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THE KNOWLEDGE ECONOMY

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Nature does not construct machines, locomotives, railways, electric telegraphs, self-acting mules, etc.. These are the products of human industry... the power of knowledge made into an object. (Marx, *Grundrisse*)

There are increasingly enthusiastic reports in Australia and other OECD countries of the emergence of the 'knowledge economy'. It is now a common view that 'in the long run, knowledge, especially technological knowledge, is the main source of economic growth and improvements in the quality of life' (Sheehan, 1999: 1). The 'new economy' is described as 'global in dimension, digital in mechanism, leisure and information in content, and is profoundly destabilising established social and economic structures' (Tanner, 1999:84). For others, a paradigm shift has occurred: 'we are in the midst of a revolution from which a new order is emerging... intangible assets – our human and intellectual capacity – are outstripping traditional assets – land, labour and capital – as the drivers of growth' (Minchin and Anderson, 2000:2).

Despite this interest in knowledge-based economies by governments and business, there are different interpretations about the nature of the 'knowledge economy'. The phrase 'knowledge economy' will be shown to be a concoction of five different approaches: information technology (usually considered to encompass computing and communication technologies); information networks; new industry processes (including innovation, research and development, and technological diffusion); the human capital approach; and a new approach to capital accumulation through the privatisation and commercialisation of knowledge.

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What is the Knowledge Economy? The Knowledge Economy as Information Technology

One of the two common understandings of the knowledge economy in Australia is that of new technology, primarily information technology and telecommunications. These discussions refer to the recent arrival of personal computers, intranets and the internet, e-mail, mobile telephones, automatic teller machines, electronic commerce and other tools which are now relatively commonplace in the workplace in Australia. Often it is claimed that the world economy is being fundamentally reshaped by 'the explosion, and convergence of computing, communications and media technologies' (Sheehan, 1998).

Evidence for this interest is dramatic. The US Department of Commerce (1998), for example, noted:

- the computing and communications industries in the USA contributed 4.9% of GDP in 1985. This grew to 6.1% in 1990 as personal computers began to enter homes and offices, increased further with the burst of commercial activity driven by the internet, and by 1998 had risen to an estimated 8.2% of the GDP
- in 1996 computing and communications industries employed 7.4 million people (6.2% of the total US workforce) who earned an average US\$46,000 per annum compared with the average wage in the private sector of \$28,000 per year
- in the 1960s, investment in computing and communications equipment represented 3% of total business equipment investment. By 1996, this had risen to 45% of total business equipment investment
- in 1995, 1996 and 1997, computing and communications industries were responsible each year for more than one-quarter of the country's real economic growth
- in 1996 and 1997, declining prices in computing and communications lowered overall inflation by one full percentage point

The US Department of Commerce (1998:7) also noted:

Despite these impressive trends, the digital revolution is just beginning. Growth could accelerate in the coming years not only in the information technology sector itself, but across all sectors of the economy as the number of people connected to the Internet multiplies and as its commercial use grows.

The dramatic growth of information technologies, and their potential for future growth is not just an American phenomenon. OECD (1998) research concluded that information and communication technologies are central to the growing speed and evolution of many countries. The relevant industry sectors, non-electrical machinery (e.g. computers) and electrical machinery (e.g. communication equipment), are the manufacturing sectors experiencing the fastest growth, exceeding 10% in the USA, Canada, Finland, Ireland, Sweden and the UK. The finance, telecommunications and retail sectors are making 'huge' investments in information and communication equipment and, with regulatory reforms, have led productivity gains in the service sector.

In Australia it has been generally assumed that this nation would benefit from the economic impact that information technology has delivered in the USA and other developed nations. It is rarely acknowledged that Australia is more a consumer of information technologies than a producer of information technologies: in the 1996 current account, Australia had total technology earnings of A\$292 million and total technology payments of A\$471 million, an overall deficit of A\$179 million (Department of Industry, Science and Resources, 1999:23). Compared with other countries, Australia's ratio of technology earnings to payments in 1996 was 0.6, compared with Sweden (8.9), the US (4.3), New Zealand (2.5) and Japan (1.6) (Department of Industry, Science and Resources, 1999).

The significance of the knowledge economy as information technology was reflected in the late 1990s by the establishment of positions of Ministers for Information Technology in all Australian Commonwealth, State and Territory Governments (in South Australia, a Minister for the Information Economy and in Victoria a Minister for IT and Multimedia). These Ministers have one or two main roles: leading the introduction of

IT into their relevant public sectors, and/or encouraging economic development which attracts or supports investment in IT and related industries.

The Knowledge Economy as Information Networks

A variation of the idea of the knowledge economy as something to do with new technologies is that the fundamental factor of change is not *technology* as such, but the shift to more efficient uses of *information* that the technology enables. Information, in this sense, includes e-mails, data transfer, marketing, and other transfers of 'digitised data, including text, sound and visual images' (Department of Industry, Science and Resources, 1999:43). The changes in information and communication technologies have assisted businesses in all industry sectors to dramatically lower costs, improve service quality, and promote their products and services to global markets through, for example, the world wide web. More information about customers, stock levels, new processes or products is available faster and cheaper, thus assisting improvements in productivity. The Internet technologies, in other words, are the economic equivalent of the railway system in the nineteenth century, and the global telephone network in the early 20th century, revolutionising transport and communication speed, costs and efficiency.

Of the few measures of the take up of the information and communication technologies in selected OECD countries, Australia is fifth in terms of Internet hosts per 10,000 inhabitants, after Finland, Iceland, the US and Norway (Department of Industry, Science and Resources, 1999:41).

The Knowledge Economy as Innovation, and Research and Development

The third common description of the knowledge economy stresses the importance of innovation, and research and development, as both the source of economic growth for the nation and the source of profits for

individual businesses. The OECD has promoted an understanding of the knowledge economy as 'intellectual capital – whether in R&D, technological innovation, managerial and worker training, work-place organisation and market knowledge' and calculated that knowledge-intensive services have an estimated turnover of \$1 trillion in OECD countries (OECD, 1999:1).

This approach has been supported in Australia with pressure from major manufacturing-based industry associations such as the Australian Industry Group and Australian Business, the latter through its think tank arm, the Australian Business Foundation which popularised the importance of innovation, knowledge generation and diffusion and the learning economy in its report *The High Road or the Low Road?* (1997a). A related description of the knowledge economy is that State (provincial) governments, not national level governments, play a major role in stimulating investment in new technologies, technology diffusion, research and development, encouraging clusters of firms, establishing industry incubators, assisting linkages between business and research and development bodies such as universities, and the benefits that arise for job creation (Australian Business Foundation, 1997b).

The knowledge economy is much broader than information technology in this perspective, and can be applied to the development of aerospace, artificial intelligence, bio-technology, eco-tourism, gene technology (including genetically modified food, gene shears and cloning), information technology, medical technology, miniaturisation, multi-media, nano-technology, new materials, pharmaceuticals, solar and other renewable energies, telecommunications, waste use and re-use.

This approach, 'Investment in the generation of knowledge, the education and training of the workforce, and the capacity for innovation and the exploitation of new ideas...' (Department of Trade and Industry, 1998: section 3.4) has been supported by national policy initiatives. The Mortimer Report (1997), for example, resulted in a substantial allocation by the Federal government of \$1 billion over 4 years to support business innovation, the maintenance of a 125% tax concession for business research and development (R&D) expenses, grants for R&D, \$153 million for venture capital funds in new technologies, and programs to encourage technology diffusion (Howard, 1997).

Also consistent with this approach was the Federal government National Innovation Summit held in February 2000 in Melbourne, co-sponsored by business groups. It developed from a concern expressed by the Federal government in 1998 by the Business Council of Australia (and others) about the slump in business research and development in Australia. A variety of papers, research and statistics were developed by the National Innovation Summit Learned Group in the lead up to the Summit (see <http://www.isr.gov.au/industry/summit>), including the Innovation Framework Paper, 'Shaping Australia's Future'. One participant, a facilitator to the 'building industry-research linkage' theme of the Conference, said that the Conference made clear there was a need in Australia for leadership to develop 'an innovation culture a la Silicon Valley', and a need for greater 'connectivity in the national innovation scheme'. Following the conference, an Implementation Group was established (chaired by Mr David Miles, former tax strategist of the Business Council) to produce a clear set of recommendations by August 2000, with the aim of the government having an agreed Action Agenda by the end of that year.

The Knowledge Economy as Human or Intellectual Capital

A fourth view of the knowledge economy sees it as a matter of human capital, which requires the provision of training and education to increase the skills and knowledge of individuals. This approach underlies Federal Australian Labor Party leader Kim Beazley's policy statement released in February 2000, called 'Workforce 2010: Labor Initiatives – Down Payments on the Knowledge Economy'. The policy statement promises to establish a Workforce Forecasting Council, encourage 'partnerships with State and Local government 'to ensure that workers have the skills necessary to take up opportunities in new and growing [knowledge industries] and targeted training and retraining programs.

The knowledge economy as human or 'intellectual' capital was posited by Stewart (1998), who proposed three sources of intellectual capital: Human Capital (the organisation of people so that they can produce innovative products or improve the businesses' processes), Structur

Capital (the techniques and technologies that capture human capital in forms which can be used to create commercial value) and Customer Capital (the relationships an organisation has with its customers and suppliers ranging from the crude and low-knowledge buyer-seller relationship to the knowledge-rich partnerships between the relevant parties). Intellectual capital is 'the sum of an organisation's patents, processes, employees' skills, technologies, information about customers and suppliers, and old-fashioned experience' (Stewart, 1998:66).

The emergence of this sort of knowledge economy relies, in part, on the restructuring of existing research and development resources and practices away from academic, intellectual, public interest or philanthropic ends to explicitly profit-oriented ends. Knowledge (its creation and application) consists of structured social practices within institutions where research is routinised, science is standardised, and educational workplaces are managed to encourage the creation of basic research (Noble, 1977:322). The view of the knowledge economy as the restructuring (for commercial ends) of the research and education sectors is particularly pertinent given the policy directions of the Australian Government. The Commonwealth Minister for Education, Training and Youth Affairs, for example, has proposed to give himself the power to guide the 'independent' Australian Research Council 'on the broad direction of its research activities within the context of the strategic planning process', to determine the balance of the priorities for grants, and to introduce greater competition for grants. The Minister has given a reassurance that 'the current balance between basic and applied research would be maintained for the time being' (Kemp, 1999).

The Knowledge Economy as the Privatisation of Intellectual Labour and Experience

A necessary, but not sufficient, element for the exploitation of knowledge is that knowledge must have the capacity to be 'transferred easily to others'. The fundamental requirement for knowledge to be commercialised in a capitalist economy is that knowledge must be transformed into a privatised commodity. New knowledge of processes, products or services are privatised through legal forms such as copyright,

intellectual property, licences, patents, the registering of Internet domain names, trade marks, and trade secrets. Once knowledge has become private property, it becomes relatively impervious to the claims of non-owners, even though there may be other legitimate interests in the (now) privatised knowledge on the grounds of human rights, consumer rights and public interest. Australia imports significantly more of the product groups reliant on patent, copyright and trade mark protection than it exports (Productivity Commission, 1999:xvi).

Patent data is gathered from national patent offices of different countries around the world by the World Intellectual Property Organisation. In 1996, 8,484 patents had been lodged in Australia, compared with 107,106 in the US and 18,257 in the UK (Department of Industry, Science and Resources, 1999:53). Another measure of patent applications and patent grants comes from data from the US Patents and Trademarks Office, which in 1996 showed Australians applied for 1,057 patents compared with 106,892 in the US (Department of Industry, Science and Resources, 1999:21).

The privatisation of knowledge is not inevitable, and are often contested. A diverse, uncoordinated range of groups in Australia (as elsewhere) are concerned about the types of controls, limits, rights and responsibilities being prescribed over privatised knowledge. In the late 1990s in Australia there has been debate, demonstrations and lobbying of governments and businesses by:

- authors, who are fighting for control over the rights of the scripts they write for films. Their rights of copyright have been opposed by multi-national media owners such as Rupert Murdoch whose lawyers argue that as the writers are preparing the scripts for his movies the scripts become Murdoch's private property. Authors and journalists are also fighting to strengthen the relatively weak sanctions for illegally breaching copyright;
- librarians, who are fighting for the right to make books and other publications available to the public in the public interest, without having to pay publishers a fee for the use of 'their' publications;

- consumer groups, who are fighting against the almost unrestricted powers of secrecy that agribusiness, pharmaceutical and bio-medical companies can impose on private property (knowledge in the form of genetically modified agricultural products and food, cloned animals, the copyrighting of DNA sequences, etc.), even though these products may have serious effects on people's health, the environment, and non-genetically modified industries;
- law reform advocates, who are concerned about the inadequacy of privacy laws because two years after the Australian Telecommunications Act, 1997, required the establishment of an industry self-regulation body (a market-driven and weak form of protection) it still had not developed an industry code; and
- consumer groups, who are fighting for the privacy rights of customers and to prevent credit card and other holders of personal financial details from selling their customer knowledge (information databases) to others.

The development of the knowledge economy also appears predicated in part on the alienation of public assets. The Howard Federal Government announced in its 2000-2001 Budget, for example, that it would sell off publicly owned bandwidth to keep its budget in balance (bandwidth is the medium through which radio, television, mobile telephones and other communication services are broadcast). There has been no debate at all about the social and economic benefits or costs of keeping bandwidth within public ownership or the effects of privatising this public asset.

Combinations of Approaches

In many instances, descriptions and explanations of the knowledge economy have combined the five perspectives just outlined in various ways. The OECD (2000:55), for example, contends that changes in European industry, brought about by innovation and new technologies, have produced an economy where competitiveness now depends on 'the capacity to generate, process and market knowledge-based products, which marks a shift from tangible to intangible - material - factors of production'. The 'intangible' assets that now give a firm a competitive

edge 'include R&D capital, marketing capital, educational organisation, the innovative and entrepreneurial know-how embodied in the persons of the organisation as well as their capabilities to work as a competent team'.

Alternative Economic Models

For nearly two decades the dominant economic paradigm in Australia has stressed policy prescriptions consistent with market competition, free trade, deregulation, fiscal balance, privatisation and labour market deregulation. From this perspective, as the Secretary to the Australian Treasury has argued, the rapid 'growth of services, including the so-called knowledge-based industries... lie in a long period of structural reform starting with the financial sector in the early 1980s, progressing through aggressive tariff reductions from the late 1980s and continuing through the 1990s with reforms to government-owned enterprises, to the labour market, to the financial sector again and, finally, to the framework for the conduct of macroeconomic policy' (Evans, 1999: 2).

However, governments have become aware that, while micro-economic reforms may be necessary, they are not sufficient for economic growth. The emergence of interest in the 'knowledge economy' has reinforced the view that government intervention in economic development was not just valid, but essential (Bureau of Industry Economics, 1992; Howard, 1997; Department of Education, Training and Youth Affairs, 1999; OECD, 1999). In policy terms, the Commonwealth industry department (in its various portfolios) began to succeed in reasserting the relevance of industry policy in spite of the scepticism of Treasury and its fellow-travellers within the bureaucracy.

This policy direction was reinforced by the rediscovery of neo-Schumpeterian and strategic trade theories, with their focus on 'creative destruction', innovation, research and development, and technological diffusion (Coates, 1999; Australian Business Foundation, 1997a; Sheehan, 1999).

Economic policies may also be built on an alternative analysis of the emergence of the knowledge economy, based on Social Structure of

Accumulation theories of what appears to be a change to the long-run patterns of capital accumulation (Kotz *et al*, 1994). In brief, Social Structure of Accumulation approaches draw attention to three inter-related processes: processes of capital accumulation; the social structures which are created and reproduced to assist accumulation; and the crises within and between the accumulation processes and the social structures.

For example, larger than average profits (and a higher rate of capital accumulation) are being generated in the new knowledge sectors (telecommunications, software, manufacture of computer chips, etc., as well as in the 'non-IT' sectors, including elaborately transformed manufacturing, engineering, science and other new technology-based sectors of advanced capitalist economies). In turn, these changes in accumulation are being assisted by changes to the social structures which support accumulation in these sectors: new (or revised) intellectual property and other laws and regulations; refocusing of government funding support to the knowledge sectors; restructuring of education, training, professional and other support associations for industries in these knowledge sectors; and so on. Consistent with the conflict which is inherent in this model, the social and economic changes are being challenged by various groups.

Conclusion

Clearly there is no one dominant conceptualisation of what a 'knowledge economy' is, and empirical evidence exists for each of the various understandings. For those working to explain, or to stimulate policies to address, the emergence of the knowledge economy, the debate has taken place within very narrow parameters in Australia.

The focus in Australia to date has been on the introduction and use of information and other technologies, the importance of firm-level changes, and skills gaps in the workforce. Analyses of customer and business privacy, worker and consumer rights, controls over intellectual property, and other issues have barely begun (except on isolated issues such as genetic modification of food or the right of the Commonwealth Government to censor erotic/pornographic content on the Internet). By

contrast, this broader debate is taking place in the US and European Union (for example, a European directive on private data protection that took effect in October 1998 stipulates that, when data is transferred from one country to another via a third country, the third country must possess a level of data protection that is at least as effective as that in the EU).

The limited understanding of the knowledge economy has in turn limited the scope of policy options and limited the analysis of potential consistencies to support social change. Despite the general lack of debate, analysis and concerted action, this nation's laws, regulations, work practices, inter-firm relations, education and training, government-business relations and other economic institutions are being changed slowly to help the private sector to profit from some forms, at least, of the new knowledge economy.

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