

Exploring the Knowledge Economy/Society

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The paper will explore the debate that has emerged both globally and within Aotearoa/New Zealand about what constitutes the knowledge economy/society. The examination will address how it has been theorised, defined and measured drawing upon both economic and sociological writing. The confused nature of the idea of the knowledge society and economy is revealed through a review of the literature and of public debate within New Zealand with respect to the economic and social transformation of the economy to increase global competitiveness and create a new sector to spur our growth.

The paper will be structured in five sections. The first will examine the rise of the Knowledge Society/Knowledge Economy debate. The second will examine the growth of the idea of KBE/KS with respect to Aotearoa/New Zealand. The third will consider the issues around definition and measurement and the final section will focus on the methodology, which will include the application of quantitative and qualitative analysis, structural modelling, and simulation based approaches we consider that these strategies will enable us to gain a clearer understanding of how the emergence of this new component of the economy and society creates new forms of inclusion and exclusion. The final section will examine some of the emerging policy questions and issues that we have identified to date.

Exploring the Knowledge economy/Society.

One of the enduring debates within social science is what drives change. There have been advocates for technology, economic wealth generation and for the part played by individuals as innovators and entrepreneurs. With respect to technology it is important to consider whether all technological changes have the same impact or whether there are defining technologies that create particular ways of producing economic and social transformations. Such technologies can be defined as General Purpose Technologies (Carlaw et al 2005) and would be relatively few. The invention of the printing press, the creation of steam power (industrial revolution) and electricity (dynamo) and the invention of telecommunications (computers and electronic communications) creating the basis of the present “information revolution” would be among them. With respect to the economic determination of change the key here has been in the way that land, labour and capital have been combined and valued under systems of agrarian, industrial and now “informational” production. In the first land was the key, in the second industrial capital and machines leading to the growth of manufacturing, cities and industrial labour force. In the present the debate centres on whether the “new knowledge economy” has shifted the emphasis sufficiently to human capital rather than fixed capital and virtual rather than real interconnection. Are these shifts sufficient to require new theories to understand the economic and social consequences? Is a new social transformation thus occurring?

Information as a central driver of production appears to require new forms of organisation favouring the more flexible and responsive idea of networks rather than institutional structures (Castells 2001, 2004). Forms of explanation have shifted from linear causality to a greater appreciation of path dependency and complexity (Urry 2000, 2003). Combinations of technologies and social and cultural practices mediated by local and global political relations are now part of what has to be considered to explain the growth of new forms of technological and economic activity. This favours explanations that explore the past as a way of understanding the present. It requires a deeper and more sustained empirical analysis than is seen in much of the debate about either the knowledge society, knowledge economy or information society.

The paper will be structured in four sections. The first will examine the rise of the Knowledge Society/Knowledge Economy debate. The second will examine the growth of the idea of KBE/KS with respect to Aotearoa/New Zealand. The third will consider the issues around definition and measurement and the final section will focus on the methodology we are developing to gain a clearer understanding of how the emergence of this new component of the economy and society creates new forms of inclusion and exclusion to provide understanding of its its distributional and social policy consequences.

Knowledge Economy and Knowledge Society

The emergence of a debate about the arrival of the ‘Knowledge Economy and Society’ came when industrial societies began to be restructured and transformed into ones with a greater dependency upon ‘information’ based areas of activity. Writers such as Drucker (1959,1969,1994) and Bell (1973) saw this as part of a move towards a ‘post-industrial’ economy and society. The initial focus on ‘information’ shifted in the 1970s to a greater emphasis on ‘knowledge’. This was accompanied by a re-emphasis on ‘human capital’ as an individual good, which enhanced the earning capacity of the individual and recognised more strongly their contribution to overall wealth generation. This stimulated attention to innovators, entrepreneurs, and knowledge managers as the key to economic growth and change. Increased attention to the rights and capacities of the individual within society more generally, as part of a wider liberalization and deregulation of economic and social activities, also gathered strength during the latter decades of the 20th century (Giddens 1991, 2001, Beck 1999). The linkages between the increased importance of knowledge as the driver of economic growth and wider social transformation became a theme in much of the writing that emerges. For example Stehr wrote that: “ *central to my thesis is that the origin, social structure and development of the knowledge societies is linked first and foremost to a radical transformation to the structure of the economy.*” (Stehr 1994, 122).

Economists typically (but not exclusively) focus more narrowly than sociologists upon the changed role of knowledge in economic activity. For example the OECD

defined a KBE as “*economies, which are directly based on the production, distribution and use of knowledge and information* (OECD 1996). In both the work of sociologists and economists it is the importance of the digital technologies, the Internet, computers, information and globalized networks that these technologies enable that have been stressed. It is now the “age of speed” time and space have been compressed (Harvey 1989, Virillio 2004). There is an increasing shift of activities to computers rather than these being carried out in specific locations. Testing of products can now be done through simulation on the computer. People can work from home (Felstead et al 2005, Leonard and Thorns 2006). People can create virtual worlds in “my space” and live out their lives in cyberspace. Whilst not all are involved in these activities it does extend the range of possibilities and gives more prominence to ‘mental’ labour rather than physical labour carried out in discrete places. Knowledge is now seen as the primary source of competitiveness and the desire of governments is increasingly to create innovative and ‘smart citizens’. Extending what constitutes knowledge to the “cultural and creative” sector is now incorporated into the discourse on the knowledge society as this sector has gained increased recognition as a potential contributor to economic growth. Through this emphasis on knowledge as the driver of economic activity knowledge itself has become a commodity and becomes traded across global networks creating new patterns of international migration – the brain drains and brain gains. New Zealand data shows that there is a brain exchange taking place with both inflows of highly qualified and losses of New Zealand nationals, especially those under 30 (MRST 2006).

Aotearoa/New Zealand and the Knowledge Economy/Society

When did the discussion around Knowledge Society/Economy begin in New Zealand? The central importance of the drive for a Knowledge based economy was recently reiterated by Hon Dr Michael Cullen in his 2006 address to the AUS conference where he stated that “*Our aim is a high income, knowledge based economy, which is both innovative and creative and provides a unique quality of life to all New Zealanders*”. He further noted that “*the innovation that drives higher productivity comes from investment in science and technology; it comes from research and higher skill levels*’ (Cullen 2006)

Debates around the need to establish a knowledge society (and the implications of not doing so) emerged during the 1990s, as the impact of Information Communication Technology based upon the creation, recording, and distribution of knowledge and information became increasingly clear, as did the significance of New Zealand developing it's own identity as a knowledge society within an increasingly global information network:

“As international competitiveness becomes increasingly knowledge-based, New Zealand faces a real challenge to achieve the level of technological innovativeness required to succeed in a global economy. Economic performance is increasingly based on knowledge and information. Knowledge is now recognised as the driver of productivity and economic growth, leading to a new focus on the role of information, technology and learning in economic performance...urge you to recognise the challenges facing New Zealand if it is to succeed as a knowledge-based society. I hope that you will recognise that meeting these challenges will require a significant shift in the skills and knowledge of New Zealanders, to achieve a more highly skilled and knowledgeable workforce” (Buwalda 1997, pp.5).

A key element in mapping the evolution of the Knowledge Society in New Zealand is the development that has taken place in the educational sector, in terms of policy and enrolment focuses and societal attitudes. Science-based studies are seen by many as the key to developing innovation and networks within the fields of biotechnology and information technology (although the supply of such students is not so obvious to see):

“Human resources in the field of science and technology are of particular importance. The accumulation of scientific and technological knowledge is important in this regard. Knowledge is a key element in developing innovation, which leads to technological and economic growth. The handling, adaptation and transformation of new complex technologies, require an appropriately skilled workforce” (HRST Report 1998, p.6).

Over the 1990s and into the present century there has been an increased value placed on education contributing towards a knowledgeable and skilled workforce, as seen in the number of New Zealanders participating in tertiary education and the perceptions of the beneficial outcomes of such study, although the issue of open-entry in New

Zealand has to be considered. In 1998, a report entitled 'Human Resources in Science and Technology concluded that "*in 1996, approximately 960 thousand people were participating in some kind of education or training programme...scientists and engineers...enjoy quite a high socio-economic status*" (pp.4-5). This increase in value and acknowledgement of knowledge attaining endeavours extends to an increased awareness of the significance of investing in 'human capital'. Further the report commented that, "*a nation's human resources in science and technology can be seen as a determinant of its economic potential, a productive and educated workforce is necessary for long term economic growth*" (HRST p.6). The report outlines the following factors as being significant 'drivers' of the need for Human Resource development in science and technology:

- The shift to a more knowledge and technology based economy and society
- The importance of human capital as a national resource
- Globalisation and waves of new technologies
- The desire for competitive advantage

Collaboration is another cornerstone of the focus towards a knowledge society and economy within New Zealand. A more cohesive and co-operative approach to the development of education policy and curriculum, which would provide the necessary training for the anticipated technology/knowledge society, was seen to be advantageous. This move is increasingly reflected in Government research and development strategy where collaboration across institutions and disciplines is now stressed and funding is shifting from outputs to outcomes. This is intended to give greater emphasis to the contribution that the research can make to longer term strategies through providing the 'evidence' base now sought for framing economic and social policy.

The Labour led coalition government of 1999 placed developing a Knowledge based economy and society and achieving the necessary "economic and social transformation as one of its key objectives. This was showcased in the Catching the Knowledge Wave Conference in 2000 where the pivotal role of research based knowledge was stressed (True 2006). In opening the conference Prime Minister Helen Clark stated:

“While others have been transforming their economies and societies through the application of knowledge and innovation, we haven’t kept up with them”

In 2001, the Minister of Research, Science and Technology Hon Pete Hodgson, released a document entitled ‘*Transforming New Zealand*’ which further outlined the government’s approach to the development of a knowledge society and economy in New Zealand. In this report, the government recognised the role of knowledge in creating a prosperous economy and society. Collaboration, notably amongst the science sector, highlighted New Zealand strengths of innovation and adaptability and was seen as central to maintaining and enhancing our international networks. The Minister outlined the official contributions being made in order to facilitate the growth of new ideas:

A wave of innovation is already discernable through Government with policy initiatives in tax, education, immigration and economic development. As Minister of Research, Science and Technology some of my specific initiatives include increasing private sector research and development (R & D), investing in basic and strategic research, and monitoring and evaluating research outcomes.

The Minister in 2001 also emphasised the government’s awareness of not only the need for financial investment in the production of a knowledge-based society, but also the importance of investing in people by offering opportunities for skill development. The New Zealand Venture Investment Fund is a “*one-off \$100 million outlay [to] act as a catalyst for private sector venture capitalists to boost funding for our investors*”. The Minister expressed a confidence in the potential benefits for New Zealand in the social and economic sectors as a result of the investment in the knowledge society.

The first Knowledge Wave conference led to the creation of the Knowledge Wave Trust as part of the creation of new public-private partnerships to promote the required economic and social transformation.

In 2003 a second Knowledge Wave Conference was held focusing on “leadership”. It is interesting to note that the majority of the keynote speakers were “international experts” who had ‘for the most part had no prior experience of the New Zealand

economy or society” (True 2006: 42). After the second conference the Knowledge Wave Trust established a new policy think tank the New Zealand Institute.

The Government in 2002 launched the Growth and Innovation Framework (GIF) to assist in the development of the skills and talents for a knowledge based economy. The development of an efficient and productive knowledge economy was seen as relying upon upskilling and innovation. The GIF framework is part of the strategy to reposition New Zealand within the global economy to enable it to grow its wealth and create new areas of activity alongside its traditional agricultural base. Focusing on “knowledge-based” economic sectors such as biotechnology, ICT, design and screen production were considered to be the ones that would create for New Zealand the new “winners in the global market. Tertiary reforms, including the new performance Based Research Fund (PBRF) were further initiatives taken by government to ensure the creation of the required skills mix to shift New Zealand to a KBS.

Measuring the KBE/KS

There are substantial challenges facing work in this area. These are both at the theoretical and methodological level. A more consistent set of definitions is required and more robust measures that are derived from theory rather than from what is currently or conveniently available. For an economist the question has been is the ‘Knowledge Economy’ a *fundamentally* new economic paradigm, with new drivers or is it just “*hype*”? Whereas sociologists have asked is the ‘Knowledge Society’ *fundamentally* different from what preceded it? The first issue we face is one of potentially viewing a *process* rather than an *outcome*. The past periods of transformation’, such as the industrial revolution, have occurred. For those studying the ‘knowledge society’ the twin problems of definitional limitations and the potential lack of a complete historical lens complicate analysis. We may simply conclude ‘the world is no different to the past’ simply because change is incomplete.

From the work we have done to date it is clear there is considerable disagreement as to the central components of either the knowledge economy or knowledge society which complicates the development of robust measures (Carlaw et al 2006). There have been a variety of attempts to create measures for the KBE and KS. For example APEC defined a KBE as “*an economy in which production, distribution and the use*

of knowledge is the main driver of growth, wealth creation and employment across all industries". However they also acknowledge there are few indicators that directly measure the extent to which a country is already operating as a KBE as distinct from its capacity to become a KBE. The indicators that are favoured would be the percentage of GDP contributed by the knowledge based industries and the percentage of the labour force that consists of knowledge workers. To apply these measures would still require the resolution of who are 'knowledge workers. Is this to be determined by the task they perform, by their formal qualifications or by their outputs and degree to which they are dependant upon the global networks and new information flows? Further there is the consideration of the fact that to be a "knowledge worker" implies that they transform information rather than just receive it passively. This leads us to a focus on the contribution of human capital and its generation and maintenance. There is also the complication of the differing forms of knowledge that are now being recognised, especially the difference between formal and tacit knowledge. Houghton and Sheehan (2000) recognise this where they write:

A knowledge economy is one in which knowledge is a key resource...one in which the generation and the exploitation of knowledge has come to play the predominate part in the creation of wealth. It is not simply about pushing back the frontiers of knowledge; it also about the more effective use and exploitation of all types of knowledge in all manner of economic activity

To adequately deal with the dimensions identified would require measures that allow us to understand the knowledge inputs and outputs, flows of knowledge and the stock of knowledge (OECD 1996). One of the disputed areas here relates to what counts as knowledge. Here sociological work has pointed to this as a contested arena and reflective of local priorities and decisions about the privileging of particular forms of knowledge generating activity with respect to for example the public funding of R and D. Widening the scope of what gets included is also being suggested as in the recent work of the US Progressive Policy Institute where they suggest

'the new economy is about the transformation of all industries and the overall economy. As such the New Economy represents an array of forces. These include the reorganisation of firms, more efficient and dynamic capital markets, more economic 'churning' and entrepreneurial dynamism, relentless globalization, continuing competition, and increasingly volatile labour markets" (PPI 2003)

To provide a way of measuring these complex shifts they suggest 21 indicators divided into five categories which are knowledge jobs, globalization, economic dynamism and competition, transformation to a digital economy and technical capacity.

The idea of a knowledge society has been employed more, than the KBE, in wider discourse about change within society and the focus has been more on the creative potential and knowledge embodied in people” The UN work here sees

ICTs are best considered as tools or facilitators which may substitute under certain conditions for other means of knowledge creation in innovative societies. These technologies do not create the transformations in society by themselves; they are designed and implemented by people in their social, economic and technological contexts” (UN 1997).

To attempt to measure these changes the UN has developed two measures. The ICT Diffusion Index (UN 2005) which is designed to measure ICT connectivity (number of internet host per capita and number of telephone lines per capita) and the Index of knowledge societies which attempts to measure the ‘foresightedness a country displays in its quest to become a “knowledge society’. However, much ambiguity still exists and the measures are not precise as the UNESCO World report *Towards Knowledge Societies* acknowledges where it states,

“While there is general agreement on the appropriateness of the expression (Knowledge Societies), the same cannot be said of the content. Which types of knowledge are we talking about? Do we have to endorse the hegemony of the techno-scientific model in defining legitimate and productive knowledge? And what of the imbalances that mark access to knowledge and the obstacles confronting it both locally and globally?” (UNESCO 2005 5)

One of the more comprehensive attempts to create such a range of measures is the INEXSK framework (Infrastructure, Experience, Skills, and Knowledge). It uses eight indicators chosen on basis of their availability and value in provoking thought about different patterns of development in Knowledge Societies. The eight indices are – personal computers per capita, main telephone lines per capita, electronics consumption, proportion of technical graduates, literacy share (percentage population

literate), Internet hosts and televisions sets per 1000 population. This range certainly extends the areas being examined but still to a large extent is driven by availability and provides at best only a fairly crude metric. For example, the number of internet connections or ownership of personal computers does not show the speed or quality of these devices and connectivity both of which are crucial to the ability to maintain access to the expanding world of information and knowledge now available.

How will we measure?

In order to identify the size and composition of the KBE one inevitably faces the issue of quantifying its extent and composition. Economists and national statistical organisations are naturally drawn to the workhorse of the ‘System of National Accounts’ as a source of such data. Introduced during WWII as a measure of wartime production capacity, the change in Gross Domestic Product (GDP) has become widely accepted as a measure of economic growth. However, GDP has significant difficulties in interpretation and usage (especially as a measure of wellbeing) which has led to the development of both ‘satellite accounts’ (ref) – additions to the original system to handle issues such as the ‘tourism sector’; ‘transitional economies’ and ‘the ‘not-for-profit sector’ and alternative measures for example, the Human Development Indicator and Gross National Happiness (ref). GDP is simply a gross tally of products and services bought and sold, with no distinctions between transactions that add to well-being, and those that diminish it. It assumes that every monetary transaction adds to well-being, by definition.

Organisations like the ABS and OECD have adopted certain implicit/explicit definitions, typically of the Information Economy-type, and mapped these ideas into a strong emphasis on impacts and consequences of ICTs. The OECD’s *Information Economy Unit*:

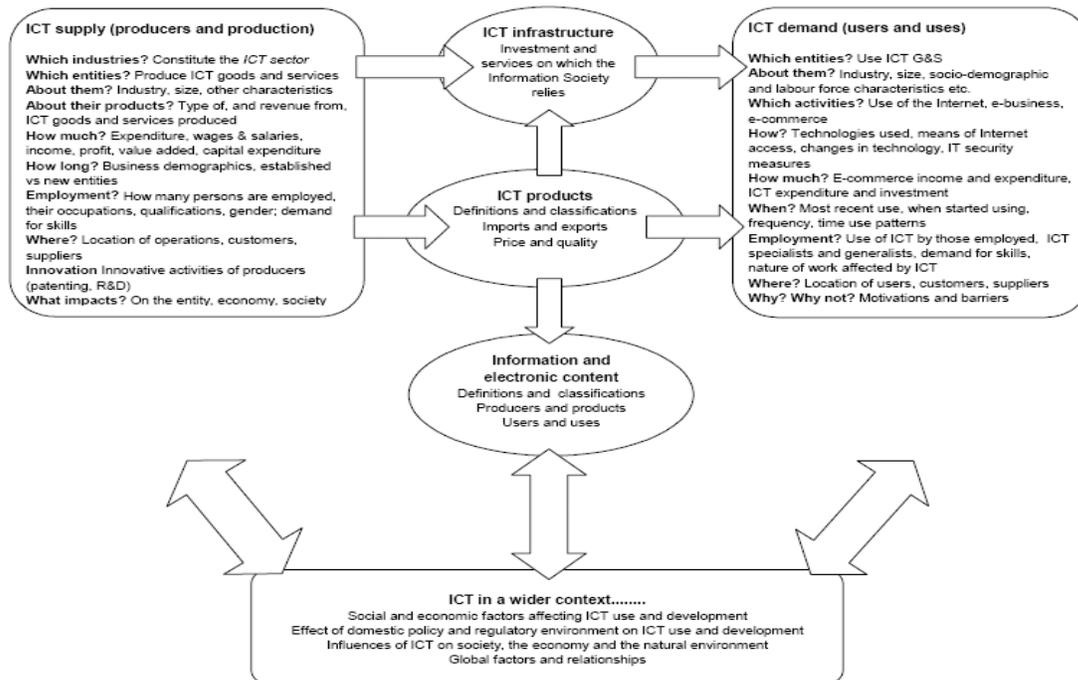
“..examines the economic and social implications of the development, diffusion and use of ICTs, the Internet and e-business. It analyses ICT policy frameworks shaping economic growth, productivity, employment and business performance. . the Working Party on the Information Economy (WPIE) focuses on digital content, ICT diffusion to business, global value chains, ICT-enabled offshoring, ICT skills and employment and the publication of the OECD Information Technology Outlook..”
www.oecd.org/sti/information-economy

Furthermore, the OECD's Working Party on Indicators for the Information Society has

“agreed on a number of standards for measuring ICT. They cover the definition of industries producing ICT goods and services (the "ICT sector"), a classification for ICT goods, the definitions of electronic commerce and Internet transactions, and model questionnaires and methodologies for measuring ICT use and e-commerce by businesses, households and individuals. All the standards have been brought together in the 2005 publication, *Guide to Measuring the Information Society*.

The whole emphasis is on ICTs for example the OECD “*Guide to Measuring the Information Society*” has as chapter headings; Chapter 2, ICT products; Chapter 3, ICT infrastructure; Chapter 4, ICT supply; Chapter 5, ICT demand by businesses; Chapter 6, ICT demand by households and individuals, and a schematic as below.

Figure 1. Information society statistics conceptual model



From OECD “*Guide to Measuring the Information Society*”

It is understandable why this route has been taken, the impact of ICTs is somewhat narrower and amenable to measurement than 'knowledge', but the use of 'information' rather than 'knowledge' is an important distinction.

Points of departure and potential for progress

Some of the key features/issues that arise in the KBE are:

- i) The increasing (but not exclusive) importance of ICTs in economic and social activities. The access to such technologies will be both enabling (GPTs) and have the potential for exclusion and differential effects – 'winners and losers'. This is not new – the introduction most/all new technologies have lead historically to winners and losers, both in the short and longer term.
- ii) The increasing proportion of 'human capital' involved in productive activities.
- iii) The changing role and importance (and ownership) of intellectual property in productive activities. When information is a key input in economic activity its ownership and control will assume higher importance. Intellectual 'property' v. Intellectual 'commons' will affect access to this resource and there will be winners and losers in the Information Economy as a consequence.
- iv) The changing nature of the 'theory of the firm'. The current economic theory of the firm is based upon firms having ownership/control of physical capital where 'workers' are employed by owners/managers to work with this owned physical capital (see GHM). As we move to 'human/knowledge-capital only' firms, the modern theory of the firm is left without theoretical substance or reason to exist. The distinction between owners (of capital) and workers (human capital) becomes blurred and economic theory stumbles.
- v) The Information Economy has typically focused upon ICTs, however, the KBE surely stretches into bio/genetic engineering issues where intellectual property, human capital and 'knowledge' have a key/dominant role. The economic and social impacts of genetic engineering, and nanotechnology have typically not been established.

- vi) Measuring the extent/effects of the KBE can occur either directly (physical/monetary values of its effects – both positive and negative) and/or indirectly via the *consequences* of the growth of knowledge effects for example, on work practices, employment patterns, social inclusion, health/wellbeing/crime/surveillance, environmental and especially energy use consequences etc.

Key to a quantitative measure of the size, extent and effects of a KBE therefore relate to a theoretical definition which would necessarily have an important (but not exclusive) role for ICTs; a measure of the size and distribution of ‘human capital’ and some boundaries where knowledge does and does not (ever?) contribute to the economy/society.

On the basis of currently available data from the System of National Accounts (SNA) we can measure ‘OECD-type’ measures of the *Information Economy*. It is generally quite easy to measure the extent and growth of a range of ICT-related goods and services for example, Computers per person; Internet hosts; IP addresses; Email addresses; Internet companies; Mobile phones, etc., but without other data for example, speed of connection; use of computers etc., these summary measures remain simply that. Furthermore, what are the critical levels of eg., computer availability; mobiles phones per ‘000, when the economy is to be deemed an ‘Information Economy’ or a ‘developing Information Economy’ etc? To answer these questions requires a clearer theoretical base to inform the statistical measurement.

We can focus more explicitly on some possible implications of a more networked economy/society, ie., the composition of labour force transitions including; Hours worked; Flexible work environment (i.e., home based work); Service workers; Knowledge intensive versus non-knowledge intensive sectors. In addition the size, composition and growth of New and Emerging sectors, where Services are a sector here, could be measured and tracked. The KBE and role of ICTs as GPTs is postulated to have had effects (mostly delayed) on productivity. One way to track the influence of knowledge on the economy is hence to measure productivity effects via Total Factor Productivity (TFP) as well as direct measures of technological change, i.e, electronic ICTs.

A key feature of the KBE is human capital. Discussion on the role of human capital has a long history in economics see Smith (1776) etc., and has been measured since Petty (1690). For up-to-date surveys on the area see Wossmann (2003) and Le et al (2003). However, these types of measures remain mainly ‘academic’ and the national systems of accounts would typically only include such things as occupational/industry level employment/participation/hours of work data; employment by ethnicity; regional employment differences; qualifications of the employed workforce. These educationally related data can be enhanced directly from University Calendars; educational attainment and curricula composition shift data (from say arts to computer science etc.), however, these are typically anonymous and not linked to specific industry employment/output effects.

Information as an ‘input’ – Knowledge as a ‘transformation process’ to an ‘output’

As shown in Carlaw et al. (2006), the words ‘information’ and/or ‘knowledge’ are attached to various definitions/concepts. The recent UNESCO Report (2005) uses the terms interchangeably for example,

“the rise of the global information society has allowed a considerable mass of information or knowledge to be disseminated via the leading media. However, the different social groups are far from having equal access and capacity to assimilate this growing flow of information or knowledge.” (UNESCO Report 2005, p 160.)¹

Beyond knowledge we have ‘wisdom’ – McKenna and Rooney (2005), which is something that “coordinates knowledge and judgements about the ‘fundamental pragmatics of life’...’knowledge with extraordinary scope, depth and balance...excellence of judgement and advice...” Information, Communication Technologies (ICTs) identify technologies, typically embodied in physical devices like cellphones, computer terminals, etc., which utilise or transmit/receive information, but we would argue are not themselves measures of ‘knowledge stocks or flows’. Knowledge will be required to create them, but their existence, stock and growth rates alone do not represent the growth or otherwise of the Knowledge

¹ Note also here the potential confusion on ‘access to’, ‘dissemination’ (terms we would ascribe to information) and ‘capacity to assimilate’ – what we would call ‘knowledge’

Society/Economy (although they may represent and measure the growth of an Information (using) Society, though that could be challenged unless we know something about utilisation rates rather than simple stocks). Creating more and cheaper access to the Internet via broadband, computer terminals, freeware etc., may increase the flow/diffusion (and reduce the cost) of information (although potentially at the risk of quality of the 'information' – for example in such sources as Wikipedia), it does not necessarily have the same impact on knowledge creation. There may be more apparent equity in access to the inputs, but still remain an elite of knowledge-output creators/diffusers (role of education here as a means of process/producing knowledge from the accessible information). Investing more in R&D may facilitate the creation of knowledge, but this requires the knowledge creators/assimilators/diffusers working with the necessary (R&D) equipment which facilitates knowledge creation. Once codifiable, this knowledge may be disseminated as a form of 'new information'. Those receiving this new information must be able to assimilate/use it – that is they need to have the necessary mental tools (human capital) to process it and potentially use it to create yet more new knowledge. Patents are a particular form of 'codified technical knowledge', measures of which are easily accessible. However, 'secrecy' is sometimes used to protect commercially valuable technical knowledge as the patent application requires the full disclosure of the new technology. The classic case here is the obvious one of the Coca Cola recipe.

Those without these specialised processing/transformation skills will remain 'outside the knowledge club' whilst those with these valuable information transformations skills may benefit at the expense of others – there remain 'winners and losers'. More new information may be created by those with 'knowledge-creation capacities' than in the past as the access to information through ICTs is spread more widely leading to assimilation facilitated by more R&D. This may enable a new production paradigm less constrained by traditional diminishing returns to scale (the New Economy), but the distribution of these gains remains an unresolved issue. Those talking of the New Economy or Goldilocks Economy seem to be alluding to these post-industrial production economic paradigm shifts. If knowledge either disembodied or embodied in human capital is the source of these new economies of scale in production, the lack of it in 'economically poorer' economies may actually exacerbate the 'knowledge divide' even although the information/digital divide may appear to be narrowing.

Accessing ‘knowledge’ we would argue necessarily requires accessing the creators/assimilators of knowledge and these are inherently ‘human’ and not technologies alone ICTs etc are complementary and not substitutes. These knowledge creators/workers/owners have the potential to be highly internationally mobile (unlike the old economy physical capital or land) which has the capacity to either *reduce* the knowledge divide or *increase* it, but importantly at *much higher speeds*. Buying the necessary knowledge creators/assimilators is like buying physical capital except the ownership of the ‘means of production’ is now vested more with the capital itself (human) than in the past modes of production. This has the potential to affect our understanding/modelling of the traditional ‘theory of the firm’ (Grossman Hart and Moore) which is vested in the ownership of **physical** capital alone. We consider this in more detail below.

Theory of the Knowledge Firm

The modern theory of the firm is best summarised in the work of Grossman and Hart, (1986), Hart (1988, 1989) and Hart and Moore (1990), where ownership and control over physical capital (machinery etc.) is key to the reason why firms exist. Owners/managers employ labour who cannot work without the physical capital these firms control. Dismissal/resignation of the labour requires them to find other physical capital owning organisations (firms) to employ them. On liquidation of the firm, physical capital can be sold and the proceeds disbursed to the owners (shareholders).

Once we move to a situation where firms may own/need **no** physical capital, then the modern theory of the firm loses its main reason for being. Once human capital (labour) becomes the most important /sole creator of wealth/value added then modern economic theory is left in limbo. If the firm comprises human capital resources (eg., a legal firm) whose accumulated knowledge is the source of wealth creation, the GHM firm theory has few answers. Now, if labour leaves a firm it is not constrained to find other firms with physical capital to employ it. The balance of power stemming from the “ownership of the means of production”, has changed. Likewise predictions about what would happen at the dissolution of a knowledge-only firm, is also unclear. Who has the rights to the sell-off of the assets, where these assets are embodied in human beings? How can these assets be sold-off? These issues, although important in the context of the economic theory of the firm may have less importance when trying to

measure the size/scale of the Knowledge Economy, but are likely to have profound effects on the idea of a Knowledge Society where the balance of (economic) power will change – owners of physical capital losing this to owners of human capital, which without slavery map one-to-one to each individual. Individual's own economic power would likely vary with their different stocks of human capital as would the price they charged to hire it to others in the form of employment.

Our methodology

We are interested in assessing the size and scale of the Knowledge Economy and Knowledge Society in New Zealand. We are interested in assessing the effects on individuals and society of the emergence/growth of knowledge based activities.

To consider these issues we need to define what we mean by a Knowledge Based Economy, what we mean by as Knowledge Based Society with a view to trying to measure the case, size and implications either directly or indirectly.

The first stage in this process is to use/create definitions of the KBE and KBS. Our work to date suggests that currently used terms/definitions are inadequate, ambiguous, confused or data availability driven. We will consider below the progress we have made towards our notions of a KBE and a KBS which will inform the second stage of our research which would be to quantify the size and characteristics of a KBE and KBS.

Stage three of the research agenda is to test a range of hypotheses on the KBE/KBS using data/indicators we have collected, informed by our 'academic' definitions. In particular, we are interested in 'who wins and who loses' as the world moves towards a (more) KBE or KBS. Furthermore, we will be able to consider some alternative pasts and futures via the creation of scenario-based simulation exercises for example, if the economy/society looks like 'this' rather than 'that' (the real past or a potential future), what would be the effects on individual 'X' with characteristics 'Y'; or the whole economy; or the whole society; or specific regions, groups, etc. A range of potential questions/hypotheses that we will consider include:

- Do all members of society benefit equally from an increase in knowledge?
- Does science education create more 'knowledge' and wellbeing than other areas of education?
- Does globalisation increase the size and/or composition of the knowledge society?
- Do knowledge societies always grow at the same rate and the same direction at all times?
- Does new knowledge increase or decrease social, educational, and skill inequalities?
- Does new knowledge increase aggregate income and wellbeing in society?
- Does the knowledge society lead/cause the knowledge economy or vice versa?
- Does New Zealand have a comparative advantage in new knowledge-based industries?
- Do new global networks form a critical part of the new knowledge based society?
- Does new knowledge lead to a change in the class structure and development of a new, knowledge worker class and a new service worker class?
- Do knowledge societies reduce or increase economic and social problems including crime, wellness/illness, social inclusiveness, etc.?
- Do knowledge societies lead to the emergence of new arrangements of work, production, shopping, education, cultural and social norms, communication, etc.?
- Is technological innovation a major driver of the knowledge society?
- What is the role of migration in the dynamics of a knowledge society?

Some examples of stage three issues include the following. ICTs have emerged as a clear new technology that is central to the growth and effects of the Information Economy. The ICTs have affected the Knowledge Economy via the role of Internet-based trading; computer hardware/software production; new modes of business; virtual firms; outsourcing, etc. We can measure these effects via their output and employment effects and can attempt to quantify some of the 'winners and the losers' here, typically from an economic perspective (see refs from ICT research at Waikato). However, at the non-economic level, the implications of ICTs are potentially 'deeper

and darker'. ICTs have increased the scale and pervasiveness of surveillance-based technologies (Lyon 2003). Reported/actual crime may have fallen/risen as a consequence of these new technologies, but at what cost to civil liberties. National Security can be extended to protect the State, but at what cost to the individual? National databases to aid for example, transplant/screening for medical purposes, have the potential to be used/abused for other purposes. Home security may protect the individual and create employment, but what is the opportunity cost of these resources?

The ICT technologies have changed what we do, how we do it and with whom in a profound, potentially 'revolutionary' way and ICTs are a necessary element in the Information Economy. Identifying the winners and losers in the ICT-driven economy/society is probably 'easier' than identifying winners and losers in a KBE/KBS, because the former is likely to be an identifiable subset of the later

Defining the KBE/KBS – some current measures and new ideas

OECD (2005)

The basis of the OECD measures are an emphasis on the role, stock and influences of ICT. They consider what comprises and ICT good or service; which ICT goods are traded and the effect of these ICT traded goods on the Balance of Payments etc. They look at the growth of the ICT sector (supply) and measure the size, scale and growth of ICT-based patents. The demand for ICT goods/services by businesses, households and firms is measured, based upon their definitions of what comprises and ICT good/service. They consider what has happened to the size, scale and growth of the ICT infrastructure including pricing issues. The role of the Internet and E-Commerce is given special treatment and some discussion is given to E-government; the digital divide and online trust.

The OECD (2005) *Guide* is all about ICTs and concentrates mainly on the economy and via this goods and service transactions rather than employment-related issues.

UNESCO (2005)

In *Towards Knowledge Societies*, the promise of a truly knowledge-based 'society' measure is offered. In chapter 10 of UNESCO (2005) the idea of *Knowledge*

Development Index (KDI) is proposed in part to enable measurement of the 'knowledge divide'. The *KDI* draws upon the work of Japan's Ministry of Education, Culture, Sports, Science and Technology, and the Government of Malaysia.

Like the OECD, UNESCO places considerable emphasis on ICT-related issues; measuring cellphones; investment in telecommunications; telephone lines; television sets; international call charges; connections to the Internet' computer power per capita; fax machines'; share of worldwide computers in use; number of computers per 1000, etc., but also measures related to the use of this information to potentially create or diffuse *knowledge*. These measures include; R&D personnel; primary pupil-teacher ratios; secondary enrolments; high-tech exports; patents granted to residents; business expenditure on R&D; total expenditure on education; business scientists and engineers in R&D, etc. However, these information access, knowledge assimilation and knowledge creation elements are all simply put into the mix.

Australian Bureau of Statistics, ABS, (2003) *Measures of a knowledge-based economy and society.*

The ABS approach is a highly data driven methodology, where existing statistical data is used to construct a range of indicators based upon three core themes:

- i. *Innovation and Entrepreneurship Indicators*
- ii. *Human Capital Indicators*
- iii. *Information Communication and Technology Indicators*

Examples of i) include:

- a) Total research and experimental development (R&D) expenditure by sector of performance (business, government, private non-profit, higher education) as a proportion of Gross Domestic Product (GDP)
- b) Expenditure on basic research by sector of performance (business, government, private non-profit, higher education)
- c) Expenditure on applied research and experimental development by sector of performance
- d) Value of venture capital draw-downs

Examples of ii) include:

- a) Proportion of all persons aged 15-64 with a non-school qualification
- b) Highest non-school qualification of employed persons by occupation
- c) Knowledge workers² as a proportion of employed persons
- d) Graduate outcomes by qualification, employment status
- e) Main field of highest educational attainment by labour force status
- f) Researchers devoted to research and experimental development (R&D)

Examples of iii) include:

- a) Internet services: number of Internet service providers (ISPs), and access lines
- b) Internet workstations available in public libraries and proportion of individuals (adults aged 18 years or over) accessing the Internet via public libraries
- c) Proportion of households with access to the Internet by type of household, state or territory and broad region
- d) Number of household ISP subscribers
- e) Use of computers and the Internet on farms
- f) Volume of data downloaded by non-household (includes business and government) ISP subscribers
- g) Number of non-household (includes business and government) ISP subscribers
- h) Proportion of households with access to a computer, by type of household, State or territory and broad region

Information is not Knowledge and Economy and Society differ

To some extent defining and analyzing the Information Sector defined by the size, scale and effects of information communication-based goods, services and employment is in principle a relatively easy exercise. Contingent on the availability of relevant data and ignoring the issues of quality changes re: price in the computer sector etc., we should be able to make progress in gauging how these particular

² Knowledge workers are defined here as those classified as managers and administrators, professionals and associate professionals in the Australian Standard Classifications of Occupations (ASCO). This definition was also used by the Department of Industry, Tourism and Resources in its publication,

technologies have impacted on the economy. To some extent the work to date by OECD and ABS has made great inroads into this issue, but has been constrained by available data and a clear theory driven definition. It is somewhat more difficult to gauge the effects on society although the metrics may help.

Knowledge is different to information. Defining 'knowledge workers' as the ABS do see in 2 above, is arbitrary and in our view misses the point of what a knowledge worker might be. Human capital is essential for knowledge creation and this form of capital is a defining characteristic of a knowledge-based firm. Knowledge workers would use information to create goods and services, however, not all *managers, administrators, professionals and associate professionals* would do this and others not in this group might. Access to information and the ability to assess and use it (literacy) are elements of the knowledge society and measures/indicators of these elements direct (literacy rates) or indirect (educational expenditure) are part of developing any meaningful measure.

Policy and Practice

In our final section we reflect on the policy and practice implications of revising our definitions and measurement tools. Clearly distinguishing between information and knowledge and how they contribute to different forms of economic growth, patterns of income and wealth distribution and thus to social change more generally are necessary to create 'evidence based economic and social policies and monitor their impact. To not do this limits our ability to test different scenarios for growth and development and estimate their impacts both positive and negative and therefore develop the most effective policies to achieve the chosen ends. In this case the end is to create a more "knowledge" based society. However, this idea – is just that, an idea about a future in which information and knowledge are more abundantly available and thus increase the overall wellbeing of the population. The specifics of how this might occur are, as we have noted, much less clearly established. Our work to date has already begun to identify a number of new policy relevant questions.

The theory of the firm and the implications that flow from a different arrangement of human and fixed capital could have long term implications for how we develop labour market policies. The question here to explore would be what has the weightless

economy done to workers, firms, ownership and control? The contemporary theory of the firm (Grossman, Hart, Moore) puts ownership of physical capital to the fore. Do we have a robust theory of the firm in a knowledge economy – we would suggest not. If and until knowledge-only driven weightless goods production can be explained by the traditional theory of the firm the possibility remains of not rejecting the notion that The Knowledge Economy represents a fundamentally new economic paradigm where the ‘old rules’ do not apply.

New forms of inequality appear to be emerging as we move into an information and knowledge based economy. In the old economy, reading, writing and the access to books was what divided the ‘haves from the have-nots’. Those with these basic skills were identifiably different from those without. Work here has moved beyond simply recording the “digital divide” to looking more closely out how this divide is being perpetuated as forms of access become important and quality of access rather than simply the existence of a connection. This requires a deeper analysis than the counting of connections that we have seen in the current range of indices. It also points to the need to develop educational programmes to create “information literacy and understanding “alongside computer skills and technologies that improve connection speed.

Recent research in France into the ‘urban riots of 2005-6 has drawn attention to the growth of social exclusion in the cities arising from poverty, unemployment, low levels of education, drug abuse and crime. The divide between those included in the knowledge based society and those excluded has become sharper and increasingly difficult to cross threatening social cohesion and resulting in a sharp increase in urban violence and reigniting debate about the creation of an urban underclass (Wieviorka 2006, Stigendal 2006)

The access to a knowledge-base of trusted information is a further area of potential ‘exclusion’ –knowledge in the past was typically expensive to acquire (books or education), but the knowledge itself was ‘trustworthy’. The modern analogy is access to the Internet and ICTs more generally. The ‘digital divide’ is in part about access and acquisition of information, much as it always was. However, the added dimension, above simple access, is about the trustworthiness of the available

information. Information is cheap to acquire, but the trustworthiness of its content is low. As in the past, information remains data without the human capital (“wisdom”) to create knowledge from combination. Reputation of the provider acts as a screen, with the role of trademarks and brands coming to the fore as they have in the past.

A significant policy question arises as to whether we treat knowledge as either a private good or as a public good. Is it created in the current information rich age solely by individual activity or is it increasingly a collective project. The history of the Internet is here an interesting case. Enthusiasts through open sources software and an underlying belief in creating an accessible and open system to share knowledge rather than restrict it largely developed this revolutionary new form of communication and connectivity. Thus innovation here has had relatively few IP patents and controls arising from such restrictions. The pirating and copying of software has been rife and restricting this has been particularly difficult. One of the interesting facets of the latest stages of this revolution is that it has been stimulated by recreational and leisure forms of consumption – gambling and on-line gaming and music.

Finally the creation of WWW 2 has brought in a whole range of new possibilities that both extend and challenge the ways that people have lived out their lives. One aspect of this that is growing is the new ‘virtual spaces’ such as ‘Second Life’ where now about 2 million participants create for themselves a virtual world in which they buy and sell commodities and live out their “dreams and aspirations creating a mingling of the ‘real and the virtual’. The entertainment world has been shaken up by the emergence of such sites as You Tube” and iTunes” (catalogue of over 3.5 million songs) Netfrix (70,000 plus DVDs available) and Myspace (120 million users taking part in a whole new society with features that maximise individuality and a place you put videos and copies of films etc) Such sites are harder to monitor and control and place new pressures on the ways and means of enforcing copywrite and intellectual property and controlling access and content.

Conclusions

The paper has explored the growth of the debate about the knowledge economy and society both globally and with respect to Aotearoa/New Zealand. The debate has been characterised by confusing definitions and underdeveloped theorising. This has

failed to distinguish adequately between the changing role of information within contemporary economies associated with the rise of new communication technologies, the place of knowledge as a component within economic production linked to the shift to human capital as the key drive of innovation and change and the wider concern to create a society that values open access to increased knowledge for all. Building a more comprehensive “nested” definition of the interrelated elements that make up the KBE/KBS is necessary to ensure that public policy and debate about future “transformational” strategies is grounded to ensure that outcomes can be monitored and outcome achieved in the most effective manner.

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