Unravelling the ICT Maze

An Overview of
Information and Communication Technology
Education and Research in Australian Higher Education

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Foreword

Co-operation for a Sustainable Future

In any organization, being aware of our surrounding environment is critical. Australian academic institutions today face pressures brought on by a multitude of forces, from globalisation, to technology, to market expectations. While responding to these pressures, at the same time we must strive to continually improve the effectiveness and flexibility in our course delivery, the quality of our research outcomes and research training, the relevance and value of our community services, and the efficiency of our general operations.

Yet whatever progress or barriers we may encounter, we must keep returning to the strong foundations upon which we built our institutions, to evaluate our performance subject to our initial goals, and to question whether our missions and visions are still appropriate and relevant to our contemporary environment. For this purpose, up-to-date and accurate data and information is critical. There is no question but that we need to rely on such data to plan for our future and help with our decisions.

The School of IT commissioned Mr Hiew Hong Liang to compile this preliminary report to provide a summary of the field of Information and Communication Technology (ICT). We seek some clarity on particular aspects of this field that have significant impact on Australian (and Western Australian) Higher Education. Moreover, we do not see this study as a singular affair. We will regularly revisit the data collected, to identify prevalent trends and directions. By doing so, we will be able to adjust and re-evaluate the best of our abilities and strengths.

As this report clearly shows, the path to a sustainable future in ICT depends on co-operation between many parties from many disciplines and backgrounds. Success in ICT will come from understanding its complex makeup, and recognising its potential impact on many facets of our society. In the spirit of cross-faculty and inter-institutional co-operation, we make this report available to all stakeholders who may find the data useful. We hope that it will ultimately contribute to more effective delivery of ICT teaching, research, and professional services from the Australian Higher Education sector.

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Table of Contents

List of Figures

List of Tables

Executive Summary

The field of Information and Communication Technology (ICT) has undergone tremendous upheavals in the past decade. The challenge for higher education institutions is to look past the turmoil and derive a set of sustainable long-term strategies. This study aims to assist in answering such a challenge by reviewing the current state of the ICT in Australia, so that we have some clarity about what is around us, where we stand, and what implications any of our actions have.

Below are the key findings of this study:

ICT in the Knowledge-Based Economy

1. ICT plays a critical role in the knowledge-based economy and society, but that role is multi-faceted and complex. Effective long-term planning for sustainable ICT developments requires in-depth understanding of ICT from many perspectives.

2. There are many different definitions of 'ICT', each with its unique purpose. As the use of the term is yet to reach full maturity, the definitions will likely be further modified. By keeping abreast of key national and international developments in such definitions, we can gain insight into critical components of this field.

3. The current consensus view for the sector is for a slow recovery in the near future. But the upheaval in the last decade demonstrates the need for structures and processes that are relatively adaptable to cyclic fluctuations. Such adaptable structures will be crucial as we face the uncertainties still present in this sector.

4. Most data currently available on this field are pre-2001. We need to take care in using such data to predict into the future.

Policy Developments

1. The Australian Federal Government's policy vision in ICT development is underpinned by the *The Strategic Framework for the Information Economy*, released in 1999, and recently the *Backing Australia's Ability* innovation statement in 2001. The framework and statement cover many areas of policies, from education to R&D to industry development. Further developments would likely be within this framework, or a variant of it.

2. Long-term policy developments in ICT require in-depth understanding of different aspects in the ICT field. In particular, current knowledge points to some key areas:

   - Effective planning and adoption of ICT at the firm and organisational level.
   - Competition, trade and investment openness.
   - Continuation in the macro-economic reforms started in the 1990s.

3. Some recent reviews of Western Australia's state performance have raised concerns over the state's ability to compete effectively in the knowledge-based economy. Such issues need to be addressed decisively.

Employment

1. Statistics suggest that there are approximately 250 000 people Australia-wide working in ICT-related jobs. A majority of them (approximately 200 000) are working in occupations requiring higher education qualifications.
2. In spite of some contradictory evidence, the current job market appears to be very weak as the industry undergoes correction in the post-bubble economy. Although long-term trends for human resource requirements would probably persist, there is great uncertainty as to the exact nature of any skills-gap or personnel deployment in the near future.
3. Employers in ICT have a higher demand for 'soft' skills and more rounded graduates than before.
4. The workforce in general has a higher demand for more flexible and stimulating work conditions.

Higher Education Courses

1. There are over 700 different ICT-related degrees offered in the 43 Australia higher education institutions. They range from associate diploma to doctorate levels. There are degrees of many types from many different faculties, and they cover a broad range of fields.
2. There are approximately 60 000 students enrolled in *Information Technology* courses in Australian higher education. That represents approximately 8.5% of all enrolments. The *Information Technology* field of education includes *Computer Science* and *Information Systems*. Due to classification, other ICT-related courses such as Telecommunications are grouped in separate broad fields of education, and the number of enrolled students for them is not as readily available.
3. Information Technology courses have very low female participation. This can be a large potential market to tap into, possibly through projecting the image of courses more in line with areas that do attract normal female participation, such as Humanities, the Arts, and Business.
4. Besides gender, residency status and location, there is very little published data on market segmentation of ICT-enrolled students, and potential students.
5. Information Technology courses in Australia attract high overseas student participation. Universities should continue to develop courses and marketing to sustain this trend.
6. There are very heavy developments toward on-line education. Pressures for flexible learning will likely see such developments continue into the future. Full e-Learning paradigms are still to be fully explored, and can potentially offer substantial teaching and learning benefits.
7. Evidence collected in this study does not provide conclusive decisions on dealing with industry certifications, and their relationship to higher education courses. Further studies are required to gain a full understanding.

Research and Development

1. The Business sector has been the largest contributor to ICT research up until now. The potential for collaboration between the Business sector and Higher

Education is large. Programmes like CRCs and ARC Linkage Projects provide further incentives to form such collaborations. However, collaborations of this kind require considerable time and effort due to logistics and intellectual property issues. Institutions need to have sufficient support and initiatives to ensure researchers and research teams can overcome barriers in forming such collaborations.

2. The ICT initiatives in the Commonwealth Government's *Backing Australia's Ability* policy statement can be linked directly to recommendations from the Prime Minister's Science, Engineering and Innovation Council (PMSEIC 2000), and the Australian Chief Scientist (Batterham 2000). These recommendations are directly focussed on addressing Australia's fragmented research policy approach, and the country's growing ICT trade imbalance. Following this direction, funding in the future will likely be more concentrated to this purpose.

3. NICTA is likely to be a focus for the Commonwealth government in the ICT area, with access to major funding. This will likely have major implications on existing ICT research establishments around the country. However, it is unclear what those implications are.

4. Data and performance analysis of developments in research for ARC competitive grants are now more readily available through the ARC. Such data and information will be very useful for institutions to compare their performances and improve on success rates in grant applications as well as research outcomes.

Secondary School Education

1. School leavers coming into ICT degrees in higher education will likely have more and more background in formal ICT education. With current developments in secondary education, it may be that some school leavers will enter University having formally achieved the outcomes of some of our first year undergraduate units. Universities will have to consider how to effectively deal with this situation, while tackling the parallel problem of mature age entrants who may not have any exposure to the same material.

2. With the diversification of options available within the secondary school system, and the introduction of VET subjects, school leavers will cover a much larger spectrum of backgrounds, interests and learning styles than before. Universities will have to advance flexible teaching delivery approaches to keep up with the diversity in this student population.

3. The W.A. Post-Compulsory Education Review and policy responses were prompted by pressures similar to those faced by higher education (eg. attracting students who are more focussed on job training and employment, rather than pure academic pursuit). Universities can gain valuable information by following the trials and errors of the current efforts to implement a new framework with the post-compulsory education system.

4. Secondary schooling considers ICT skills as a basic life-skill. Universities should do the same, and have a whole-of-University approach to ensuring all graduates have basic applied ICT skills.

Vocational Education and Training

1. ICT training packages in the National Training Framework (NTF) have been developed with close attention to workplace skills, and close consultation with industry. Although the primary purpose of University curriculum development may not be exactly the same, we can still learn from developments of the vocational training packages. Demands from a changing student-body profile will apply pressure for this to happen.

2. Universities need to clarify their roles and relationships with the vocational training sector in providing education and training for graduates who will go into the ICT workforce. A clear vision of those roles and relationships will allow Universities to develop articulations with vocational institutions to promote undergraduate courses among vocational students.

3. The IT&Titab review have indicated that training packages in ICT will need to undergo constant evolution due to rapid changes in this field. Universities need to have their own strategies for managing the same changes.

This study is primarily a data collection and information dissemination exercise. All constructive feedback is welcomed. We hope the information will be useful in further strategic or operational decision-making. Since this study has yet to go through a full consultative exercise with relevant stakeholders, we recommend such a consultative process be conducted before proceeding with using the data.

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Part of the data used in this report was collected by Ms Fiona McGrath in August 2002, in a contract funded by the School of IT at Murdoch University. One outcome of that contract is a database containing summary data on ICT tertiary courses across Australia at that time. The listings in Appendix J that forms the bulk of this document were generated from that database. Also, all references used in this report accessed in August 2002 (see *Reference* section) were collected by Ms McGrath in the same contract.