkages between research, policy, and practice in various ways. In the case of the European Union, this includes the goal of connecting all schools to research networks by the end of 2002. Becta is progressing this objective through the role of the Becta Research Network which is directed at interaction between researchers, policy makers, teachers, and industry through membership of the Network spanning all these audiences.7 The Network is directed at building up a community of researchers, policy makers, teachers, and employers for an ongoing dialogue to strengthen and focus the research role (http://www.becta.org.uk/research/).

The European Union is developing a European Research Area for New Learning Environments which will be directed at strengthening of educational, socio-economic and technological research in respect of e-learning in education and vocational training.8 This action will include the development of a “virtual centre of excellence” which will focus the research being undertaken on new models of learning environments.9

This research will explore:
• development of systems including studies on new learning environments and innovative applications in education and learning
  - educational methods, organisation (learning communities, regions and organisations) and management of change will be key aspects;
• virtual models, eg virtual campus, virtual mobility, and virtual networks;
• individual differences and special needs education in the new environment.10

The Federation of American Scientists in a survey of international investment in educational technology research and development concluded that EC activities in educational ICT research and development “are unique around the world for their combined scope, centralised and co-ordinated character, emphasis on tool-building, and clear commitment to communicate research findings.”11

The Federation also observed in its report that EC educational ICT research was “seamlessly incorporated” in the overall framework of EC research and development with close links to EC programs.12 The way these linkages are achieved is explored in some detail in the Federation report.

The United States 2000 National Education Technology Plan involves a systemic agenda for research on technology opportunities for teaching and learning, with priorities indicated to accompany what is seen in the Plan as an impending “revolution in teaching and learning”.13 This is seen as requiring a long-term national agenda for collecting, analysing and disseminating information on the use and effectiveness of technology in education.
Six priority areas for research are identified in the plan including basic research in various learning-related disciplines. There has already been an intensification of American research on how people learn, with a recent overview by the National Research Council providing a useful overview of research in this area including a chapter on technology to support learning.

Like the United States, Britain has also sought to develop a focussed long-term research agenda with both the Department for Education and Skills and Becta active in this area. Becta’s Corporate Plan for 2001-2004 identifies research priorities which are guiding Becta’s research activity. These include longitudinal studies on technology and student achievement with findings from the three year ImpaCT2 study, which is discussed in Chapter 10, due by the middle of 2002 (http://www.becta.org.uk/impact2). As noted above, Becta has given priority to fostering interaction between researchers, policy makers, and practitioners, and to the dissemination of research findings.

The priority being given to strengthening research is based on the recognition that the impending revolution in teaching and learning, in institutions and in society, should be guided by the best available research information, with policy more closely linked to research information than before and with effective dissemination of research findings to teachers and policy makers.

There is further discussion of research priorities in Appendix 2.

3. Building Networks to Encourage New Ideas

A third innovation strategy that we found across the countries, in varying degrees, was to actively foster the building and linking of networks to stimulate the generation and flow of new ideas. This strategy recognises that new ideas and creativity are fundamental to the success of a knowledge society and its economy.

This strategy is best seen in European Union countries where building networks that cross national frontiers has been a key policy of the EU. European SchoolNet and Neld@ys europe provide good examples of this strategy.

European SchoolNet operates as a European network of national networks with 19 countries linked to the network which has a secretariat and website in Brussels (http://www.eun.org).

SchoolNet aims to encourage co-operation between schools in Europe and the exchange of experience. A large number of SchoolNet initiatives support these objectives with programs like myEUROPE (http://myeurope.eun.org), the European Principals Online initiative, the Multimedia project, community space (http://community.eun.org), and the virtual magazine for teachers stimulating the exchange of ideas and experience.

National SchoolNet schemes also operate in EU member countries such as Sweden, and are also found in Canada and in some state jurisdictions such as Ohio.

The Canadian SchoolNet program shares many of the features of the European SchoolNet and has a similar focus on grassroots collaboration and partnerships. Canadian schools
dialogue and exchange ideas and experience across jurisdictional frontiers, and build partnerships that otherwise would not happen.

A recent evaluation of Canadian SchoolNet by KPMG concluded that the program had had a strong role in establishing connectivity between Canadian schools and libraries, and had done this in “an environment where jurisdictional sensitivity is of paramount concern.”

This has resulted in an interesting and important mix of partnerships between federal, provincial, organizational and private sectors that, given the constantly changing nature of knowledge and technology in the modern context, will require continual renewal into the future.17

While there are other initiatives, such as the EU Neld @ ys europe which build and link networks and so stimulate the flow of new ideas, there seems particular value in programs such as the various SchoolNets discussed above which encourage partnerships and collaboration between schools in a diverse range of situations.

The networks which result from these initiatives can be seen as learning communities (communities of practice) where ongoing learning from the experience of others is a stimulus to building a culture that encourages continuous innovation and improvement. Australia would benefit from encouraging further networks, not only across Australian institutions, but also linking to international networks so as to provide a continuing source of new ideas. This might be achieved through a strengthening of the education.au role.

The concept of building networks to give schools, students, and teachers a richer experience in learning in groups and in network situations is also very appropriate as a preparation for life in the knowledge society.

A report prepared for the 1998 World Conference on Higher Education suggested an imminent paradigm shift for education to a knowledge model through three successive models. This thesis is illustrated in the table below.18

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There is growing evidence that networks are one of the key building blocks of a knowledge society so that the richer the experience of students and teachers in learning through networks, the better will be the preparation for life in the knowledge society.
4. Developing and Promoting Models of Good Practice

A further strategy that is widely applied across the countries studied as a catalyst to innovation and change, is to develop and actively promote models of good practice as informal benchmarks for good practice in the information society.

This strategy is widely applied across these countries, in some cases with a focus on the role of ICT, while in other cases ICT becomes only one factor in broader reform strategies for schools. This model and exemplar strategy is most widely applied in the school sector, and we found less of its use in VET and higher education.

Examples of the good practice model strategy include:

- the initiative of European SchoolNet to build up a network of 5000 European innovative schools to act as a test-bed for the latest technologies and new learning strategies;
- the existing EU Insight program where case studies of 50 schools serve as models of good practice;
- the Smart School project in Malaysia whereby 90 Smart Schools are developed as exemplars of leading practice;
- the Irish Schools Integration Project where 361 pilot schools are involved in 71 classroom-based action-research projects;\(^\text{19}\)
- the OECD case studies of organisational change;\(^\text{20}\)
- the British Teachernet case studies.\(^\text{21}\)

In addition to case studies and models where the use of ICT is central, the growing number of case studies and exemplars of innovative schools often bring the use of ICT into models that involve other strategies as well. These innovative networks include the British Beacon schools, British Columbia Network of Innovative Schools, and the large number of American models of innovative schools.

The British Government plans to achieve a network of 400 Beacon Schools by 2005. In the case of the United States the wide range of models include New American High Schools and Charter Schools. A model of some interest was developed by the North Central Regional Education Laboratory. This was based on a systems approach to a high performance school system with six essential characteristics identified for effective technology use in schools.

The collections of case studies and models of good practice which have evolved in the countries studied have value in exposing the critical variables relating to effective implementation of ICT in education, and to building a culture in the education system that supports innovative and continuous improvement.

In addition to building up a database of exemplars of leading practice and generally supporting the frontrunners, a recent report prepared for the Netherlands Ministry of
Education, Culture and Science drew attention to the need for “innovative ways of disseminating new practice and expertise.”

Australia does not yet have comparable sets of case studies and models of good practice on a national basis, and much would be gained from developing a database of models such as is happening with European SchoolNet.

5. Implementing Whole-of-Community Strategies

A further innovation strategy that is being widely applied across the countries studied, is to implement whole-of-community strategies so that a learning culture is fostered in the whole community which stimulates and supports change in schools and colleges. ICT is often a key instrument in these broader whole-of-community strategies.

These community-oriented strategies involve the recognition that schools and colleges do not exist in a social vacuum, but rather are profoundly influenced by the values, attitudes and overall socio-economic context and culture of the community they serve. There is further a general recognition that the role of ICT provides new opportunities to strengthen relations between the school and home in innovative ways.

Examples of whole-of-community strategies include Canadian Smart Communities, British Wired-up Communities and Learning Cities, Learning Regions in various parts of Europe, and Community Regeneration Zones in America and Britain. While Australia has had several learning community projects these have not usually had up to now a particular focus on the role of ICT in these communities.

Like the school models and case studies discussed above, community-oriented strategies have the merit of exposing the critical variables that influence innovation and change. The Canadian Smart Communities program involves a $60 million program of support for 12 communities over a period of 3 years with evaluation of the program to occur in that third year.

Reporting on the projects already available reveals considerable innovation in the ways ICT is being used to regenerate and revitalise communities. In Smart Labrador, for example, the problems of distance are being addressed through initiatives such as a distance telehealth project, a Labrador Health Online service, a virtual courtroom service, a Virtual Museum and Virtual Museum Shop, and a Remote Community Services Telecentre. The education process is seen as central to all these initiatives. (http://www.smartcommunities.ic.gc/demoprojects/).

While the Smart Communities program have not yet been evaluated, various insights and lessons have already emerged from the program. A key outcome has been that the program encourages innovative forms of collaboration at the local level.

A key implication is that one cannot choose a single layer of government but rather learn to innovate and create new forms of multi-level processes – made much more feasible, and more necessary in a world of e-governance.”
As the local level becomes the crucible of innovation and learning, what role does the federal government play in promoting smart communities across the country. Clearly, top-down federal approaches to economic development are no longer feasible in an ever changing, dynamic global world, which requires a substantial degree of flexibility in order to constantly adapt.\textsuperscript{25}

As systems move to strategies to bring about the transformation of learning in the information society, it is probable that community-oriented strategies will become increasingly important as learning is embedded in the whole community and innovative partnerships become the vehicle to marshal community resources for learning. Sweden has already signalled such learning society objectives in the comments by the Minister for Education and Science on the third phase of ICT development in Sweden.

There is much to be learnt from innovative community-oriented programs such as the Canadian Smart Communities and British Wired-up Communities. It is also likely that learning community programs in Australia will progress towards innovative uses of ICT in building connected learning communities as it becomes recognised that the local level is increasingly “the crucible of innovation and learning in the information age.”

6. Innovation in Forms of Partnership

A feature of development across all countries has been the emergence of innovatory forms of partnership. ICT has been aptly termed by OECD the partnership challenge, and this recognition has driven much of the innovation we observed across the countries studied.

We discuss in Chapter 12 which follows a number of the main forms of innovatory partnership that we observed. These include:

- \textbf{cross sectoral collaboration} as in university and further education partnership under the British JANET scheme and the Digital California Project;

- \textbf{public/private partnership} as in the British University for Industry and National Grid for Learning, the Singapore edu.Quest, Australian IT Hub, and Irish Schools Integration project;

- \textbf{partnership in local and regional development} as in Canadian Smart Communities and British Wired-up Communities;

- \textbf{initiatives by groups of firms} as in the American CEO Forum and European e-Learning Summit.

- \textbf{collaboration between groups of universities and colleges} as in the development of the Swedish Internet University and in consortia such as JANET, CANARIE, Internet2, CENIC, and AARNet;
• **partnership between levels of government in federal systems** as in the Canadian Connecting Canadians programs (including SchoolNet and Smart Communities) and Australia ICT initiatives.

The cost and complexity of e-learning implementation makes partnership inevitable, but the growth of these forms of collaboration and partnership in education also mirrors the trend to partnership in the global economy, and is driven by similar reasons.

The growth of this spectrum of partnership initiatives is redefining roles and relationships and, viewed from the long-term perspective of educational change, can be seen as a force driving towards the third phase of policy for ICT in education.

This phenomenon can also be seen as a driver towards building a learning culture in society where learning occurs in many contexts with ICT an enabling tool. It follows that the richer the mix of partnership initiatives, the more likely the pace of change will be accelerated towards a full achievement of the potential benefits of ICT in education and learning, and the transformation of the way people learn in the information society.

**Some Examples of Innovations**

Examples of innovations in the use of ICT in education have been discussed throughout this report. A selected list of significant innovations is given in Exhibit 12.

**General Comment**

While all countries included in this study have implemented policies to lay the foundations for the role of ICT in education, it is probable that innovation systems and strategies will become increasingly important as countries aim to progress to the stage of transforming the way people learn in the information society.

There are already indications of key components in a systemic approach to innovation in the policies adopted across these countries. These components include the strategies discussed in this chapter: vision and leadership, strengthening research and development, building networks to stimulate the flow of new ideas, developing models of good practice, implementing whole of community strategies, and extending partnership arrangements.

The need for Australia to create a more innovative culture was highlighted at the National Innovation Summit held in Melbourne in February 2000. Developing and fostering innovative strategies for the use of ICT in education and the community could make a significant contribution to this national objective for Australia in the information age.
### Exhibit 12: Some Innovations in the Use of ICT in Education

1. **European SchoolNet**  
   A network of networks that fosters collaboration and the flow of new ideas across Europe.  
   [http://www.eun.org](http://www.eun.org)

2. **British National Grid for Learning**  
   The Government’s headline initiative for enhancing the use of ICT in schools.  
   [http://www.ngfl.gov.uk](http://www.ngfl.gov.uk)

3. **Digital California Project**  
   A partnership between California universities and government to provide broadband for schools.  
   [http://www.cde.ca.gov/edtech/edtech.html](http://www.cde.ca.gov/edtech/edtech.html)

4. **Canada’s SchoolNet**  
   Includes a range of initiatives to foster innovation and collaboration in the use of ICT in schools.  
   [http://www.schoolnet.ca/ln.rb/](http://www.schoolnet.ca/ln.rb/)

5. **Sweden’s Internet University**  
   Partnership between all Sweden’s universities and a new agency to extend higher education.  
   [http://www.netuniversity.se](http://www.netuniversity.se)

6. **Singapore’s edu.Quest**  
   Based on Singapore-Apple collaboration to provide exciting learning opportunities.  

7. **Sweden’s Interactive Institute**  
   Combines tools to foster creativity and learning with high level research.  
   [http://www.interactiveinstitute.se](http://www.interactiveinstitute.se)

8. **European Union’s Netdays europe**  
   An open platform to foster educational and cultural networking and international links.  

9. **Australian Learning Federation**  
   A collaborative Commonwealth/State initiative to provide quality online content for schools.  
   [http://www.soci.edu.au](http://www.soci.edu.au)

10. **Ufi (British University for Industry)**  
    An innovation to extend access to learning in many contexts with learndirect its main instrument.  
    [http://www.ufi ltd.co.uk](http://www.ufi ltd.co.uk)

11. **Becta Research Network**  
    A network that associates researchers, policy makers and practitioners.  
    [http://www.becta.org.uk/research/](http://www.becta.org.uk/research/)

12. **Finland’s Virtual University**  
    Collaboration between all Finland’s universities to offer online courses.  
    [http://www.minedu.fi/julkaisut/information/english.html](http://www.minedu.fi/julkaisut/information/english.html)
NOTES

3 This is discussed in Chapter 3.
4 See European Commission 2001a, 2001b.
5 OECD 2001c, p.11.
7 Becta 2002.
8 European Commission 2001b, p.9.
13 U.S. Department of Education 2000a, p.44.
14 Ibid, p.44.
16 This program is reached through the SchoolNet web site: http://www.eun.org.
17 KPMG 2000, p.i.
19 OECD 2001b, p.91. See http://www.nete.ie for access to these projects.
20 These are discussed in Chapter 10.
23 These include the ANTA National Learning Communities Project 2001 and the Victorian Learning Towns project.
25 Ibid.
12. TRANSFORMING THE WAY WE LEARN

*Technology necessitates a global viewpoint.*  
Becta, Corporate Plan for 2001-2005

*Sweden is now moving into the third phase. Here the role of ICT in schools is not only changing, but the whole view of learning and the school as an institution is also changing.*  
Minister for Education and Science Sweden, 2001

*These things are in the future; present tasks claim our care: the ordering of the future rests where it should rest.*  
Final chorus, Sophocles, Antigone

This overview of policy for ICT in education in a selection of leading countries has revealed a turbulent and dynamic situation of change as education systems everywhere attempt to keep pace with shifts in the socio-economic and technological environment of education.

The challenge of the emerging information society has led to a succession of phases in the evolution of policy for ICT in education as systems have progressed from an initial “rolling out” phase focussed around the four pillars discussed in this report, to a mainstreaming phase where policy for ICT has been integrated in strategic policy directions for education systems, while some systems now stand on a threshold of a third phase which will see a much more radical transformation of the way people learn in the information society.

The development of Swedish and United States policy for ICT in education illustrates these phases, while the current dialogue on the transformation of learning in the information society in systems such as Britain, Ontario, the Netherlands and Sweden foreshadows progression to this critical third phase.

The concept of three phases in the evolution of education policy for ICT is moreover supported by no less an observer than Bill Gates who has identified in a recent book three steps in the integration of PCs in the classroom:

- **Step 1**: Establish infrastructure and train teachers and pupils;
- **Step 2**: Use PCs to improve existing models of teaching and learning;
- **Step 3**: Use PCs to transform models of teaching and learning.¹

All countries studied in this project have progressed in this way, and are currently at various stages in the Gates Step 2 which we have termed phase two. We point out in Chapter 11 above, that ICT League countries are considering ways of progressing to the third phase in policy development.
While policy has progressed in these ways, the available research evidence points to practice in schools and colleges remaining a mix of the old and the new, with strong cultural barriers to change remaining to be addressed in most systems.

For this reason, a second key dimension in policy may be observed across most systems. This involves a progression from a foundation phase, in which the essential four pillars are laid, to a phase with a strong focus on strategies that bring about innovation and cultural change.

This phase, which is discussed in Chapter 11, involves using the tools of the information age in imaginative and creative ways to bring about a “grassroots revolution”.

A strong element in policy across the systems studied, is a progression from traditional top down policies to strategies that stimulate and energise local initiatives. This theme reflects the realities of the emerging global economy and society in which it is widely recognised that traditional top down policies no longer work.² The requirement is now for flexibility, nimbleness and responsiveness, partnership, enterprise, and creativity, with education policy searching to find ways to foster these attributes.

The strategies discussed in Chapter 11 reflect this search for ways of bringing about cultural change so as to transform the way people learn in the information age.

This requirement was expressed in a recent report prepared for the Netherlands Ministry of Education, Culture and Science in the following terms:

... policy is likely to concentrate more and more on promoting the use of ICT in learning and teaching from learn to use to use to learn. ICT will play a major role in educational innovation, opening possibilities for made to measure education for everybody.³

Fostering vision and leadership, strengthening research and development, building networks and models of good practice, and implementing whole-of-community strategies were common directions for policy in leading countries.

The Partnership Challenge

A further major theme emerging across all countries is the role of innovative forms of partnership in promoting desired change. OECD has aptly termed e-learning “the Partnership Challenge”.⁴

A feature across all countries has been the emergence of innovative forms of partnership including public/private partnership, partnership across the sectors of education, the emergence of a wide range of coalitions and alliances, and partnership across the levels of government.

Some of this partnership action has been stimulated by the necessity to develop educational markets for online content, while in other cases a recognised need for “joined up” policies has led to innovative alliances and partnerships in such areas as linking
education and community programs. Partnership action in the federal systems studied provides an area of particular interest to Australia.

Comment follows on some of these forms of partnership.

**Cross-sectoral collaboration**

ICT facilitates collaboration across the sectors of education and provides opportunities for new forms of partnership. As systems move towards the condition of a learning society, sectoral divisions in policy will become less pronounced and partnership in using all education resources more common.

Partnership across the education sectors was seen in policies to access bandwidth in affordable ways. Some examples are:

- **Britain** where further education colleges now access bandwidth along with universities through the JANET scheme and share membership of the Joint Information Systems Committee with universities.
- **California** where Californian universities in the CENIC consortium are working with schools to extend bandwidth to all California schools under the Digital California Project.

It is difficult not to conclude that sectoral boundaries seem sharper in Australia than in most countries studied with less cross-sectoral collaboration.

**Public/Private Partnerships**

This is a growing trend across all countries as the government role shifts in a number of key areas to that of facilitator with private enterprise as partner.

Some examples are:

- the British University for Industry (UfI) arrangements;
- development of the British National Grid for Learning;
- the Singapore edu.Quest program with government/Apple partnership;
- various projects in the Irish Schools Integration Project;
- the Australian IT Hub;
- the New South Wales Skilling People for an Information Society program.

Public/private partnership is likely to become even more significant in systems committed to transforming the way people learn and to building a learning society. Partnership in respect of workplace learning is a key area for development.
Partnership in Local and Regional Development

A third major area for partnership development is in the area of local and regional development which is an area of growing significance in the information society. Programs such as Canadian Smart Communities, British Wired-up Communities and Learning Cities are directed at encouraging collaboration and partnership in the regeneration and revitalisation of communities. Linking education policies for ICT with broader community strategies is a key aspect of these strategies which are reflected in such developments as community technology centres and the role of community technology strategies.

The Swedish vision of a third phase of policy for ICT driving the achievement of a learning society reflects this key area for partnership development. While there is a growing interest in community-oriented strategies across the OECD countries, not much research evidence is yet available and this area should be seen as a priority research area.\(^5\)

Partnership in Federal Systems

This is an area of special interest to Australia. Australia appears to be better placed than the United States and Canada in terms of machinery for Commonwealth/State collaboration in ICT because of the roles of its Ministerial Council (MCEETYA), the ICT in Education Committee of MCEETYA (AICTEC), and the national roles of the Australian National Training Authority (ANTA) and the Department for Education, Science, and Training (DEST).

On the other hand, Canada does not have federal education powers and there is no federal education department while federal/state collaborative programs is not a strong feature of the United States scene.

Canada, however, has managed to implement successfully national programs such as SchoonNet and Smart Communities which have combined a strong national flavour with local school and community initiatives, and substantial partnership development.

While both Canadian and Australian federal systems have been responsive to changing conditions in the information age, there is nevertheless an issue as to whether federal systems with fixed constitutional boundaries are sufficiently responsive to radical change in the information society, when compared with unitary systems.

On the one hand, there has been a rapid and continuous development of comprehensive policy for ICT in unitary systems such as Britain, Sweden, and Finland which is matched by the federal systems in some areas, but rather less in areas such as access and equity.

Britain, for example, has instituted a broad battery of “joined up” policies in addressing the Government’s vision of Britain as a just learning society which none of the federal systems match in terms of range and scope, while Sweden, Finland, and other Scandinavian countries have had a long pre-occupation with equity in a just society. The equity challenge in the information society is discussed below.
Large business corporations have faced a similar challenge in becoming more nimble and flexible in the globalised information society and have adjusted in ways summed up by Rosabeth Kanter in the phrase “When Giants Learn to Dance”. Whether federal systems can similarly learn to dance in the information age will be critical for their competitive futures.

The Equity Challenge

The question of federal systems in the information age is especially pertinent to the way they respond to the widely held objective that all citizens should have opportunities to benefit from the information economy/society.

This issue is given force by the existence of a learning and digital divide in society with large sections of the community having less access to the benefits of the information society because of inadequate learning, literacy, and digital skills, and consequently being disadvantaged in such areas as maintaining employability.

We found that all countries included in the study had recognised access and equity issues, and were addressing these with varying degrees of priority, and with a range of strategies. These included comprehensive “joined up” policies in the case of Britain, which included major initiatives such as UK Online and the University for Industry, and the range of initiatives adopted by Canada under its Connecting Canadians program. In these cases, policy reflected the conclusions of the Digital Opportunity Task Force of the G8 Heads of State that the digital divide could not be successfully addressed in isolation from the root causes of socio-economic inequality and exclusion, and that there was an urgent need for a multi-faceted and multi-layered effort by all stakeholders.

An initiative of particular interest in the context of the current review of Australian higher education was innovation in finding new ways of using the Internet to extend higher education opportunities to communities in remote locations. The new Swedish Internet University and Finland’s Virtual University are currently under development and aim to combine the potential of the Internet with partnership strategies in widening higher education opportunities.

Policy for Lifelong Learning and ICT

We found that in a number of countries there has been a convergence of policy for ICT and for lifelong learning, with ICT viewed as a tool to extend learning opportunities across society on a whole-of-life basis. This is the policy position adopted by Britain, Canada, Sweden, Finland, and by the European Union. It is also reflected in OECD work on ICT and lifelong learning.

While Australia does not have a comprehensive national policy for lifelong learning, policies and strategies are in place, or under development, in most Australian States and Territories. There is a question whether a comprehensive national policy in this area could support the action being taken by the States and Territories, and lead to value added outcomes. There is a good case for this question being examined in the context of the development of policy for ICT in education.
The Australian Situation Overall

Our conclusion is that Australia, like all countries included in this review, is still in a transitional situation involving the need to complete the foundations for effective use of ICT in education. We have termed this Phase 2.

At the same time, an increasing number of leading countries are looking ahead to the so called third phase in policy for ICT in education which will see a more fundamental transformation in the way people learn in the information society, and a more complete realisation of the benefits of ICT for education and learning in many contexts.

The Netherlands, like the other countries in the ICT League, is one of these, and a recent report on Dutch progress in the use of ICT compared to a group of other countries, concluded that although the Netherlands was still in a (Phase 2) transitional situation, it was nevertheless necessary to look ahead to the more innovative third phase in which pedagogical strategies to exploit the full educational potential of ICT will be implemented widely, and there will be a transformation in the way people learn. The comparison report prepared for the ICT League provides an assessment of where companion ICT League countries stand and identified subjects for collaboration between League countries in progressing to the third phase of policy making.

While Australian systems, like other countries, need to complete the foundations phase, much could also be gained by a collaborative examination, involving both Australian education systems and links to international developments, of ways to progress policy for ICT in education to speed up the pace of change leading to the transformative third phase in which the full potential of the educational and learning role of ICT is realised for the benefit of Australian society and Australia’s economic performance.

This is likely to require a greater emphasis on strategies to promote innovation and cultural change along the lines of those discussed in Chapter 11, and with a significant research effort focussed on how people learn in the information age in a range of contexts.

Criteria for Leading Practice

We have been asked by the Department for Education, Science and Training to identify criteria for leading practice from this overview of policy in ten countries and three international agencies. While this overview reveals considerable diversity between countries in the range and mix of policies adopted, reflecting cultural and other differences, there are certain common characteristics of leading practice which are present in varying degrees in most, but not all, of the countries and international agencies studied. These characteristics are set out in Exhibit 13 which is based on the analysis of this report.

These criteria apply best to policy in the European Union countries, but are also found in the policies adopted in Canada. While they may be regarded as fitting a European model of policy for ICT in education, the application of these criteria in Canadian policy suggests that they could have a more general application in countries committed to building a cohesive, just, and competitive Information Society.
This “European” model is found in its most developed form in the Nordic countries where it builds on policies implemented over many years to build a learning society. This observation aligns with the conclusion of OECD from a recent analysis of where Member countries stand in supplementing lifelong learning that “the Nordic countries stand out with good performance across multiple sectors”.

However, Britain is currently implementing a broad spectrum of multi-faceted “joined up” policies and programs designed to modernise Britain and to catch up to leading international practice. Ireland is also playing catch up with ICT and education policies to match its success with globalisation policies.

A central feature of the European model is the convergence of policy for lifelong learning and for ICT in education so that ICT is seen as a key instrument for building a cohesive, competitive, and just Information Society underpinned by the aspiration of lifelong learning for all. This convergence is reflected in European Union policies for lifelong learning and ICT, and underpins the new generation of EU education programs such as Socrates and Minerva.

**Questions for Australian Policy Makers**

This overview of international developments in policy for ICT in education points to a range of innovations and directions for policy that could be relevant to the further development of Australian policy for ICT in education towards the broad objective of transforming the way we learn in the information age.

There are grounds for believing that any set of criteria for leading practice in policy for ICT in education represents a shifting target. As strategic plans are designed and implemented to incorporate leading practice objectives, socio-economic and technological shifts change the nature and rules of the game so that policy and strategy must continue to be re-focussed on the emerging imperatives of the dynamic information society and its economy. The implications of this situation for Australia warrant careful consideration.

In order to focus these options for discussion, I conclude this report with a series of questions in key areas of development that appear to emerge from the analysis of the report.
Exhibit 13: Criteria for Leading Practice in Policy for ICT in Education

1. **Vision and leadership**  
   There is a clearly articulated vision which encompasses social and economic objectives while leadership is actively fostered through training, network building, and in other ways.

2. **Strategic planning**  
   Strategic planning is used to connect policies and to give coherence and progression to policy directions.

3. **Lifelong learning**  
   Lifelong learning for all is seen as an essential underpinning of a competitive, cohesive, and just information society.

4. **Monitoring progress**  
   Indicators and targets are set with ongoing monitoring of progress.

5. **Foundations**  
   Policies directed at professional development of teachers, infrastructure, and online content have laid the foundations for effective use of ICT in education.

6. **Digital literacy**  
   There are active strategies in place to foster digital literacy for all students. This is broadly defined to include essential 21st century generic skills (including higher order thinking and reasoning skills) which can be furthered through the effective use of ICT.

7. **Bandwidth**  
   There is a strategic approach to providing affordable bandwidth for all education institutions which may link to broader national strategies for providing broadband access for all communities, or local and regional strategies, or discrete education strategies.

8. **Access and equity**  
   There is a comprehensive and co-ordinated approach to the national objective of providing access to the benefits of the information society for all citizens including a strategic approach to addressing the learning and digital divide in society through a co-ordinated multi-faceted and multi-level approach.

9. **Innovation strategy**  
   An innovation strategy is in place to foster innovative and creative applications of ICT in education and to drive cultural change in responding to the conditions and opportunities of the information and knowledge society.
### Exhibit 13: Criteria for Leading Practice in Policy for ICT in Education Cont’d.

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<th>Research and development</th>
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<tr>
<td>10.</td>
<td><strong>Research and development</strong></td>
<td>R&amp;D has been strengthened and focussed on key priorities in a national research agenda to support the transition of education to the conditions of the information society with action taken to foster dissemination of findings and to maximise interaction between policy, research, and practice.</td>
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<td>11.</td>
<td><strong>Network building</strong></td>
<td>Networks have been actively built up across the country and with other countries through programs such as SchoolNet to foster the generation and flow of new ideas and to support innovation and cultural change. Networks function as learning communities of practice.</td>
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<td>12.</td>
<td><strong>Models and exemplars</strong></td>
<td>A bank of models and exemplars of good practice has been built up through case studies to benchmark good practice which are accessible to all through an appropriate web site.</td>
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<td>13.</td>
<td><strong>Community strategies</strong></td>
<td>Synergies have been established between education focussed and whole-of-community strategies, such as the Canadian Smart Communities, so that education change is supported and encouraged by community-oriented programs directed at complementary objectives.</td>
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<td>14.</td>
<td><strong>Transforming learning</strong></td>
<td>An active dialogue has been promoted in the community on ways of transforming learning in many social contexts using the power of ICT so that broad community support is engendered for the vision of an information and learning society with complementary action taken by the full range of stakeholders in a broad spectrum of partnerships.</td>
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<td>15.</td>
<td><strong>Partnership</strong></td>
<td>There is an active development of partnership initiatives with all stakeholders involved. The range of partnerships includes innovation in public/private partnership action.</td>
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### 1. Social Vision and Lifelong Learning

Policy in the majority of countries and international organisations included in this study has been driven by a vision of an Information Society underpinned by the aspiration of lifelong learning for all. While most States and Territories are developing policies for lifelong learning, there is no comprehensive national vision and policy for lifelong learning or for a vision of Australia as an information society.

**Question 1:** Is the absence of a national vision for Australia as an Information Society, underpinned by lifelong learning for all, an impediment to realising the full potential of the role of ICT in education and in Australian society?
Some Models: Canada, Britain, European Union, Sweden, Finland.

2. Providing Affordable Bandwidth

Affordable bandwidth continues to be a problem for many Australian schools and VET institutions. This remains a barrier to realising the full potential of ICT in education and in Australian society. Models exist in the countries studied of national policies to extend broadband to all communities and their schools in countries such as Sweden, Canada, and Britain, while the innovative Digital California Project illustrates cross-sectoral collaboration to benefit schools.

Question 2: Is there a need for a national strategy to extend affordable bandwidth to all Australian communities and their schools and colleges. Alternatively, should the focus be on a national education strategy to meet other objectives?

Some Models: Sweden, California Digital Project, Britain, Canada.

3. Innovation Strategy for ICT in Education

Australian policy to date has mainly been focussed on laying the foundations for the role of ICT in education and there has not yet been a transformation of teaching and learning in most schools and colleges. Examples of innovation strategies adopted in the countries studied to drive a grassroots revolution are given in Chapter 11. The relevance of these strategies to Australia merits consideration.

Question 3: Should Australian policy for ICT in education give more priority to innovation strategies to drive cultural change in education systems and to stimulate a grassroots revolution in practice?

Some Models: European SchoolNet, Canadian SchoolNet, Becta Research Network, European Union case studies of innovative schools, EU Neld @ ys europe, Singapore’s edu.Quest.

4. Equity and the Digital and Learning Divide in Society

All countries studied have sought to promote equity in access to the benefits of the information society, and to address the learning and digital divide in society. The Nordic countries have made most progress while Britain has a comprehensive battery of “joined up” policies in place now to accelerate progress towards the Government’s vision. Australia has a mediocre performance on OECD indicators and there is a significant proportion of the adult population beyond the digital and learning divide.12

Question 4: Should Australia develop a comprehensive national policy and strategy to address the learning and digital divide in Australian society which links the action of Commonwealth, State and Territory Governments, and local communities?
Some Models: The range of British policies (Online Centres, University for Industry and Learndirect, National Grid for Learning, Wired-up Communities, Learning and Skill Councils etc), Canada’s Connecting Canadians program, Sweden’s Internet University, Finland’s Virtual University and Virtual School.

5. Strengthen Research and Development

All countries studied have sought to focus and strengthen research and development to guide policy and practice in the transition to the Information and Learning Society. Australian R&D in ICT in education and society remains relatively weak and fragmented across sectoral agencies (ACER, NCVER, ANTA etc). How to strengthen the research and development effort, focus on national priorities, and improve interaction between research, policy and practice is widely seen as a key issue.

Question 5: In what ways could Australian research and development on the use of ICT in education and learning be focussed on identified key priorities and strengthened, with improved interaction between research, policy, and practice?


6. Building Networks for the Flow of New Ideas

A common innovation strategy across the countries studied was to build and link networks to stimulate the generation and flow of new ideas as catalysts to innovation. Programs such as the European, Swedish, and Canadian SchoolNet serve this purpose with common interest networks forged as learning communities (communities of practice) that flow across national and provincial boundaries. Stimulating grassroots interaction can foster creativity and innovation and generate new knowledge.

Question 6: Should steps be taken to build and extend network of practitioners and others on a national basis to foster innovation and the generation and exchange of new ideas in the use of ICT in education, and to contribute to building an innovation and learning culture in Australia?

Some Models: European SchoolNet, Canadian SchoolNet, Eu Neld @ ys europe, European Principals Online initiative, ENIS (European Network of Innovative Schools).

7. Building a Bank of Case Studies and Models of Good Practice

A further common innovation strategy found across most countries was to build up a bank of case studies and models of good practice. Examples include the program of European
SchoolNet to build up a database of 5,000 case studies, the existing network of 50 Insight schools across 19 countries, the OECD case studies of organisational change, and case studies under the Irish Schools Integration Project. An option is to follow the European SchoolNet model of building up a database of innovative case studies across the States and Territories which could be accessed from a web site such as EdNA Online.

Question 7: Should a national bank of innovative case studies in the use of ICT in education be built up covering all States and Territories with access through a website such as EdNA Online?

Some Models: European SchoolNet program to build up a database of 5,000 case studies, EU Impact Schools, OECD case studies of organizational change in schools, Irish Schools Integration Project case studies.

8. Linking Education and Community Strategies for the Role of ICT

There is a growing interest in whole-of-community strategies across the countries studied which seek to build synergies between policies for ICT in education and broader community strategies directed at innovation and cultural change. These strategies foster collaboration and partnership building in more holistic approaches. Examples include Canadian Smart Communities, British Wired-up Communities and Learning Cities, and OECD Learning Cities and Regions project. Strategies such as strengthening school and family relationships are often used. Australia has some current Learning Community initiatives but these have not usually to date given priority to the role of ICT.

Question 8: Should a stimulus be given to the role of ICT in whole-of-community strategies which link community building approaches with initiatives to strengthen the role of ICT in education? How can this be done?

Some Models: Canadian Smart Communities, British Wired-up Communities and Learning Cities, OECD Learning Cities and Regions project.

9. Innovation in Partnership Action

A feature of development in leading countries has been innovation in new forms of public and private and cross-sectoral partnership in promoting the role of ICT in education. In some cases business groups have taken national and international initiatives as in the American CEO Forum and the European e-Learning Summit. While business groups have been active partners in some States and Territories, this has been less the case so far at the national level.

Question 9: Should action be taken to stimulate innovative forms of partnership in promoting the role of ICT in education, including innovation in public and private partnerships and cross-sectoral partnerships?

Final Observations

Education policy in respect of ICT is confronted by a number of sharp dilemmas in responding to the dynamic and turbulent environment of the globalised information society in which several revolutions are converging to present both opportunity and challenge. The convergence of the learning revolution emerging from this environment and the technology revolution opens opportunities for creative responses.

The aspiration that technology will transform the way we learn has not yet been realised in any of the countries studied, although some have progressed to the threshold of this vision. While the information society requires that traditional education values should be reasserted, it also requires shifts in the way individuals, organisations, and communities learn in order to meet the conditions, imperatives, and opportunities of the globalised information society.

The pace of change in both technology and policy means that there is considerable interest in exchange of experience between countries, in particular between the countries of the European Union. Although education.au limited has done much to build linkages to counterparts in other countries, Australia continues to be less connected to these international networks and exchanges, so that there would be substantial value for Australian education if arrangements were put in place for the systematic up-dating and dissemination of information on international developments in this field. While the policy database accessed through EdNA Online could be used for this purpose, there would also be substantial value in a short report on key developments during the year being made available annually for all interested parties.

A feature of recent years has been the strengthening of the exchange of information and experience between countries, both through the work of international agencies and through informal networks. Appendix 3 provides an overview of some of these agencies and networks which include the ICT League which links the Nordic countries, Canada, and the Netherlands. The growing role of ICT in education provides an opportunity to further the internationalisation of Australian education, in particular in the school and VET sectors, and much could be gained from Australian participation in networks such as the ICT League.

As Becta rightly observes, technology necessitates a global viewpoint, and it is important that global, national, state and territory, and local perspectives are all brought into focus, in ever shifting balances, in the ongoing development of policy for ICT in education and training, for the benefit of Australian society.
NOTES

2  See Lester Thurow 1999, pp.49-81.
4  OECD 2001a.
5  An exception exists in the OECD report on its three year study of learning cities and regions: OECD 2001g.
6  Kanter R 1989.
7  This objective is common in national policy statements in countries such as Australia, Canada, Britain, Sweden, and Finland.
8  See Appendix 3 for a discussion of the ICT League.
9  Netherlands Ministry of Education 2002b.
12  OECD in its Education Policy Analysis 2001 provides a stocktake of Member country progress in implementing policies for lifelong learning and attempts an overall systemic assessment (OECD 2001c, pp.65-67). Australia is placed in the third tier of four tiers and is shown as no better than average on such indicators as adult literacy. In the Australian report we cite assessments by New South Wales and Western Australia of the significant proportion of adult Australians beyond the digital divide who lack basic computer and Internet skills.
References

Advisory Committee for Online Learning (Canada) 2001, The e-learning e-volution in Colleges and Universities, Industry Canada, Ottawa.


Becta (British Educational Communications & Technology Agency) 2001, Becta Corporate Plan, 2001-2004, Coventry.


DETYA (Department of Education, Training and Youth Affairs) 2000, Learning for the Knowledge Society: An education and training action plan for the information economy, Canberra.


a The references given below are mainly to print materials and are supplemented by the web sites given throughout the report.


EUN Briefing for National Policy Makers 2001a, Sweden, EUN, Brussels.
- 2001b, United Kingdom, EUN, Brussels.

- 2001a, Making a European Area of Lifelong Learning a Reality, Brussels.
- 2001c, ICT @ Europe.edu: Survey 4 (Eurydice), Brussels.


European e-Learning Summit 2001, Summit Declaration, Brussels.


Further Education Funding Council 1999, ILT Implementation Plan (99/45).


Human Resources Development Canada and Associates 2001, Educators as Adult Learners Project: Project Summary, Ottawa.


Kearns, P & Grant, J 2002, The Enabling Pillars, DEST, Canberra.


National Centre for Education Technology (Ireland) 2000, Schools Integration Project, Dublin.


NATSEM (National Centre for Social & Economic Modelling) 2000, Socio-demographic Barriers to Utilisation and Participation in Telecommunication Services, NATSEM, Canberra.


OECD (Organisation for Economic Co-operation and Development)


Queensland Department of Communication and Information, Local Government, Planning and Sport 2000, IT2T Skills in the Smart State, Queensland Government, Brisbane.

Roy J 2001, Rethinking Communities: Aligning Technology and Governance, IT World Canada, Ottawa.


UKERNA 2000, UKERNA Objectives and Memorandum of Association (http://www.ukerna.ac.uk/objectives).


- 1999b, Professional Development and the Integration of Information and Communication Technologies in Teaching and Learning USA, Washington.


### Appendix 1

**Key Web Sites in relation to Policies and Programs for ICT in Education**

#### Australia

<table>
<thead>
<tr>
<th>Service</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>EdNA Australia*</td>
<td><a href="http://www.edna.edu.au">http://www.edna.edu.au</a></td>
</tr>
<tr>
<td>Australian Information and Communications Technology in Education Committee</td>
<td><a href="http://www.aictec.edu.au">http://www.aictec.edu.au</a></td>
</tr>
</tbody>
</table>

#### Britain

<table>
<thead>
<tr>
<th>Service</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department for Education and Skills</td>
<td><a href="http://www.dfes.gov.uk">http://www.dfes.gov.uk</a></td>
</tr>
<tr>
<td>British Educational Communications and Technology Agency (Becta)</td>
<td><a href="http://www.becta.org.uk">http://www.becta.org.uk</a></td>
</tr>
<tr>
<td>National Grid for Learning</td>
<td><a href="http://www.ngfl.gov.uk">http://www.ngfl.gov.uk</a></td>
</tr>
<tr>
<td>Ufi (University for Industry)</td>
<td><a href="http://www.ufiltd.co.uk">http://www.ufiltd.co.uk</a></td>
</tr>
<tr>
<td>Teachers Training Agency</td>
<td><a href="http://www.canteach.gov.uk">http://www.canteach.gov.uk</a></td>
</tr>
</tbody>
</table>

* Websites for the Australian states and territories can be reached through EdNA Online.
Canada

Connecting Canadians  http://www.connect.gc.ca
Canada’s Schoolnet  http://www.schoolnet.ca
- Schoolnet’s Grassroots Program  http://www.schoolnet.ca/grassroots
CANARIE  http://www.canarie.ca
LibraryNet  http://www.schoolnet.ca/ln.rb/
Smart Communities  http://www.smartcommunities.ie.gc.ca
education @ canada (CMEC)  http://www.educationcanada.cmem.ca
Can Connect  http://www.canconnect.ic.gc.ca

British Columbia

British Columbia Education Department  http://www.beed.gov.bc.ca
Provincial Learning Network (PLNet)  http://www.beed.gov.bc.ca/technology/o_pln.htm

Ontario

I&IT Infrastructure Services  http://www.cio.gov.on.ca/scripts/index_asp
Strategic Directions for ICT in Education  http://oknl.edu.gov.on.ca/eng.pdf

Quebec

Quebec Ministry of Education  http://www.meq.gouv.qc.ca
### European Union

<table>
<thead>
<tr>
<th>Program</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>European SchoolNet</td>
<td><a href="http://www.eun.org">http://www.eun.org</a></td>
</tr>
<tr>
<td>CEDEFOP</td>
<td><a href="http://www.cedefop.eu.int">http://www.cedefop.eu.int</a></td>
</tr>
<tr>
<td>Electronic Training Village</td>
<td><a href="http://www2.trainingvillage.gr/etv/publication">http://www2.trainingvillage.gr/etv/publication</a></td>
</tr>
</tbody>
</table>

### Finland

<table>
<thead>
<tr>
<th>Program</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Education</td>
<td><a href="http://www.minedu.fi">http://www.minedu.fi</a></td>
</tr>
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</table>

### Ireland

<table>
<thead>
<tr>
<th>Program</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Education and Science</td>
<td><a href="http://www.irlgov.ie/educ">http://www.irlgov.ie/educ</a></td>
</tr>
<tr>
<td>National Centre for Technology in Education</td>
<td><a href="http://www.ncte.ie">http://www.ncte.ie</a></td>
</tr>
<tr>
<td>ScoilNet</td>
<td><a href="http://www.scoilnet.ie/">http://www.scoilnet.ie/</a></td>
</tr>
</tbody>
</table>
Benchmarking Ireland as an Information Society

Malaysia

Framework for Industry Development 2001-2005
Multimedia Super Corridor
Smart School

New Zealand

ICT Strategy for Schools 2002-2004
Online Learning Centre
ICT in New Zealand Schools 1993-2001

OECD

OECD
Ceri Program on ICT and the Quality of Learning
OECD Case Studies on ICT and Organisational Change

Singapore

Ministry of Education
Masterplan for IT in Education
edu-Quest

Sweden

National Action Plan for ICT in Schools (IT IS)
<table>
<thead>
<tr>
<th>Organization</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Swedish ICT Commission</td>
<td><a href="http://www.itkommissionen.se">http://www.itkommissionen.se</a></td>
</tr>
<tr>
<td>Swedish Agency for Flexible Learning</td>
<td><a href="http://www.ssv.se">http://www.ssv.se</a></td>
</tr>
<tr>
<td>National Agency for Higher Education</td>
<td><a href="http://www.hsv/se">http://www.hsv/se</a></td>
</tr>
<tr>
<td><strong>United States of America</strong></td>
<td></td>
</tr>
<tr>
<td>Department of Education</td>
<td><a href="http://www.ed.gov">http://www.ed.gov</a></td>
</tr>
<tr>
<td>Technology Literacy Challenge Fund</td>
<td><a href="http://www.ed.gov/technology/">http://www.ed.gov/technology/</a></td>
</tr>
<tr>
<td>Community Technology Centres</td>
<td><a href="http://www.ed.gov/offices/OVAE/CTC">http://www.ed.gov/offices/OVAE/CTC</a></td>
</tr>
<tr>
<td>Internet2</td>
<td><a href="http://www.i2x.org">http://www.i2x.org</a></td>
</tr>
<tr>
<td>Natural Telecommunication and Information Administration (NTIA)</td>
<td><a href="http://www.ntia.doc.gov/ntiahome/">http://www.ntia.doc.gov/ntiahome/</a></td>
</tr>
<tr>
<td>CEO Forum on Education and Technology</td>
<td><a href="http://www.ceoforum.org/">http://www.ceoforum.org/</a></td>
</tr>
<tr>
<td>Consortium for School Networking (COSN)</td>
<td><a href="http://www.cosn.org">http://www.cosn.org</a></td>
</tr>
<tr>
<td>E-rate</td>
<td><a href="http://www.slcfund.org">http://www.slcfund.org</a></td>
</tr>
<tr>
<td>Benton Foundation</td>
<td><a href="http://www.benton.org">http://www.benton.org</a></td>
</tr>
<tr>
<td><strong>California</strong></td>
<td></td>
</tr>
<tr>
<td>Californian Department of Education</td>
<td><a href="http://www.cde.ca.gov/">http://www.cde.ca.gov/</a></td>
</tr>
<tr>
<td>Office of Educational Technology</td>
<td><a href="http://www.cde.ca.gov/edtech">http://www.cde.ca.gov/edtech</a></td>
</tr>
<tr>
<td>Digital Californian Project</td>
<td><a href="http://www.cde.ca.gov/edtech/dcp.htm">http://www.cde.ca.gov/edtech/dcp.htm</a></td>
</tr>
<tr>
<td>Californian Commission on Technology in Education</td>
<td><a href="http://www.cde.ca.gov/ctl/index/htm">http://www.cde.ca.gov/ctl/index/htm</a></td>
</tr>
<tr>
<td><strong>Ohio</strong></td>
<td></td>
</tr>
<tr>
<td>Ohio SchoolNet Commission</td>
<td><a href="http://www.osn.state.oh.us">http://www.osn.state.oh.us</a></td>
</tr>
</tbody>
</table>
ONEnet Ohio
Technology and Learning Centres
e Clearninghouse

Texas

Texas Long Range Plan for Technology 1996-2010
Texas Technology Allotment
T-Star
Technology Review Centres and Training Programs

http://www.osn.state.oh.us
http://www.osn.state.oh.us
http://www.imrc.osn.state.oh.us

http://www.tea.texas.gov
http://www.tea.state.tx.us
http://www.tea.state.tx.us/technology
http://www.tea.state.tx.us/technology
Research Priorities

We found very general recognition across the countries studied of the need to strengthen research and development in aiding policy and practice in the evolving ICT role in education, and to focus the research effort on key priorities. A further important theme across countries was the need to achieve a better interaction between research, policy, and practice as an ongoing dialogue.

In this context, we have set out below an overview of research priorities in some of the key documents in the United States, Britain, Ontario, and European Union as a basis for discussion of research priorities for Australia to accompany policy for ICT in education.

United States National Education Technology Plan 2000

The American December 2000 National Education Technology Plan identified research as one of the five key goal areas under the Plan. This was stated in the following terms:

"Goal 4: Research and evaluation will improve the next generation of technology applications for teaching and learning."

In recognising the need for a long-term national agenda for collecting, analysing and disseminating information on the use and effectiveness of technology in education, the Plan proposed a number of priorities, and argued for the implementation of a national research agenda with sustained, multi-disciplinary collaboration between learning scientists, technologists, and subject-matter experts.

The priorities identified were:

1. Basic research on various learning-related disciplines and fundamental work on various educationally relevant technologies.

2. Early-stage research to improve the state-of-the-art in educational hardware and software, digital content, networked applications, and other technology-enabled applications of pedagogy and assessment.

3. Empirical studies – conducted in schools and classrooms – designed to determine which approaches to the use of technology are most effective and under which conditions with which students.

4. Evaluations of federal, state and local programs with a substantial technology component to gather the necessary information to adjust their operation so that they better meet intended purposes.

5. Descriptive studies of the availability and use of technology in classrooms, schools and communities to allow the nation to continue to track progress in integrating technology into education.
6. International comparative studies to benefit from innovations in using technology in education occurring elsewhere in the world.¹

These priorities involve basic and applied research and development. A survey by the Federation of American Scientists, funded by the Spencer Foundation, showed that most Department of Education ICT research and development involved development initiatives (98%) with a small amount of applied research (2%) and no basic research. However, where funding by other government agencies (especially Department of Defence) and foundations is taken into account, the largest category of funding is for applied research, with significant funding of basic research as well as development ($84.97m, $46.50m, and $68.4m respectively)²

**European Union**

The European Commission identified three research priorities in its e-learning Action Plan for 2001-2004 with these three areas to be explored in detail with a focus on new models and learning environments. The three priority areas are:

1. **Development of systems**
   Research into, testing of, and forward studies on new learning environments, from the educational and technological viewpoints. Special attention will be devoted to using emerging technologies for the development of innovative applications for education and training. Education methods, organisation (learning communities, regions, and organisations) and management of change are essential aspects.

2. **Virtual models**
   The concept of virtual campus, new prospects for European universities, virtual mobility, and virtual networks.

3. **Individual differences and special needs**
   Taking account of individual differences and special needs.³

We have noted in Chapter 11 above, the conclusion of the Federation of American Scientists survey of international investment in educational ICT research and development, that the European Commission was unique in its co-ordination of research, tool building, and communication of research findings, and the way educational ICT research was “seamlessly incorporated” in the overall framework of EC Research and development.⁴

**Becta (British Educational Communications and Technology Agency)**

The Becta research strategy involves a focus on the following key themes:

- ICT and effective pedagogy;
- The ‘data-rich’ institution;
- Managed learning environments;
- Home-school links;
• Portable technologies;
• The digital divide.\textsuperscript{5}

A feature of the research funded by Becta and the Department for Education and Skills over the past four years has been the funding of a number of long-term research projects including several major longitudinal studies.

These have included:

• Impact2, a major longitudinal study of the impact of ICT on standards in a sample of schools over 1999-2002 with the findings to become available during 2002;

• continuing evaluation of programs in the Pathfinders LEAs, aimed at gathering data on the technical, management and teaching issues arising out of the implementation of the National Grid for Learning;

• evaluating the use of ICT to make links between the school, home, and community.

Becta has also implemented a Research Network directed at strengthening interaction between research, policy makers, and practitioners to increase the relevance and impact of research on policy for ICT in education, and in practice in institutions.

**Nordic Council of Ministers**

The Council supports Nordic projects for the development of and implementing the information society. A particular priority has been meeting the needs of communities in remote locations. The Nordunet2 research and development project focuses on the development of network applications for the needs of distance education and electronic libraries. It also serves as a channel to corresponding American projects, Next Generation Internet (NGI) and Internet2.

**Ontario Knowledge Network for Learning**

Research priorities include:

• Development of new models of learning and teaching that can take advantage of new technologies.

• Development of rigorous standards and policies to ensure quality in e-learning products and services.

• Innovation, including action research for education applications.

**Comment**

An overview of the research priorities outlined above, and other research needs emerging from this study, suggests the importance of the following research needs.
1. Learning with technology. How learning with technology occurs in a range of educational and community contexts and the development of new pedagogical models.

2. Development of systems to support learning. Characteristics of new learning environments that are supportive of learning including community contexts such as learning communities and learning organisations.

3. Managing change. Case studies and longitudinal studies of the change process and outcomes as a guide to policy and practice.

4. The role of virtual models in extending learning opportunities to groups with special needs (including remote communities) and including new forms of partnership and collaboration.

5. Adjusting to individual differences and special needs.

6. Outcomes of access and equity strategies including strategies for addressing the digital divide.

NOTES

A feature of the current situation has been the strengthening of international co-operation and exchanges of experience in the development of policy for ICT in education. While this development has included the roles of international agencies such as the European Commission, OECD, UNESCO, APEC, and the Nordic Council of Ministers, it has also involved the development of informal networks such as the ICT League which links the Nordic countries, Canada, and the Netherlands, and the network of Online Knowledge Networks which came together in a Global Summit in Adelaide on 4-5 March 2002.

Some of these agencies were included in the scope of this study, but others were not. The European Commission, OECD, and APEC were included in the study, but UNESCO and the Nordic Council of Ministers were not. A brief overview of the work of key international agencies is given below and background is given on the ICT League and Online Knowledge Networks.

**European Commission**

The European Commission has been active in development of policy for ICT in education which has been brought into a new generation of EU education programs, in particular Minerva. There has been a convergence of EU policy for lifelong learning and ICT in education, with ICT seen as a tool to foster lifelong learning in an information society. The e-Learning Action Plan of the Commission contributes to the broader e-Europe development, and is linked to the objectives of the European Area of Lifelong Learning. EU programs such as Schoolnet are discussed in the report.

**OECD**

While OECD has taken an interest in the educational role of ICT for some years, the main recent initiative has been the CERI project on *ICT and the Quality of Learning*. This project has focussed on the school level and led to publications on *e-Learning: the Partnership Challenge*, *Learning to Change: ICT in Schools*, and *Learning to Bridge the Digital Divide*. The project included 93 case studies across 26 OECD countries with a number of overview reports. OECD has continued its related work on lifelong learning with a series of reports since 1996.

**UNESCO**

UNESCO has established an Institute for Information Technologies in Education (IITE) and is implementing a program on ICT in education titled UNITE (UNESCO’s New Information and Communication Technologies and Education Program). The UNESCO approach to ICT in education is based on the philosophy articulated in the Delors Report (*Learning: the...*
which is expressed in UNESCO’s commitment to fostering learning throughout life for personal and societal development. The UNITE program includes a Clearinghouse and Observatory for ICT in education, with the data base annotated and catalogued along policy dimensions. This is intended to support a “Permanent Global Forum” on the impacts of ICT on education and lifelong learning.

The ICT League

In 2001 the Nordic countries, Canada, and the Netherlands came together to establish an ICT League. The ICT League is an informal network of policy makers and experts in member countries concerned with ICT in education. The Nordic members of the League are Sweden, Finland, Iceland, and Denmark.

The league has taken a particular interest in the so called third phase of policy for ICT in education which goes beyond foundation policies to consider pedagogical innovation in the use of ICT and the major development of e-learning.

In order to stimulate discussion of the third phase of policy development, the Netherlands Ministry of Education, Culture and Science produced in February 2002 an overview paper on policies for ICT in education which provided an assessment of the current condition of ICT policy, and its implementation, and which proposed an agenda for consideration by League countries. A companion report produced for the Netherlands Ministry of Education, Culture and Science compared the performance of the Netherlands with other countries.

Network of Online Knowledge Networks

Informal contacts have been forged between Online Knowledge Networks in a number of countries leading to a Global Summit of Online Knowledge Networks held in Adelaide on 4-5 March 2002 hosted by education.au limited. The Summit focussed on the future of education using information and communication technologies.

The ideas and suggestions arising from the Global Summit were directed at key issues which included the development of skills by both students and teachers, online communities, the role of teachers and teaching, and standards.

One of the major outcomes was the formation of an informal network of the heads of national and international agencies, in several countries, focussed on the use of ICT in education and training. The heads of national agencies/programs in Canada Industry, European Schoolnet, the United States Department of Education Office of Educational Technology, and Australia (education.au limited) agreed to meet twice a year when meetings could be arranged during international education events. Agency and program heads from a number of other countries will be invited to join this informal group.

The issues of common interest for information sharing and discussion include progress on issues such as portal content strategies, learning architectures, research, sharing online collections, standards, business models for the learnware sector and learning communities.
Networks of Public and Private Partners

A further significant development in international exchanges of information and experience has been the development of networks of firms with an interest in educational uses of ICT which are sometimes linked to public agencies for exchanges of information.

Action taken by a Task Force of five companies which led to the European eLearning Summit held on 10-11 May 2001 at La Hulpe in Belgium illustrates this kind of informal network development.

Planning for the European eLearning Summit involved IBM, Cisco, Nokia, SanomaWSOY, and SmartForce. The Summit attracted over 350 participants from both public and private sectors including policy makers from ministries of education and employment, senior officials from the European Commission, and representatives from a wide range of related industries.

Following the Summit, the five companies on the original Task Force have been joined by a further 25 companies in a Steering Group to take forward the conclusions of the Summit.
Policy for Information and Learning Technology
Strategies in British Further Education Colleges

Policy to promote the effective use of ICT in British further education (FE) colleges has involved a requirement for all colleges to develop an Information and Learning Technology (ILT) Strategy. This policy has been linked to funding for colleges under the National Learning Network. This system has been supported by the development of Ferl (Further Education Resources for Learning) to support colleges in the effective integration if ICT into their teaching and learning strategies.

While the ILT strategy system was instituted by the former Further Education Funding Council (FEFC), these arrangements are now administered by Becta on behalf of the Learning and Skill Council which is now the funding body.

College Information and Learning Technology Strategies

The British Government in 1999 announced a 74 million pounds package of financial support for ICT development in FE colleges. The designation National Learning Network was the umbrella term coined for the package of initiatives.

In order to benefit from this funding, FE colleges were required to produce an Information and Learning (ILT) Strategy which was to be submitted to Becta for monitoring and evaluation. Guidelines were produced for colleges in preparing their ILT strategies under seven headings. These were:

- A vision for ILT; managing the strategy;
- learners, learning and the curriculum; staff;
- IT infrastructure; schedule of activities; budgets.

An implementation plan issued by FEFC in November 1999 provided detailed guidance on the implementation of the National Learning Network (NLN) and the local college ILT plans. Colleges were assisted by a model ILT strategy available from the Becta web site (http://ferl.becta.org.uk).

Becta has evaluated college ILT strategies and reported on their strengths and weaknesses. A 2001 assessment concluded that exemplary strategies all started from a pedagogical/curriculum focus and had a clear vision of how technology could and should serve learners, teaching, and learning. The weaknesses usually resulted from many colleges having no real
pedagogical vision for ILT, and hence weaknesses in strategic thinking about the issues (http://ferl.becta.org.uk/ILTStrategydocuments.cfm)

Becta promotion of the ILT strategy has included the conduct of ILT Strategy roadshows in regional centres, and the provision of feedback to colleges

**National Learning Network**

The National Learning Network is the umbrella term for the package of measures announced in December 1998 as a three year program with a budget of 74 million pounds. The Network supports the provision of bandwidth for FE colleges secured centrally through the Joint Information Systems Committee (JISC) by UKERNA (United Kingdom Education and Research Networking Association).

This arrangement enables FE colleges to secure bandwidth in partnership with universities through the JANET scheme, and colleges are directly represented on the JISC. The original planning for this scheme involved FEFC funding a standard connection for every college of 2 megabits per second. Nine regional support centres funded by FEFC were established to provide technical support for colleges, based in either colleges or universities.

In addition to the funding of the National Learning Network, the Government grant of 74 million pounds has also supported local learning infrastructure, learning materials, technician/champion training, and learning management.

**Further Education Resources for Learning (Ferl)**

A third prong in the FE ICT strategy has been the development of Further Education Resources for Learning (Ferl). Ferl is a web-based information service for practitioners that provides a one-stop shop for FE teaching and learning staff. Ferl provides information and resources in the following areas: People and practice; Technology and infrastructure; Learning and teaching resources; Training and skills; Current issues and key documents.

These resources include guidelines for ICT strategies in colleges, case studies of good practice, guidance on curriculum based software and web sites, including independent reviews by practitioners. A valuable aspect of Ferl is the ILT exemplar strategies, and the access to key documents and resources on current issues http://www.ferl.becta.org.uk.
**APPENDIX 5**

**Select Glossary of Key Terms**

**Action learning**  Deliberate, conscious effort to review and reflect upon action of the individual, a team, or the organisation. This is often undertaken in teams or sets.

**Blended learning**  An approach that combines e-learning with other learning strategies such as face-to-face teaching and action learning in blended configurations.

**Digital divide**  This is a term used to describe the social implications of unequal access by some sectors of the community to information and communication technology and to the acquisition of the necessary skills.

**Digital learning**  The educational approach that integrates technology, connectivity, content, and human resources to create productive and engaging learning environments.

**Digital literacy**  The acquisition of basic ICT skills, including the ability to use computers and the Internet, as well as a broader capacity to use ICT for educational, social, and economic purposes which involve reasoning, problem solving, and other key skills.

**e-learning**  This term covers a wide range of technology–based applications and processes such as web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via the internet, intranet/extranet (LAN/WAN), audio and videotape, satellite broadcast, interactive TV, and CD-ROM.

**Informal learning**  Incidental and tacit learning that occurs in many social, organisational, and community contexts.

**Learning community**  Any group of people, whether linked by geography or by some shared interest, which addresses the learning needs of its members through proactive partnerships.

**Learning portal**  Any website that offers learners or organisations access to learning and training resources from multiple sources. EdNA Online, Ferl, and the National Grid for Learning provide examples.

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1 This glossary has been restricted to learning related terms and does not include technical ICT terms which are defined in many other places.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lifelong learning</strong></td>
<td>All learning activity undertaken throughout life, with the aim of improving knowledge, skills, and competencies, and enhancing quality of life and personal fulfilment, within a personal, civic, social and/or employment-related perspective.</td>
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<tr>
<td><strong>Managed learning environment</strong></td>
<td>A managed learning environment (MLE) describes the electronic management of learning processes to support teaching and learning. The MLE concept is often seen as similar to a virtual learning environment.</td>
</tr>
<tr>
<td><strong>Portal</strong></td>
<td>A website that acts as a “doorway” to the Internet or portion of the Internet, often targeted towards one particular subject or client group.</td>
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<tr>
<td><strong>Situated learning</strong></td>
<td>Knowledge and skills are learned in contexts that reflect how knowledge is obtained and applied in everyday situations; situated learning theory conceives of learning as a socio-cultural phenomenon rather than the action of an individual acquiring general information from a decontextualised body of knowledge.</td>
</tr>
<tr>
<td><strong>Visual literacy</strong></td>
<td>This describes effective interpretation and production of visual imagery including the ability to translate thinking and creativity into effective presentations, manipulate a variety of media including video, and appreciate aesthetic values.</td>
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## DATABASE POLICY SUMMARIES BY COUNTRY/ORGANISATION AND BY POLICY AREA

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<th>Texas</th>
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<td>1.2 Frameworks for collaboration between constituencies within the jurisdiction, and between the jurisdiction and other jurisdictions.</td>
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<td>2.5 Addressing equity issues including lifelong learning and community access, and reduction of inequities in ICT skill levels between social groups including rural and remote.</td>
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<td>6.1 Appropriate legislation or regulation to support the effective use of ICT in education and training.</td>
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**Legend:**

a. British Columbia  
b. European Commission  
c. New Zealand  
d. United Kingdom
A Brief Description of the Australian Education System

Australia has a federal system of government. The six states and two territories have responsibility for school education, and vocational education and training (VET). The national government (usually referred to as the Commonwealth Government or sometimes as the Federal Government) has responsibility for Higher Education.

Preschool and school education

Preschool and school education has a similar structure across Australia with only slight variations amongst the States and Territories. Preschool education is commonly one year in length and is not compulsory. School education is thirteen years with some variations in Queensland and Western Australia. It is divided into a preparatory year, primary schooling and secondary schooling. The preparatory year is not compulsory but is almost universally undertaken. Children usually start in the preparatory year at around five years of age although in some States the starting age is closer to four years. Primary schooling is six or seven years duration, Years 1-6 or 1-7; and secondary schooling is five or six years duration, Years 7-12 or 8-12. School education is compulsory until the age of 15 except in Tasmania where it is compulsory until age 16.

Tertiary education

Tertiary education programmes can be divided into two main types those offered by institutions and industry within the Vocational Education and Training (VET) sector, and higher education programmes which are mainly offered by universities and other higher education institutions. VET is competency-based and offers a wide variety of programmes under the National Training Framework (NTF). Higher education offers programmes leading to Bachelor degrees and a range of postgraduate awards. Universities also offer some shorter undergraduate programmes.

While the VET and higher education sectors in Australia remain largely distinct, there are an increasing number of connections being forged between the two. A few universities offer programmes under the NTF and some Bachelor programmes are offered by mainly VET institutions. Articulation from VET programmes into specific degree-level programmes at universities or vice versa is now well developed with the granting of credit in one sector for studies undertaken in the other.

Administration and financing of education in Australia

The administration and financing of education in Australia is shared between the Federal Government and the States and Territories. The Federal Government is mainly concerned with the development of national policies and strategies for education, whereas the States and Territories are responsible for delivering education within their borders. The Federal Government provides significant funding for education across the educational sectors and administers some national programmes.
Consultation between the Federal Government and the States and Territories occurs at Ministerial level through the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) and at official level through the Commonwealth [Federal]-State Joint Planning Committees. Membership of MCEETYA comprises Federal, State and Territory ministers as well as New Zealand Ministers responsible for the portfolios of education, employment, training and youth affairs.

MCEETYA’s education and training responsibilities cover national co-ordination and policy development across issues involving all levels and sectors of education school education, Vocational Education and Training, and higher education, and cross-sectoral matters. MCEETYA works closely with the Ministerial Council on the Australian National Training Authority (ANTA) which has responsibility for certain aspects of Vocational Education and Training. The Commonwealth-State Joint Planning Committees provide advice to MCEETYA on matters such as national agreements on shared agreements and objectives, negotiations on the scope and format of national reporting, coordination and collaboration on national issues, the source and distribution of higher education resources, and cooperation with the VET system.

The Department of Education, Science and Training (DEST) is the responsible Commonwealth department in these fields. This department was previously known as the Department of Education, Training and Youth Affairs (DETYA).

Education.au limited is a national body established by the Commonwealth, states, and territories to promote and co-ordinate education information services including management of the Australian education portal EdNA Online.