



1 - Introduction

The Shared Technology project provides individuals with a summary of the technologies that are likely to have an impact in a range of industries in the next five years to 2008. The industries included in this “Shared Technology” project are:

| | |
|---------------------------|------------------------|
| Automotive | Electronics |
| Building and Construction | Information Technology |
| Engineering | Telecommunications |
| Electrical | |

The purpose of this summary is to provide these industries with an advanced warning of those technologies that will change the way that work is accomplished in the future.

This project has canvassed the thoughts of a number of employees and managers in Australian enterprises and organisations. The data collected from these individuals regarding the emerging technologies has been compared with the outcomes of similar projects in other countries. Each of the technologies identified are explained within the report and referenced.

For online material: <http://www.sharedtechnology.net.au>

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Beginnings

The concept for this project originated during discussions with the Australian National Training Authority (ANTA) and the ElectroComms & EnergyUtilities Qualifications Standards Body (EE-Oz) who are the developers of a number of electrotechnology related training packages. Immediately prior to this discussion, ANTA received from the Centre for the Economics of Education and Training (CEET) a working paper that investigated the insights into employment and training practices of leading edge enterprises in Australia. This paper begins with the following statement.

“The early recognition of changes in the qualifications and skills required by industry can contribute to the productivity and competitiveness of the economy. Indicators of change are especially important where training is provided principally by public sector institutions that are to some extent insulated from market forces. Mismatches between the supply of, and the demand for, skills can contribute to inefficiencies in the economy.”¹

Methodology

As the purpose of this project was to define the new technologies that would be in used in a range of industries, a quantitative approach would only be able to provide trends of existing technologies rather than the emerging technologies. It was decided that a qualitative approach would be more applicable as this would allow for the development of an understanding of future technologies and the likely impact on the various industries.

Data gathering was done in three steps. Firstly, a group of 30 individuals were selected in Western Australia to provide information on the types of new technologies likely to impact in their industry. This was accomplished through face-to-face, semi-structured interviews of around one hour each. Secondly, from the content of these interviews there was a process of gathering documentation regarding these technologies. This data gathering included information from the vendors who were providing these technologies, journal articles regarding these technologies and other resource material.

The third stage was the verification of the identified technologies using a larger group of contributors. Another 80 interviews were conducted with knowledgeable individuals in the eastern states of Australia using telephone interviews with some face-to-face interviews. This data provided further confirmation (or dismissal) of the technologies that were likely to have an impact on the Shared Technology industries.

The persons interviewed were primarily senior managers or researchers within these particular industries who were actively involved with the implementation of “new” technology within their industry. It was believed that this approach would provide the project with an informed view of emerging technologies. Drafts of the chapters were sent to all contributors for review and comment. The comments received have been mostly incorporated into the final version.

Scoping Process

It was important to limit the scope of the project very early in the research. The limits placed on the technologies to be considered were that they be:

- evident in these industries in five years time;
- shared by two or more of the industries covered in this project;
- commercially available in some location in the world; and,
- adopted by Australian enterprises within the time frame.

These limits were developed by the Steering Group and the intention was that the data from this project be available to vocational education planners to assist in the development of training packages and standards. The horizon of five years allows for the data to be current and useful for the near future. The shared nature of the technology will allow those industries where the technology is incumbent to assist the industries in which new applications are emerging.

The technology needs to be commercially available if it is to be used in enterprises as there is little purpose in discussing or anticipating technologies that are unlikely to be utilised in Australia. Therefore the technology needed to be an economic reality and likely to be adopted.

Some technologies have not been included and there may be debate that they should be. For example, photonics is an emerging technology but is not mentioned in this report. Fibre optics and microelectromechanical devices that use photonics are mentioned.

Technology Roadmaps

Many industry associations and other organisations have prepared reviews of the technology forecasts for their industries. These forecasts are commonly known as “technology roadmaps” and have event horizons of between five and fifty years. Reports are available from international and national organisations with some focusing on automated buildings, electricity generation, renewable energy and communications infrastructure. These reports have been particularly useful as the process and the information gained from these forums and research provided input for this report. Therefore the title of this report has included this concept of a technology roadmap.

This project was intended to provide for an early warning of technologies that will be used and perhaps to signal to those involved in training and development to be ready for the changes. Therefore, the title of this report has included this concept of a technology roadmap.

Construction of the Report

The report has been written to accomplish a number of outcomes. It has been written in a format that is hoped to enable the report to be accessible and useable for a range of purposes.

Target Audience

The report has been written to provide individuals who have some understanding of a technology or science to be informed about the emerging technology. Much of

the technical literature available has been developed for those who are already familiar with the technology. The explanation of each technology in this report has been kept at a level that provides for this information to be communicated to those who are interested but in a simplified form. At times it may seem to become overly complex and at other times simplified but it is hoped that sufficient detail can be communicated.

Scientific Notations

It is necessary to use scientific notation for the technologies being discussed and the reader is encouraged to learn these notations. A conscious effort was made to avoid scientific formulas as this was seen to be far too complex for the purpose of the report. The use of industry jargon was kept to an absolute minimum except for those technologies that should be in common use and considered to be basic knowledge for a person working in these industries.

Acronyms

There was a conscious effort to avoid the use of acronyms. The report provides the name of each technology in full with the acronym following. This is not the usual presentation where a technology is mentioned in full once at the beginning with the acronym in parentheses and the acronym used in the remaining text. In a highly technical document that uses this convention one finds the last few pages heavy with acronyms. It was felt that a more user-friendly approach would enable the reader to concentrate on the content rather than on remembering what the letters in the acronym imply.

Referencing

This report has used a range of resources in its preparation with an underlying assumption that this report should be available through the Internet. As such, many of the references are also available through the Internet. The purpose of this was to assist those who were interested in reading further to have access to these reports at a minimal cost. While every effort has been made to ensure that the links are working, it is inevitable that some of these links will degrade over time. Not all of the data was available through the Internet and some of the sources used are only available through subscription or direct purchase.

The format of the references at the end of each chapter is based on the American Psychological Association (APA) referencing with some minor adjustments.

Stand-alone Chapters

The intention of the report is that those individuals who wish to read only about their particular industry or technology need read only one or two chapters. Each chapter is independent and can be read without referring to other chapters although some technologies are used across the chapters and the reader is alerted to this.

Implications

Finally, each chapter ends with a review of the likely impact that the technology outlined may have on individuals in the Shared Technology industry group. These

implications are “best guesses” as to what may happen to individuals in these industries. For convenience, these comments have been grouped by industry in Appendix 3.

Chapter Review

In the next chapter, Chapter 2 –Technology Innovation and Adoption, a broad overview is provided of the process of technological advance in terms of scientific development, planned application, technical development and market acceptance. This chapter discusses the difficulties new technological advancements face in terms of economics and general acceptance by the community.

In **Part 2 – Networking**, Chapter 3 – Networking for Automated Buildings examines the use of technology in networking for automated buildings where there is a move towards even more automated and open systems with the use of BACnet and LonWorks. Commercial buildings will see the continuing integration with energy saving devices. Residential buildings will not have a similar integration but will have more connectivity to the Internet, video security and in-home entertainment systems. In Chapter 4 - Networking for Engineering a discussion is provided of the open systems that are likely to impact on the automation of process and manufacturing industries and the move to an Internet based platform. Chapter 5 - Next Generation Telecommunications Networks examines the new Internet-based telecommunications networks.

Part 3 – Wireless Communications looks at the range of wireless communications that will have a significant impact on the way that information will be passed between users. Chapter 6 – Wireless Personal Area Networks (WPANs) focuses on the development of the Bluetooth technology also known as IEEE 802.15. Chapter 7 – Wireless Local Area Networks (WLANs) examines of the use of the wireless technology IEEE 802.11 (also known as WI-FI) including issues relating to security and encryption protocols. Other competing technologies are discussed. Chapter 8 – Wireless Broadband looks at the various radio frequency solutions for issues relating to broadband access where cable-based infrastructure is insufficient to provide connectivity between the local telephone exchange and the end user. Chapter 9 – Comparisons between Wireless Technologies is a short chapter that attempts to clarify the differences between WPANs and WLANs and the likely applications of each.

Part 4 – Electricity Generation examines the range of energy solutions for the networks and smart devices that will be employed throughout the Shared Technology industries. Chapter 10 - Electricity Production and Distributed Generation outlines the projected growth in electricity demand and the technologies that are in use and planned for the future. An examination of distributed generation is made in relation to the growing awareness of the cost of maintaining transmission and distribution infrastructure. Chapter 11 – Micro Gas Turbines and Heat-Driven Cooling discusses the development of distributed generation and the planned increase in the gas distribution network. Gas turbines are seen to be a reliable alternative to grid connection and when coupled with co-generation of steam-powered electricity generation and use of waste heat, these facilities can provide greater efficiencies than current generation equipment.

Chapter 12 – Renewable Energy and Power Electronics reviews recent incentives and regulatory influences for the promotion of renewable energy sources with one of the main drivers in the direct-current to alternating-current transmissions being power electronics. Not only is this technology being used in renewable energy but will also have an impact in automotive, lighting and other areas. Chapter 13 – Fuel Cells looks at the range of fuel cell technologies and their current and proposed applications in stationary power generation, transport, portable and micro applications.

Part 5 – Embedded Processing discusses the range of devices that drive the next generation of distributed computing. Chapter 14 – Embedded Processing examines the increase in “smart devices” that power equipment and includes the applications of microcontrollers and digital signal processors. Chapter 15 – Field Programmable Gate Array Microprocessors looks at the development of programmable and re-programmable microprocessors. These processors are highly flexible and can be reconfigured through remote access. Chapter 16 – Microelectromechanical Systems discusses the applications of “nanotechnology”. While already in use in a number of commercial applications such as in the electronic circuitry for automotive air-bag deployment and thermostats, these devices will become more prevalent in areas such as electrical and electronic switching.

Part 6 – Enabling Technologies looks at two technologies that will influence work processes of the future. Chapter 17 – Radio Frequency Identity Tags (RFIDs) looks at the applications available for this technology. These are the “E-tags” that are used in various applications such as toll collection or “smart cards”. However, new manufacturing techniques will reduce the cost and we will see these devices used in many more applications. Chapter 18 – Geographic Information and Location Sensing is an emerging technology that will provide physical referencing to mobile computing devices through a web-browser application.

Part 7 – Human / Technology Interface is a review of the impact that technology has on individuals and management decisions. Chapter 19 – Individuals and Technology examines the aspects of psychological theory such as expectancy, self-esteem and locus of control and provides some understanding as to why people react to new situations the way they do. Issues relating to “employability skills” are also examined. Chapter 20 – Management and Technology looks at the issues relating to managerial decision making in respect to either adopting new technology or waiting until greater clarity emerges.

Finally, the Conclusion provides a summary of the data uncovered from the project with recommendations.

Summary

It is hoped that this report will provide individuals with the knowledge of the technologies that will be emerging within their industry and allow them to plan or seek further training to enable them to remain employable into the future.

¹ Long, M., & Fischer, J. (2002). *Project 2000-3 leading edge enterprise: insights into employment and training practices*, p. 1. Melbourne: Centre for the Economics of Education and Training. Available: <http://www.education.monash.edu.au/centres/ceet/WP42.pdf>
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