BEYOND THE HYPE: INTELLECTUAL PROPERTY AND THE KNOWLEDGE SOCIETY/KNOWLEDGE ECONOMY

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Abstract. This paper explores the debates surrounding whether or not we have now moved into a new knowledge economy and/or knowledge society and if so whether this shift is as significant and as far reaching as the industrial revolution. In this possible transformation the place of information communications technologies has been crucial. Debate has occurred across both economics and sociology with differing emphases as is shown in the ranges of definitions that we review in the paper. One consistent factor is the lack of clarity and consistency between them both within and across the disciplines. In order to explore the issues that the debates raises in a more grounded way, the paper explores them in relation to intellectual property (IP) and the intellectual commons in the process of innovation, growth and economic development. The paper is developed through an analysis first of the industrial revolution and the role within this of uncertainty, technologies, complementarities and elective affinities and the way IP was protected and controlled through patents, secrecy, being first to the market and copyright. The second part of the paper examines definitions of the knowledge economy and society and the role within these of information communication technologies in order to explore whether the ways that IP is protected and controlled have changed. In the debate about the 'knowledge economy and society' the role of innovation via human capital with a greater reliance on intellectual capabilities has been emphasized. The role of IP thus remains central but is now challenged by the rise of new forms of communication, which make its protection harder and move much of the concern with respect to regulation to a global rather than national and local level.

Keywords. Intellectual property; Knowledge economy; Knowledge society

1. Introduction

Much has been made about whether anything is 'new' about the 'New Economy' with the conclusion being that we now *are* a knowledge-based society. But in what sense, if at all, are we any more of a knowledge society now than we were

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in Neolithic times, the Renaissance, and the Industrial Revolution? What is the role of intellectual property (IP) and the intellectual commons in the process of innovation, growth and economic development? What role does technology and technological knowledge play both in the process of innovation and economic growth and in the protection of IP itself? To answer some of these questions requires a clear understanding of 'the nature of the beast', what we mean by the New Economy, how we measure the level and growth of innovations and how we test for association/causation between knowledge (both embodied in human capital and disembodied) and any consequences it might generate (both good and bad), and how we protect IP.

Foss (2002) argues that '[w]hatever we think of this journalistic concept [of the knowledge economy], it arguably does capture real tendencies and complementary changes'. What might these 'new' tendencies be?

> We define the knowledge economy as production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance, as well as rapid obsolescence. The key component of a knowledge economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources. (Powell and Snellman, 2004)

Here the 'modern' emphasis seems to be on 'knowledge' (yes) 'accelerated technical and scientific advance' (yes) and 'greater reliance on intellectual capabilities than physical inputs or natural resources' (yes). Is this all new? Marshall (1890) states that 'Knowledge is our most powerful engine of production'. MacLeod argues that '[t]he unreformed [pre-1852] patent system was at best ineffective, or at worst, a brake on invention and its dissemination' (MacLeod, 1988). Furthermore Ashton (1955) suggests that '[i]f Watt's Fire Engine Act had not extended the life of his steam engine patent we would have had a railway system earlier' and Boehm and Silbertson (1967) state that '[E]vidence placed before the 1851 Select Committee ... certainly throws doubt on a strong causal connection between our early patent system and the British industrial revolution'.

In other papers in this special issue a number of authors[1] will consider, in particular, the role of IP in the process of innovation creation/limitation and economic development. In this paper we will emphasize a *historically grounded* approach to consider what, if anything, is fundamentally 'new' about the knowledge economy/society and whether it constitutes a modern economic and social 'revolution'. The themes we will investigate mirror some of the issues raised above as potential indicators of a 'changed world' and include (1) *the role of entrepreneurship, technological knowledge creation and obsolescence*; (2) *intellectual capabilities and intellectual knowledge*; and (3) *the role of science and research and development.* In order to consider whether the modern world is 'fundamentally' different we will, through the lens of history, consider these issues with a view to then analyzing what the current literature on the knowledge economy/society really has to say.

In particular, in Section 2, we explore characteristics of the British Industrial Revolution of the 18th and 19th centuries and similar episodes in Europe, with a

view to 'setting the historical scene' for subsequent comparisons with the 'modern eras' of the 'new' 'information' and 'knowledge' societies emerging in the latter half of the 20th and the beginning of the 21st centuries. Section 3 focuses on the role of the *entrepreneur* as risk taker and innovator in a world characterized by uncertainty, complementarities and elective affinities. The analysis is illustrated with references to a range of developments that led to and potentially 'caused' the Industrial Revolution. This section continues to 'set the scene' to allow us to consider whether the world is 'fundamentally different' now to then. In Section 4, four particular forms of IP and its protection are considered including patents, secrecy, 'first-to-the-market' and copyright, to identify their historical origins, historical developments and their potential roles in the two epochs contrasted here. Section 5 presents the case for the critical role of *science and research and development* in the European Industrial Revolutions to allow an historical comparison with current debates on the assumed primacy of such elements in 'New Economy' and the potentially changing role of IP that modern developments and ownership create. With this historical background in place, Section 6 undertakes a detailed analysis of what might now define a modern knowledge economy/society via extensive reference to what others have said on such matters. The evidence from this section is that 'quantifiable, non-circular' definitions are frustratingly absent; however, 'knowledge' and the resultant role of IP creation and protection are a key component in all the cited authors' discussions. Whether IP and knowledge are 'uniquely' key to the 'New Economy' will be an issue we return to in the concluding section. Section 7 extends discussion of the role of IP in the knowledge society, emphasizing the fundamental role of the Information and Communication Technologies (ICTs), where innovation is increasingly seen as the fuel of the New Economy, with the internet the 'electricity', and Section 8 concludes by looking forward to identify key research questions and methodological challenges to progress these debates.

2. Historical Background

One of the key questions we try to address relates to whether we are currently living through a period of fundamental change, as radical and extensive as the 'great transformation'[2] (Giddens, 1982) of the 18th and 19th centuries. This 'transformation' comprised changes to the technological, economic, political and values base of societies.

To explore this question we will examine the two historical periods that have been identified as ones of dramatic change. The first created the 'industrial/modern society', replacing the agrarian period whereas the second is attributed to creating what many typically call the 'information/knowledge society'[3] (Toffler, 1980). Considerable controversy still lingers around both these claims with some seeing linear progress (Hirst and Thompson, 1996) and gradual change rather than sharp discontinuities whereas others subscribe to more radical transformations and argue for difference rather than continuity. Drawing on economic, sociological and historical traditions and critique we seek to take stock of the debates and identify the key questions still to be addressed in an ongoing research program.

Knowledge has always been important for the development of economic and social life.[4] In the 18th and 19th century industrial revolution, and in the more recent post-1960s information revolution, we see an age-old tension between the desire for an openness to innovation and change and the spread of information that would assist this activity and the need to control the access to knowledge in order to enable those who have created new IP to gain some economic return. Without protection of some kind it is suggested that there would be no incentive for a continued investment in the time, energy and capital that is necessary for the creation of yet more ideas. However, sorting out what if anything is different in the two time periods with respect to the role of knowledge has not proved straightforward for most authors. We would argue, however, that it is simply a matter of identifying the *specific types of knowledge* in use in the relevant periods and suggesting how the legal systems are forced to adapt their 'rules of the game' as these technologies emerge and evolve.

A considerable volume of research by both sociologists and economists has been devoted to examining the industrial revolutions that took place in the 18th and 19th centuries. A substantial change came from the use of new technologies and motive power – water to coal and electricity and oil. Such technologies allow new forms of production to take place expanding the industrial base of these societies. It also changed how things were made, moving products from small craft shops to factories and assembly lines. Human labour was deskilled from craft working and 're-skilled' to skilled and semi-skilled production line work (Hobsbawm, 1975). Larger units of labour required different settlement patterns encouraging the growth of new cities. For example, in the UK in 1801 there was only one city, London, that had a population of over 100,000 and by 1901 this number had increased to 35 cities of more than 100,000 containing 25.9% of UK population (Thorns, 2002). The initial development of industrial cities was marked by tenement housing and crowded conditions that allowed workers to live close to their work, but was associated with poor living and health outcomes,[5] reflecting the unequal distribution of the cost and benefits of the new system.

Economic changes associated with the development of the industrial system were profound. The source of wealth creation shifted from land-based and raw commodity trading to products of the industrial system. The accumulation of capital from the production and sale of commodities produced by increasing large-scale manufacturing became the key driver of economic life.[6] This led to the formation of the 'Fordist' system whereby reducing the cost of commodities through mass production and paying a wage that allowed workers to consume and regulating working hours[7] to create leisure, became a recipe for expansion (Amin, 1994). The labour process was changed with the growth of scientific management – 'Taylorism'. This created an ongoing debate as to what created increased efficiency and worker satisfaction (Braverman, 1975). Was it through streamlining that the production process (time and motion study) was improved or was it through creating a strong collegial bond between workers and management and developing more of a team approach (Roethlesberger and Dickson, 1939, Human Relations School)?

In industrial societies the principal source of value was human labour allied to new technologies of production. A key social change that was suggested as critical to the creation of this new system of economic activity was the spirit of capitalism (Weber, 1930, 1947). A change took place in values as a result of the Protestantism reformation emphasizing a more individual understanding of faith and religious work. Weber argues that it was the Calvinist idea of predestination and 'election' that encouraged hard work and the achievement of economic prosperity that then indicated that they were part of the 'elect'. Weber identified what he termed an 'elective affinity' between the economic, social and religious changes that created a climate that allowed the industrial system to develop extremely rapidly (Gerth and Mills, 1948). However, Lipsey *et al.* (2005) see the Protestantism work ethic as a sub-evolution following the invention of the printing press rather than a major theme. In particular they identify five key differences between Europe and the rest of the world. The first is pluralism of authority and control. The second is the corporation in the forms of the church, guilds and universities. Third is the adoption of natural philosophy rather than the doctrine of occasionalism that leads directly into the fourth, Newtonian science that cannot exist without natural laws, and fifth, a legal system that evolves out of canon law. Therefore, the economies of India and China fell behind in terms of their rates of economic growth. What this shows is that technology on its own is insufficient to create economic growth; therefore such growth comes from a combination of influences including *changes to the values and ideas* underpinning a particular society.

3. Industrial Revolution and the Role of Uncertainty, Technology Ideas, Complementarities and Elective Affinities

It is broadly recognized (see e.g. Suatet, 2000) that innovative entrepreneurship is a significant engine of technological knowledge creation, which itself is recognized as the fundamental engine of long-run economic growth.[8] Innovative, typically profit seeking, entrepreneurs have been responsible historically for a large proportion of the innovation necessary to make new technologies commercially viable. For example, much of the mapping of the globe and the refinements to the technology of three masted sailing ships in the 15th and 16th centuries occurred because individuals were seeking new ways (routes) to obtain economic profit.[9] This entrepreneurial activity led to the development of complementary technologies in the form of the joint stock company[10] and many other related financial innovations. In fact *economic incentives* have driven a significant number of major technological innovations throughout history. Writing was invented as a result of a desire to keep records for the purposes of taxation to fund public works.[11] The steam engine was invented to pump water out of mines. Furthermore, while other such General Purpose Technologies (GPTs) have found their inspiration from non-economic motives (e.g. the computer and Internet were originally developed as military technologies) their proliferation (i.e. development and diffusion) has been the direct result of entrepreneurs exploiting economic opportunities.

To the extent that economic growth is desirable it is necessary to understand this entrepreneurial engine of economic growth. In order to do this we must understand how technological knowledge manifests and develops, how it relates to other knowledge and pre-existing technologies and economic structures such as institutions, laws and capital (physical and human). We must also understand the incentives and motivation of the entrepreneurs that drive the process of technological change. Consider the process of economic growth driven by technological change. The critical feature of this process is that it is pervaded by uncertainty. Individual pieces of technological knowledge are complementary with other pieces of technological knowledge and with the economic structure into which they get embodied. The economic growth process exploits complementarities through combinations and re-combinations of technological knowledge. Decision makers (including entrepreneurs) of the system must form expectations with respect to investment decisions that take into account these features of technological change.

Because innovation implies doing something that has not been done before, uncertainty pervades the process of technological change.

> It is often impossible even to enumerate in advance the full set of outcomes of a particular line of research. Time and money are often spent investigating specific research questions to discover whether the alley they lead up is blind or rich in potential. As a result, massive sums are sometimes spent with no positive return, while trivial expenditures sometimes produce results of great value. Furthermore, the search for one technological advance often produces different, unforeseen advances. (Lipsey and Carlaw, 2000)

Uncertainty implies that different agents may make different innovative choices with respect to the same technology, resulting in different outcomes. Sociologists have drawn attention to the unintended as well as intended consequences from technological and other innovations, which also create uncertainty as we are unable to fully predict the associated or down stream affects. The environmental effects of chemical fertilizer applications and dioxin-based sprays are good examples where the unintended consequences of these new ways of enhancing farm production have had major unforeseen consequences upon the health and well-being of local populations. Yet, it is still possible for all outcomes of technology to generate economic value because each outcome can result in a commercially viable product or service. One important point is that while some outcomes may generate more value than others, there is no uniquely optimal outcome that should be chosen above all others nor do we always measure the long-term effects in making these calculations. Another important point is that no single individual can know in advance all of the potential applications for a given technology. The set of applications that is realized after this fact is the result of many diverse experiments (resulting in innovation) conducted by many different agents.

As an illustration of the importance of complementarities, consider the following thought experiment. How much would a group or groups within society be willing to pay not to have an identifiable technology such as electricity of the computer taken away for a given period, say a year? Think about conducting this experiment

for several iterations, replacing the previously removed technology and taking out another. Now contemplate how many times this experiment must be conducted before the entire annual GDP of that national state (i.e. its ability to pay) is exhausted. Our conjecture is that the number of technologies that need to be individually removed to exhaust total GDP is smaller than the total number currently in use creating that national state's GDP.

Why does this occur? It is because of technological complementarities. The removal of electricity from the production system renders several (most) other technologies in that system useless. There would be no electric light, no telephones, faxes or email, no Internet in computers, etc. The subsequent replacement of electricity and removal of the computer or Internet means that the willingness-to-pay calculation has double counted the value of these technologies.

These observations about technological complementarities reveal that there is a major issue of attributing value to *individual pieces of knowledge* about which we say more shortly. The complementary structure of technological knowledge leads directly to another observation about the innovation process. Elements of technological knowledge can be combined and recombined to make different technologies. For example, many of the components for the Wright Brothers airplane were derived from bicycle parts. Another example is found in the sequence of power technologies: water wheels were displaced by steam, which in turn was replaced by electricity. However, hydroelectricity generation uses a water wheel. This is the characteristic of knowledge that leads to the optimistic view that economic growth driven by technological change is sustainable because the combinatoric possibilities with new and existing knowledge are boundless. These combinatronic possibilities circumvent diminishing returns in the creation of knowledge. In making such combinations and adaptations of technologies to new conditions the social and cultural conditions are a major factor. In Kobe, Japan, the local Rugby Union team imported a scrum machine from New Zealand and decided to 'improve the technology' by making the machine work with less friction. However, by doing so they completely defeated the purpose of the technology. Clearly there was no transfer of the complementary cultural information about the purpose and use of the machine!

There are two important aspects of entrepreneurial behaviour with respect to innovation that must concern us. First, given the characteristics (uncertainty and complementarity) of the technological growth process, the entrepreneur plays a critical role in identifying and exploiting the innovation opportunities that new technologies present. Second, entrepreneurs are the economic mechanism which transforms technological knowledge into economic value.

Entrepreneurs are the decision-making force which generates both continuous innovation and economic value from that innovation. The innovative entrepreneur is the opportunist who recognizes the opportunities inherent in new technologies. 'In that sense, the entrepreneur gives life to the implicit [in some cases explicit] demand on the part of consumers' (Sautet, 2000, p. 60). In almost all cases it is impossible to attach probabilities to outcomes and expectations are in many cases best guesses. Thus, entrepreneurs are the risk takers who form a vital linkage in

the process of technological change and economic growth, converting technology into commercial value.

With such pervasive uncertainty, how do we appraise the economic value of the IP generated from innovative entrepreneurship and contemplate mechanisms to protect such property? Both are difficult issues. Appraisal requires assigning value often to individual pieces of technological knowledge. The problem exists because the economic value of the individual pieces of knowledge is only generated when they are combined with other pieces of knowledge to form commercially valuable products and processes. Protection provides the incentive to individuals to undertake innovative research, thus overcoming the positive spillover associated with the non-rivalrous characteristic of knowledge.[12] However, it also limits the exploitation of the protected technology by subsequent innovative entrepreneurs who will themselves create innovations by applying the technology in novel ways. Thus, protection slows the diffusion of new technology and limits the value extractable from it.

Economists' accounts of how technical change arises in market economies are influenced by Schumpeter's (1942) work that recognizes the need for profit in 'rivalrous' competition. In contrast sociological accounts have featured the social and professional aspects of this process and have given more attention to the social actors involved (Nelson, 1989). Increasingly both have recognized the need for an evolutionary approach that takes account of the inter-relationship of the private (market-based) imperatives and the 'public' knowledge creation and application-based aspects of innovation. Evolutionary paths though are not smooth. They may have significant spikes when major technological innovation occurs as is clearly shown by the work on GPTs.

What was the value of the printing press when Gutenberg first introduced the technology (i.e. before the standardization of the vernaculars of Europe)? The press became much more valuable after the standardization of spelling and dialect. Should we then appraise Gutenberg's IP before or after the standardization of languages? Our problem with appraising the value of Gutenberg's IP is a problem that pervades all of IP over technological knowledge. How should we appraise the value of the individual pieces of knowledge contained in the printing press, many of which Gutenberg did not create himself? For example, movable type was invented in China long before the European version of the printing press was created. Other critical pieces of knowledge, such as the alphabet and language were also used by Gutenberg but not invented by him. This provides support for the way that ideas and technologies interact with the social and political conditions of particular nation states in specific time periods.

The ability to associate economic value with a particular piece of knowledge is made difficult by the very nature of technological knowledge and the processes that create it. However, if we are trying to get incentives for these agents of change such that they create as much economic value from new technologies as possible,[13] we face some major issues. Some of the value will come from giving agents the incentive to expand the set of application technologies associated with a particular enabling technology as quickly as possible, which implies the need for diffusion.

Some of this value implies giving agents the incentive to create the enabling technologies in the first place. (These incentives may take the form of IP protection.) The critical issue is the amount these agents must receive in order for each type to undertake innovative entrepreneurial activities. This amount need not be nearly as large as the appraised value of the technology at any given stage of production. In fact, economic theory tells us that the number need only be sufficient to cover the resource and development costs (including the entrepreneur's opportunity costs and risk premium) of innovation. This minimum reward is sufficient to induce the desired behaviour and in all cases where the innovation is commercially viable it must be less than the total value of the technology over its useful life. The problem then is to appraise IP to get incentives correct for innovative entrepreneurs, which means appraising the costs of innovation and not the total potential value.

4. Intellectual Property Protection and Controls

4.1 *Patents*

In exploring the role of ideas and innovation, the issue of IP is a central one as it concerns the way in which ideas can be diffused (Rogers, 1962). In thinking about innovation, clearly one component is the creation of new ideas, such as the creation of new technical processors, and new ways of organizing and managing work. One way of controlling the flow of ideas and information is to subject these to patents and copyright restrictions (see e.g. Liebowitz and Watt, 2006; Ramello, 2006; Towse, 2006).

Economists see IP protection as desirable because it gives inventors the incentive to create new technologies in the first instance. However, such protection is potentially a double-edged sword in that it restricts the creation of innovative technologies that exploit the initial technology. For example, Watt's patent on his atmospheric steam engine effectively delayed technological innovation in the form of high-pressure steam engines for 80 years (the length of his patent).

Historically, property rights, especially with respect to IP, have played a major role in technological and economic growth. However, it is important to note that the development of property rights is as often driven by technological change as it is a cause of such change. For example, rights to water access were established only after the need for fast flowing water to run water wheels to power textile and other manufacturing factories were put in place. A modern example of this problem is the Internet's impact on privacy and copyright for music (see Liebowitz and Watt, 2006). The important lesson is that well-defined property rights may help to facilitate the creation of new technologies, but new technologies may also require changes to existing property right regimes. IP comes in a variety of forms and this variety is actually a reflection of the technological knowledge being protected.

On the surface a *patent* seems to be a fairly straightforward way to ensure IP protection. However, in practice patents have little enforcement value for many holders. Pharmaceuticals and chemicals innovations enjoy nearly complete property right protection from patents while computer software innovations obtain very

little protection. There is a fundamentally different characteristic between these technologies that relates to the technological characteristics of complementarities and combinatorics. Pharmaceuticals and chemical innovations are new combinations of complementary components of knowledge that take the form of molecules. The critical feature of pharmaceuticals and chemicals is that there is a unique mapping between the particular molecular combination and the output generated by the combination. Therefore, any marginal variation to the molecular combination will result in a completely different output. This is not the case for computer software (or most other technologies). Variations in computer code can produce virtually the same output. For example, consider the number of different word processors available to consumers. Thus, patents appear to be a useful protection mechanism only for technologies where there is a unique relationship between the combination of pieces of technological knowledge and the output of the technology.

Patenting does, however, have a long history. Machlup and Penrose (1950) note that a rather well-developed patent system existed in Venice in the 15th century, and that the practice of granting monopoly privileges by the Crown or by local governments to inventors was widely followed in many parts of Europe in the 16th and 17th centuries. In England the policy of granting the privilege of monopoly under royal prerogative culminated in the Statute of Monopolies of 1624, to provide the first patent law of a modern nation. Other countries followed, after a gap of more than a century, with France and the USA enacting patent laws in 1791 and 1793, respectively.

The role of patenting during the British Industrial Revolution, however, is a controversial one. On the one hand, controlling the flow of new innovations through patenting copyrighting and use of trademarks was prevalent and some analysts see this as a factor that limited innovative activity during the industrial revolution for example, 'Evidence placed before the 1851 Select Committee ... certainly throws doubt on a strong causal connection between our early patent system and the British industrial revolution'. (Boehm and Silbertson, 1967, p. 26). However, many economists have argued that innovators are 'rational profit maximizers' and as such without the protections of IP laws there would have been little incentive for them to spend time in the research and development that creates new innovations as they would be unsure as to whether or not they would have an economic return (Drahos, 2005).

Historians' judgements of the consequences for economic development of the precocious English patent system are mixed. Some, including Fox (1947) simply associate the origins of the modern patent system in England with the location of the British Industrial Revolution. MacLeod (1988, p. 198) takes a more cautious approach. She notes that the concept of 'intellectual property' in regard of technical invention was a late development.[14] It was mentioned first in a pamphlet of 1712, and after that the term re-appears sporadically in the patent applications later in the 18th century, before being enshrined in the Act extending James Watt's patent in 1775, 'his property in the said application secured'. However, MacLeod argues that the unreformed (pre-1852) patent system was at best ineffective, or at worst, a brake on invention and its dissemination. Ashton (1955, p. 107) suggests that if

Watt's Fire Engine Act had not extended the life of his steam engine patent we would have had a railway system earlier.

Ironically, Dutton (1984, p. 204) argues that the imperfect nature of the British patent system during the Industrial Revolution may have in practice approached the ideal. Inventors paid heavily and separately in England, Scotland and Ireland, for the temporary, 14 years in the first instance, and uncertain privileges of patent protection, because property rights were dependent on decisions made by the Courts, not by the Patent Office. Nevertheless, British patents offered a degree of property protection to inventors, but did not provide complete barriers to access and use by others, and this, according to Dutton, was in all probability the most appropriate for the economy as a whole during the Industrial Revolution. The balance eventually swung in the favour of patentees. Sullivan (1989, p. 436) argues that part of the increased patent activity after 1830 was a response to the increased value of patent rights due to favourable treatment of patentees in the courts. Even so, in 1850 the system, according to Boehm and Silbertson (1967, p. 19) was enormously cumbersome, and involved 10 stages, which involved obtaining the sovereign's signature twice. The Patent Law Amendment Act of 1852, which simplified the process and cheapened the price of patenting, was the outcome of the persistent lobbying by inventors in the years since 1780.

For the period 1780–1851, Dutton's instinct that an imperfect patent system approached the ideal, receives the support of classical economists from Smith to Mill, the latter stating categorically that the condemnation of monopolies ought not to extend to patents. Sentiments in favour of abolishing the patent system were not entirely absent in an era that saw the end of Bank of England and East India Company monopolies in the 1830s. Machlup and Penrose (1950, p. 15), for example, cite an editorial from the *Economist* in 1850, which argues that inventors, to establish a right of property in their invention, should give up all the knowledge and inventions of others, which is impossible. Nevertheless in Europe, only the Netherlands, in 1869, abolished patents, although its citizens could take out patents in foreign countries, while Switzerland did not enact patent legislation, after torturous debate, until 1888. Schiff (1971) argues that industrialization flourished in these two countries in the absence of a patent system.

Whether the property rights afforded to inventors during the Industrial Revolution were a lever to technological and industrial progress is, on the basis of the historiography, unclear. Indeed, Boehm and Silbertson (1967), cite Rogers' (1863) view of the century earlier debates, 'that the arguments have not gone further than a *post hoc ergo propter hoc* discussion', and express doubt there has been much subsequent advance in thinking. The reverse interpretation, that the growth of patenting after 1760 followed industrial development, does appear in the literature. Ashton (1948) postulates that the timing and the direction of Industrial Revolution patenting activity was influenced by economic conditions, including prices, costs and interest rates.

Historians remain divided on the sectoral pervasiveness of Industrial Revolution technological progress. O'Brien (1993), Harley (1993) and Crafts (1985) argue that technological progress was localized in the cotton and iron industries. Alternatively,

Temin (1997) and Landes (1969) see the Industrial Revolution as broadly based. McCloskey (1988) adopted an intermediate position, claiming that around 46% of economy-wide productivity growth arose outside the 'modernized sectors'. The linkages between patents, as a measure of 'protected' inventive activity, and the disaggregate records of British industrial growth between 1780 and 1851, have the potential to inform the debates surrounding historians' conceptualizations of the Industrial Revolution. The extent, if any, to which the effects of patented inventions spilled through the industrial economy, will shed light on whether protecting inventors' property rights impinged on the economy-wide adoption of new technology. Conversely, the statistical causality tests will also show if patenting activity was stimulated by particular industrial sectors.

In a series of papers, Greasley and Oxley (1994, 1996, 1997a) use modern times-series econometric methods and macro-level real total industrial production data, to identify the origins and likely 'end' of the British Industrial Revolution, dating the period as 1780–1851. Their work uses the Crafts and Harley (1992) amended version of the Hoffman (1955) data set. Using traditional Granger-type and more recent Toda and Phillips (1991) and Toda and Yamamoto (1995) methods, Greasley and Oxley (1997b) and Oxley and Greasley (1997) also consider possible causal linkages between industrial production (output) and other aggregate level data that have traditionally been identified in the economic history literature as potential candidates for 'drivers/engines of growth'. The candidates included real wages, imports, exports, population and *patents* and affected production *processes*. In that work, bi-directional causality between patents/processes (levels or growth rates) and industrial production (levels or growth rates) was identified. Their work is the only published work we know that considers the causal relationship between British industrial production and patent activity over the period of the Industrial Revolution. In related work, however, Sullivan (1989) assumes that because increased growth of patenting *preceded* increased growth of total factor productivity (TFP), a causal relationship can be inferred. However, he does not test for causality or, importantly, consider the effects of the non-stationary nature of the data that would affect the form of chosen causality test.

Greasley and Oxley (2000) also consider the sectoral inter-relatedness of the growth of industrial output, and thus of the pervasiveness of technological progress during the Industrial Revolution period, applying co-integrating relationship methods and tests for common stochastic trends, to Hoffman's disaggregrate, sector-level data. They conclude that Industrial Revolution technological progress spread widely, but unevenly. From their perspective, the productivity shocks shaping cotton and iron goods output defined the profile of early British industrialization. These two key industries shared a common stochastic trend with a wide group of mining and metal industries, and had long-run causal links to shipbuilding, paper, malt and sugar. The output trends in other important industries, notably woollens, linens, flour and bread, were isolated from the technological progress driving the cotton and iron goods industries.

In Greasley and Oxley (2007), they add to the debates surrounding the pervasiveness and the forces shaping Industrial Revolution technological progress

by investigating the causal links between patenting activity and industrial output at the sectoral level during the period 1780–1851. Using time-series methods applied to the Hoffman (1955) data set they consider the existence of bi- and multivariate causality between patents and 16 sectors of the British economy comprising copper, copper ore, beer, coal, iron and steel, woollens, worsted, tobacco products, tin, sugar, shipbuilding, malt, linen yarn, cotton yarn, cotton pieces and hemp products. Broadly, their results show that the rise in patented inventions after 1780 was a consequence, not a cause, of the Industrial Revolution. Because patenting procedures did not change materially in the period to 1851, the simple implication is that the value of protecting the IP embodied in technical inventions rose sharply during the Industrial Revolution. These findings offer support to those historians, including MacLeod (1988), who argue that inventors 'rediscovered' the patent system after 1760 and learned to use it to their best effect. Before this date, inventors did not figure prominently in the debates surrounding IP, which centred largely on the rights of authors, publishers and printers. In contrast, post-1780 the engineering lobby was the most vociferous in the campaigns for patents reform, and for cheaper and more certain protection of IP. Interestingly, the results show that patenting activity was associated particularly with the 'new' fast growth sectors of the Industrial Revolution, notably cotton and iron. Inventors responded to the specific opportunities of the Industrial Revolution, a result that coincides with Ashton's (1948) interpretation of the direction of patenting activity.

4.2 *Secrecy*

Secrecy is another illustration of how the particular characteristics of a technology imply which IP protection mechanism is best suited. IP used internally in a particular production process is often usefully protected using secrecy. Moser (2005) demonstrates, using data on 4688 English innovations at the 1851 Crystal Palace Exhibition, that industries such as watch makers rely on alternatives to patenting to protect IP, that is, secrecy, tend to be more geographically concentrated than those that do. Those industries that subsequently shift to patent protection experience a tendency to geographic diffusion. Close proximity is required to enforce secrecy and minimize 'leaks'. Similarly, in the lean (or 'just in time') production created in modern Japanese automobile manufacturing firms (particularly Toyota) the technological knowledge was completely internal to the firm's production activities. Even when American automobile manufacturing firms first visited Japanese plants to uncover the secrets of the Japanese success they misunderstood the technology. The many failed experiments in robotics and complete automation of the assembly line in the USA are a testament to this.

4.3 *First to the Market*

Being 'first to the market' is an especially effective protection mechanism for technologies that are complementary with human capital that must be acquired by the user to extract any value from the technology. For example, computer software

requires a human capital investment by the user in order to be able to generate output by using the software. In this case being first to the market means that owners of software capture large segments of the market because there is a cost for consumers to switch to any competing technology that enters the market subsequently. Technologies that require users to invest in complementary human capital in order to use them are most likely to find protection by being first to the market.

4.4 *Copyright*

Historically copyright has been a relatively effective mechanism for protecting IP that is stored in a physical medium. For example, owners of IP stored in books, records, cassette tapes and CDs have been able to appropriate much of the value of their property. However, with the new technology of digitally recording music the physical medium is no longer needed and, thus, we observe the current debate about the rights of Internet web sites such as Napster breaking copyright law (see e.g. Liebowitz and Watt, 2006 for a fuller discussion of this particular issue).

There are various other mechanisms for IP protection in use today, but the above discussion is sufficient to illustrate the point that the effectiveness of the mechanism depends on the type of technology to which it is applied. This should not be surprising given what has already been said about the complementary nature of technological knowledge. *Intellectual property protection mechanisms are a kind of technological knowledge themselves that are complementary to the particular technology to which it is applied.* Given what we know about complementarities and combinatorics it should be obvious that these complementarities will manifest in different forms just as different technologies do.

It should also be obvious that the protection mechanisms will co-evolve with technology. Furthermore, as has already been noted, some technological changes undermine existing IP protection mechanisms. In a sense the technology of these protection mechanisms is rendered obsolete by Schumpeterian creative destruction. Just like technologies themselves, new IP protection mechanisms must be invented and in many cases the inventors of such mechanisms will be entrepreneurs trying to protect research investments and profits they perceive from the opportunities in the new technologies.

5. The Role of Science and Research and Development

A further critical component of the ‘great transformation’ was the role of science. The adoption of a natural philosophy (rather than occasionalism) within the Christian religion brought a challenge to existing authority systems and epistemologies creating a belief in ‘scientific knowledge’ and exploration. The basis for this was systematic enquiry based on the new methods of science – observation, objectivity, classification and theory development. The world could be better explained through these means and once understood would be easier to shape and control. Reason was to dominate over the belief in other forms of knowledge. Science expanded and as it did so did the demands on it by the

growing industrial economy and society. The growth of new applied disciplines of engineering, metallurgy and mining became important and new universities based around delivering these areas of study arose – often in the new industrial cities (e.g. Manchester, Leeds and Sheffield) and were supported by public funds and civic investment. In part, the rise of these new more technologically focused institutions occurred because the older established institutions were less sympathetic to these new areas of knowledge. This raises a further interesting question that impinges on our interest in IP and the way ideas flow which is, how far is growth in knowledge limited by the institutional structures that exist at the time?

In an important contribution to the understanding of how science advances, Kuhn (1962) suggested that this was through paradigm shifts. Kuhn argued that science and technology grew not through the falsification of existing paradigms, but in fact by making a move to a new paradigm. Movements in ideas therefore occurred through 'scientific revolutions' when a new paradigm overthrows an existing one – rather than paradigms being defeated through careful and systematic study. During non-revolutionary periods 'normal' science takes place within the dominant paradigm. The work of Kuhn drew attention to the social conditions and institutional restrictions of innovation that can occur through the ways in which disciplines and areas of knowledge become dominated by powerful elites who, as the gatekeepers of knowledge, attest to the quality of work, shape the journals and decide on orthodoxy. Such systems would also strongly support a more restrictive approach to IP transfer and availability.

The role of research and development is a critical component of the innovation system and one that impinges on debates around IP rights. In many countries there is substantial public investment in R&D and this raises the issue of the new subjects and sub-disciplines within science and technology, the rise of more applied subjects and the growth of the social sciences. It also raises the issue of the ownership of knowledge created via public investment (Nelson, 1989). Knowledge, though a commodity, is different from other commodities, in that many can make use of it without degrading it.[15] However, it can also be used to create new wealth generating activity and thus limitations on its dissemination have attractions. The New Zealand New Economies Research Fund (NERF) is an example of where public money is available to support research, which it is hoped will have possible commercial applications that will stimulate new economic activity. In such cases the release of research results can be restricted and can therefore conflict with the right of the public to know the outcome of funded research activity. David (2005) identifies three principal institutional devices employed by states to encourage the provision of public R&D – these are patronage, property and procurement. Patronage is where publicly financed research is awarded on the basis of a competitive process, such as the way that the NZ Foundation of Science and Technology administers the Public Good Science Fund of $460 million. Here the assumption would be that the results are in the public domain and are available for wide distribution. However since the 1990s, as the science system has increasingly been based around Crown Research Institutes (CRIs), which operate as profit making concerns and with universities also being encouraged to adopt a more business like model, holding onto the

IP by the research organization has become more attractive and significant for their overall economic performance.[16] Procurement is where the state contracts with a preferred research organization or individual and the decision as to whether or not the information is made available tends to be a decision of the contracting party rather than the researcher. This model has increasingly been adopted within NZ Government especially as the public sector reforms of the 1980s led to the downsizing of the internal research capacity within Departments and Ministries (Pool, 1999; Thorns, 2000, 2003). Here research can be 'buried' where it is of a sensitive nature and at odds with current policy directions. Release here is often dependent on the nature of Freedom of Information legislation and Statutes of Limitation. The final arrangement is that where private producers of new knowledge are granted exclusive property rights that allow them to collect fees and other forms of return for the use of their knowledge. The increasing importance of information, and the new ways that this can now be accessed, sets the context for new struggles over IP rights and controls within the second period of transition that we are considering in this paper – the 'information and knowledge revolution'.

6. Information/Knowledge Economy/Society

So far we have considered a number of themes, that is, the role of entrepreneurship, technological knowledge creation and obsolescence; intellectual capabilities and intellectual knowledge and the role of science and research and development in our historical comparisons to set the scene. Up to this point we have not considered the modern meanings and origins of the period that is (currently) referred to as (variously) the information/knowledge economy/society in any systematic or rigorous way. However, if we are to critically and, importantly, fairly, to address the fundamental question of whether we are any more of a knowledge society now than we were in Neolithic times, the Renaissance and the Industrial Revolution, we have to be sure that we are talking the same language of those authors we seek to review.

In this section we will undertake a thorough critical analysis of what current authors appear to mean when they refer to the information/knowledge economy/society; what they identify as the unique characteristics of this period etc., with a view to ascertaining whether, based upon 'their' definitions of the beast, the world is fundamentally different.

The foreshadowing of the 'new' information/knowledge economy/society can be found in the revival and development of the economies and societies of the protagonists in the Second World War built around a continuation of the pre-war pattern. The basic industries were still mining, steel production and manufacture of commodities within a 'Fordist' system of production. This system was one based around mass commodity production and strong welfare states that ensured full employment and basic social provisions such as health, education and social security (Jessop, 2000). Economic growth was assisted by the recovery required after the destruction of wartime, strong growth in population as a result of disruptions and delays to marriage and childbirth through war. Growth in population also stimulated

housing and the growth of consumer spending on household appliances and motor cars, which became an increasingly significant mode of transport. However by the 1960s the boom times were ending and the restructuring of the industrial economies began that had far-reaching effects in the 1970s and 1980s. This was a time of 'de-industrialization' in the economies of North America and Western Europe (Bluestone and Harrison, 1983; Massey, 1984; Lash and Urry, 1987). Manufacturing reduced as a component of the economies and in a number of cases shifted to cheaper labour markets in Southern Europe (e.g. Spain) to Central and South America (e.g. Mexico), and into Asia (including the Asian 'tiger' economies). This began the formation of a 'new international division of labour' and was one of the factors that stimulated the debate as to whether a new 'epochal' transformation was taking place and what would be the central drivers of the former industrial manufacturing economies (Froebel *et al*., 1980; Smith and Feagin, 1987; Thorns, 1992).

The idea that the industrial manufacturing society was starting to be transformed into an 'information society' was initiated by among others Peter Drucker (1959, 1969, 1994) and Alvin Toffler (1980) and was part of a debate about the role of information and service workers within the changing economy of the time. Manufacturing and consumer services were seen as growing as the operation of companies became more complex as they grew in size. New areas of activity emerged and new areas of expertise were called upon to run the modern corporation. Strong growth occurred in information management, finance, marketing and sales. Also the expansion of the welfare systems created an expanding 'service' population engaged in government work including education, administration, social welfare services and urban and regional planning. In many of these positions – information was a more significant requirement than it had been in the past. Analysis of the growth of 'services', as part of a shift from a 'secondary' to tertiary economy and workforce, was often difficult as separating out whether the activities of service workers were new rather than an extension of previous forms of work proved very difficult due to the way that occupations were classified and recorded in national statistical databases.

By the 1970s the understanding of the changes taking place shifted from information alone to a greater emphasis on knowledge. This occurred in the 1980s and 1990s at a time when the institutional environment was one of deregulation and liberalization that encouraged government to dismantle border controls and other forms of economic regulation.

Thus we see that technological and economic change has been allied with political and social change as it was in the 'great transformation'. This supports the argument that *we are living through a time of far-reaching changes to the basis of societies*. The key to understanding these changes is being ascribed to the place occupied by knowledge, but what exactly is this role and is it uniquely 'new'?

Stehr has suggested that

> central to my thesis is that the origin, social structure and development of knowledge societies is linked first and foremost to a radical transformation to the structure of the economy. (Stehr, 1994, p. 122)

The main element of change is seen here as that from a *material* economy to a *symbolic* one. Stehr argues

> The economy of the industrial society is initially and primarily a material economy and then changes gradually to a monetary economy ... and then becomes as evident recently, a symbolic economy. (1994, p. 123)

Economists as well as sociologists have also identified knowledge as a key driver of contemporary economies. Economists, however, present a wide set of definitions/characteristics of what they believe constitutes a knowledge economy and hence its drivers. Smith (2002), however, summarizes succinctly the problem one faces with such attempts:

> What does it mean to speak of the 'knowledge economy' however? At the outset, it must be said that *there is no coherent definition* (emphasis added), let alone theoretical concept, of this term: it is at best a widely-used metaphor, rather than a clear concept. The OECD has spoken of knowledge-based economies in very general terms, as meaning 'those which are directly based on the production, distribution and use of knowledge and information'. This definition is a good example of the problems of the term, for it seems to cover everything and nothing: all economies are in some way based on knowledge, but it is hard to think that any are directly based on knowledge, if that means the production and distribution of knowledge and information products. (pp. 6–7)

Economists tend to focus on the idea of Knowledge Based Economies (KBEs) which could be seen as a subset of the knowledge society, and limit the focus to 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 the Asia-Pacific Economic Co-operation (APEC, 2000) definition this is broadened somewhat to talk about how in such an economy all sectors are being reconstituted around a higher input of 'knowledge', but fundamentally the circularity persists.

In a series of papers Quah (2002a, b) and Coyle and Quah (2002) raise the idea of the New Economy as a *weightless economy*. This terminology is inherently 'Quah' and has not resulted in widespread adoption even though it has more concreteness than several other leading brands:

> The weightless economy,[17] comprises four main elements: 1. Information and communications technology (ICT), the Internet. 2. Intellectual assets: Not only patents and copyrights but also, more broadly, namebrands, trademarks, advertising, financial and consulting services, and education. 3. Electronic libraries and databases: Including new media, video entertainment, and broadcasting. 4. Biotechnology: Carbon-based libraries and databases, pharmaceuticals.

Central to many authors' views on the New Economy is the importance of digital technologies, the Internet, computers, information and the globalized networks these technologies enable. To Talero and Gaudette (1996),

> the information economy – is emerging where trade and investment are global and firms compete with knowledge, networking and agility on a global basis. A corresponding new society is also emerging with pervasive information capabilities that make it substantially different from an industrial society: much more competitive, more democratic, less centralized, less stable, better able to address individual needs, and friendlier to the environment.

Where does all this take us in our understanding of what the knowledge economy is and whether it is fundamentally different from the past? Appendix 1 below highlights a range of definitions/ideas that currently exist. All explicitly or implicitly have a central role for 'knowledge' in economic activity. We would suggest, however, that historically this is not *fundamentally* 'new'. The entrepreneurs of the Industrial Revolution used 'knowledge' to create new products. Fundamental constraints on the quantity and quality of the these products during this (and later industrial) period included importantly land, raw material and production technologies (factories and machines) governed by scarcity, rivalry and diminishing returns. However, what is 'new' now is the type of technologies in which the economy and society exist – digital technologies, built around ICTs. The issue to economists is whether these technologies create a fundamentally new technical environment where, for example, diminishing returns and inflationary tendencies are 'a thing of the past'.[18] To Gordon (1998) this has led to the growth of the 'Goldilocks Economy' where

> Freed from the restraint of restrictive monetary policy that had choked earlier expansions, and with its fires stoked by the lowest medium-term and long-term nominal interest rates in three decades, the economy charged ahead and achieved a state of high growth-noninflationary bliss that some have dubbed the 'Goldilocks economy' (neither too hot nor too cold, but just right).

Although it is clear that economists talk of knowledge, Stehr criticizes them for not giving the role of knowledge sufficient attention in their work:

> A close examination of the literature in economics indicates, however, that the function of knowledge and information in economic activity is, for the most part, ignored by economists. Either that, or they introduce knowledge as an exogenous variable, as an expense and generally treat it as a black box. (1994, p. 123)

However, although there has been considerable recent growth in the study of knowledge, the view of Adhikari and Sales (2001, p. 2–3) is that concepts such as the knowledge society are also incomplete and imprecise for they are found wanting in exact meaning and are of partial and sectarian relevance. McLennan (2003, p. 4) notes that in much of the literature concerning the knowledge society there has been an absence of a sustained discussion concerning definitional issues. Others, such as Ungar (2003), argue that the idea of the knowledge society is itself a gloss,

as it is frequently evoked but rarely ever defined or explored in a systematic way. Moreover, Ungar continues, it is used merely as an extension of the 'more concrete' concept of the knowledge economy. Indeed, it seems apparent that the concept of the knowledge society needs additional clarity so as to differentiate it from other, similar concepts. In the view of Knorr Cetina (cited in Adhikari and Sales, 2001, p. 15), there is a need for a sociological concept of knowledge growth that brings into focus knowledge itself, 'breaking open and specifying the processes that make up the 'it'.' In other words, a more sociological approach to knowledge needs to identify the social processes in which knowledge is generated and from which it is turned into a commodity.

If the term 'knowledge economy' is primarily concerned with knowledge as a commodity and the value of intellectual labour in the creation of wealth, then the term 'knowledge society' should concern the social climate in which the knowledge economy resides. In other words, the knowledge society concept should relate to the much broader social context that both motivates and mediates the development and exchange of knowledge. This point is elucidated by McLennan (2003, p. 7) who notes that while some persistently equate the knowledge economy with the knowledge society, in actuality they are concepts that run in two different directions. McLennan notes that while the concept of the knowledge economy involves a 'strenuous reductionism', the concept of the knowledge society generally accepts that there are broader social and cultural factors that underlie the techno-economic momentum central to the post-industrial order and acknowledges knowledge's intrinsic value beyond its worth as a commodity.[19] This conceptual position is antithetical to that of the knowledge economy that merely conceives of knowledge as an object of economic value. Knorr Cetina and Preda (2001, p. 30) refer to this an as exteriorized perspective of knowledge whereby knowledge viewed as a commodity is regarded merely as a product or a research finding. Such an approach to knowledge growth overlooks social and cultural factors, which may be pertinent to how knowledge is generated and valued. This, on the other hand, appears to be what the concept of the knowledge society is attempting to address. Rather than viewing knowledge growth in purely reductionist terms, the concept of the knowledge society acknowledges that there are social and cultural factors that may influence knowledge growth at any point of time. As Thorlindsson and Vilhjalmsson (2003, p. 99) note, although the concept of the knowledge society is not yet well developed, it generally acknowledges that while science, innovation and expertise are the moving forces of economic development, social forces may intervene at any stage. This often relates to issues with power: those who own knowledge and the politics of knowledge-exchange.

In discussion of the current 'transformation of capitalism' knowledge as a key driver of production has been cited; typical of this view is that

> Capitalism is undergoing a transformation from a mass production system, where the principal source of value was human labour to a new era of innovation mediated production, where the principal component of value creation

> productivity and economic growth is knowledge. (Houghton and Sheehan, 2003, p. 2)

The key element in the transformative properties of the knowledge society is identified as 'information' and here the major factor has been the ICT revolution and in particular the growth of the Internet and more recently digitization. This makes the access to information easier and quicker, extends its global reach and makes it considerably harder to control. For all these reasons Castells has suggested that

> What is new in our age is a new set of information technologies. I contend they represent a greater change in the history of technology than the technologies associated with the Industrial Revolution, or with previous Information Revolution (printing). (Castells, 2000a, p. 10)

Castells has further suggested that the Internet is the 'electricity of the information age' (2001, 2004). There has been a phenomenal increase in the expansion of the Internet within a very short space of time. In 1989 there were 159,000 Internet hosts and this has grown to 43 million by 2000 (Houghton and Sheehan, 2003). However, one must not ignore the fact that there have also been massive gains in computational capacity of Complementary Metal Oxide Semiconductor (CMOS) logic design. This has been far more rapid and for a much longer period of time than the expansion of the Internet. Some would argue that the expansion of the Internet would not have been possible without the efficiency advances of microchips. What the IT revolution has brought about is the ability to manipulate, store and transmit large quantities of information at very low cost (Houghton and Sheehan, 2003). ICT and digital technology through the power of the modern computer and the next generation of high-speed computers with storage in terabytes rather than gigabytes have created new possibilities in the storage, surveillance, linking and processing of data sets that previously were unconnected. This extends possibilities from the tracking of criminals and terrorists across the globe, to profiling markets for products by small geographical areas (Geographic Information Systems (GIS) and other applications) to tracing benefit frauds (Lyon, 2003). New networking opportunities are created through this enhanced connectivity that generates new forms of knowledge and leads to a whole range of new economic activities associated with the creation, storage and retrieval of information.

The new computer and digital technologies have started to transform the way that work gets done across all sectors, but particularly within the 'knowledge generating' areas of science and technology. We can see here the growing impact in the last decade of E-Science and E-Social Science based on collaborations built around shared information transmitted via the new fibre optic superhighways and satellites – creating a much more globally connected world. These transformations are at least partially attributable to particular characteristics of the technology, namely, the sending and receiving capabilities of communication at a very large number of dispersed nodes, generating a network externality and the non-rivalrous nature of the commodity being exchanged, *information.* This stimulates the demand for new

software products and creates new networks, information clusters and incubators that have become key nodes of innovation. The managing of these new information systems has led to knowledge management becoming a critical area of contemporary business development and practice.

We need here to distinguish between the data – which are the units recorded, information which is processed data and knowledge which is what can be created from the information. What this indicates is that in 'knowledge societies' some would argue that we have a new principle, 'knowledge' that creates a new source of added value. This leads into the wider debate that has emerged about different forms of capital. Bourdieu (1986) has extended understanding of capital to include alongside economic capital, cultural capital, and subsequently social capital has also been distinguished (Cunningham, 2005; Pillay, 2005; Marinova and Raven, 2006).

Human capital in knowledge societies has also been reinterpreted and seen to be of increased importance. Knowledge is now a commodity to exchange and create new wealth generating opportunities; thus those with desired 'human capital' become sought after. Bell (1973) sees this shift leading to the end of the industrial working class and its gradual replacement by a post-industrial proletariat consisting of poorly unionized, part time, casual workers. Such a core peripheral pattern of employment creates new patterns of social inequalities with the new 'knowledge' class as one of its significant components. Such a class is global in its importance and it significantly increases the value of and need for new skills and capabilities that in turn has impacted upon the way education is thought of and delivered. Drucker (1969) drew attention to the importance of teamwork in a knowledge society, and he drew a distinction between people who work with their hands and people who worked with their minds and thought. Increasingly, in the knowledge society he argues the dominant class of people is likely to be those who work with their minds.

Contemporary society is coming to *depend more and more* on knowledge in economic production, political regulation and everyday life (Stehr, 1994; Castells, 1997). With the spread of knowledge and the demonstrated loss of scientific legitimacy through a growing realization that there are many areas where there is still limited understanding, a greater questioning and scepticism towards experts is becoming more prevalent. This is part of the wider post-modern critique of the enlightenment scientific paradigm and a move away from meta-narratives and linear theories to embrace a greater range of understandings about how social change takes place. Many now see path-dependent and complexity theories providing greater insights into change than more determinist approaches, either technologically driven explanations or ones that assumed a linear pathway such as forms of modernization theory (Urry, 2003; Law and Urry, 2004). The idea of the knowledge society is not a new form of technological determinism, but rather a new argument about 'elective affinity'. Social actors have greater capacities for self-interpretation and action than have been acknowledged in past theories of change (Giddens, 2001). For Castells 'the information technology revolution did not create the network society. But without information technology, the Network Society would not exist'

(Castells, 2000a, p. 139). In a knowledge society it is suggested that the wealth of a company is increasingly embodied in its creativity and information. The place of the creative industries cannot be relegated to a footnote, but now it needs to be seen as an integral component of the 'knowledge'-based industries (O' Brien *et al.*, 2002).

Alongside these views that information technology has created new social and economic conditions thus creating a social transformation, are a range of sceptics who consider that there is insufficient evidence for such an assertion (May, 2002). Much of this critique turns on the view that the argument is based on technological determinism through the assertion that 'technological changes bring in their wake major shifts in societies which use them' (May, 2002, p. 24). Bimber (1995) draws attention to three strands of technological determinism: the normative, nomological and unintended. Most accounts of the shift to the *information society* stress the first two rather than the unintended as they are stressing the positive move towards a new social and economic organization of knowledge and practice of accumulation. Sociological work adopting less determinist views has stressed continuity rather than rupture; thus the information 'revolution' becomes part of the continuing development and utilization of technologies to change the ways that we do things both intentionally and unintentionally (Mumford, 1966; May, 2002). This suggests that we should adopt an approach to the 'knowledge society and economy' that sees it as part of a continuingly evolving history of connection between specific national and international contexts, technological innovations and economic, social, political and cultural opportunities that either facilitate or resist innovation and change.

The other strong link that has been made is between the knowledge society and globalization. Globalization, rather like the knowledge society, is subject to controversy (Scholte, 2000; Holton, 2005). There is some agreement that what we are now seeing is a much greater connectedness across the globe created by the possibilities arising from the IT revolution. This compresses time and space and allows new ways of working drawing upon globally connected workers. This makes national boundaries and forms of control much more difficult and potentially creates challenges to local and national cultures through the penetration of globalized entertainment, information, ideas and practices. The world through a range of new media has now become accessible and available as never before. Competitiveness is now within a global environment that emphasizes free trade and weaker national borders to allow the freer flow of capital and labour. A greater importance is attached to flexibility in labour markets that brings an end to stable employment and predictability of career paths. Growing inequality has resulted at both the global and local levels with a growing gap between rich and poor at the national and individual level.

7. Intellectual Property in the Knowledge Society

One of the major themes that runs through the current literature on the knowledge economy/society is the role of innovation created via human capital with '*a greater reliance on intellectual capabilities*' in production and consumption. These issues

are increasingly seen by some as the 'fuel' of the New Economy, with the Internet, *enabled by electricity*, as the 'energy/motive power'. In this section we will focus upon the role of IP in modern societies, an area that is typically ignored or subsumed in simple *economy*-based discussions.

For advanced societies a greater emphasis appears to be placed upon a culture of innovation and a focus on how this can be generated. The power of the Internet and the connectivity that it allows poses new threats to the control of IP and for some raises issue as to whether it is still possible to protect the flow of information at all. Computer systems are vulnerable to security breaches and ensuring the security of such systems has become a significant growth industry in itself as web-based activity extends into all aspects of life from work through to shopping, banking, recreational and leisure activities including gambling and downloading music and video MP3 files onto iPods (see e.g. Liebowitz and Watt, 2006).

The speed of innovation also raises further questions with respect to the protection of IP in the contemporary environment where in some areas, with the current speed of diffusion, the shelf life of new products may be only a matter of months. Computer systems and software are subject to frequent upgrades and changes making it potentially a 'greedy technology' that constantly demands investment to keep it 'current'.

The importance of networks and clusters within the new environment has led to the creation of new territorial and virtual clusters of innovation, for example, Silicon Valley in California and New York's Manhattan's Silicon Alley (see Graham, 2004). Knowledge can now thus be created in 'virtual' research communities that can gain intellectual capital through the participation of cross-national teams working through computer-based collaborative technologies. Such innovations have led to new linkages between universities and commercial enterprises looking to make use of the new knowledge areas such as genetics and genetic engineering, bio-technology and nanotechnology. Universities now operate in the new 'enterprise and business environment' in which they are also interested in the commercialization of the IP of their researchers (see Verspagen, 2006). This raises questions as to who owns the IP created (Delanty, 2001). Digital access, broadband and Internet connectivity become the key aspects of inclusion in the new knowledge creating activities and thus become of increased importance. Being part of the 'advanced networks' to allow fast and extended linkages across national systems and globally are now seen as keys to research and development and maintaining global competitiveness. For example, the NZ Government's decisions to invest in the Advanced Network providing gigabytes of connectivity across universities and CRIs was stimulated by the desire to keep the New Zealand R&D sector globally competitive. Such Advanced Networks are now present in 40 other countries, so the absence within New Zealand creates problems for our scientists – the Advanced Network will 'ensure our scientists are able to catch up with their partners and participate in the exciting world of modern science' (Jarvie, 2005, p. 2). However, there is still a digital divide with the levels of connectivity across and within nations differing that creates a new set of inequalities. For example a recent UNCHS report talks about

> Enclaves of 'super connected' people, firms and institutions, with their increasingly broadband connections to elsewhere via the internet, mobile phones and satellite TVs and their easy access to information services, often cheek by jowl with much larger numbers of people with at most rudimentary access to modern communications technologies and electronic information. (UNCHS - United Nations Centre on Human Settlement, 2001, p. 6)

The OECD countries have the highest rates of telephone, mobile phone subscribers and Internet and broadband connections and as with many other forms of technology those with the lowest incomes, globally and locally, have the most restricted access to the benefits of the technology.

Sociologists have typically focused on the issues associated with power and the limitation of access and the reasons why material might be withheld. Do such restrictions assist in maintaining the power and position of the dominant sectors within society and thus contribute to the maintenance or creation of social inequalities? Information on the new superhighway of the Internet is mostly public and therefore freely available as long as the potential user is connected. Open source software was central to the original creators of the Internet as they were about facilitating interchange and not restricting access to information. Acknowledging the power issues are crucial to a sociological understanding of the role of knowledge in society and therefore to the understanding of IP. The concept of IP refers to a number of protections for human creations including patents, trademarks and copyrights (amongst others).

In the shift to a knowledge-based economy, whereby ideas gain economic value, it is believed that the existence of intellectual property rights (IPRs) are absolutely vital in order to prevent others from producing and selling copies of your own ideas (Kenny, 1996, p. 701). Owing to their abstract nature, intellectual technologies are difficult to control and may 'escape' the clutches of their creators to become public goods, to be used and manipulated by others (Kenny, 1996, p. 702). Acknowledging this, it is apparent that assigning IPRs is an exercise in knowledge management aimed at restricting the accessibility of knowledge in order to preserve or enhance its value as a commodity; or in Fuller's words (2001, p. 188), with the assignment of IPRs, knowledge is 'captured' and then delivered as a service. IPRs, in this case, are directly concerned with the privatization of knowledge for monetary gain.

Globally there is a significant digital divide with levels of connectivity that are very different across nations and within nations (UNDP, Mansell *et al.*, 2002). One of the changes to IP under the knowledge society is that knowledge has itself increasingly become a commodity, a product that can be traded. The ideas as well as the people creating them are valuable. The cost of excluding people from information can also be high as it can limit innovation or can result in the appropriation of information by the few. The shift to greater emphasis upon ideas and their creators increases the value of the well-educated and trained section of the population giving rise to 'brain drains and brains gains'. The declining and ageing of the intellectual workforce in the European economies is one of the growing pressures on migration from the less developed countries of their innovative and

highly qualified and trained people. This has implications for the digital and other aspects of the knowledge divide and is one factor in the continuing inequalities between the wealthier and poorer nations.

One of the key differences 'knowledge as a commodity' has with other commodities is that it is not reduced by use; rather there is evidence that it is a collective product that is enhanced by many users. This raises a further challenge to determining IP as many of the 'innovations' and 'inventions' within a knowledge society are the products of large international, multidisciplinary teams; thus ascribing IP to individuals becomes increasingly difficult. Research and development funding has also had to adjust to these new times and there has been a move towards longer funding cycles and a greater emphasis on inter- and multi-disciplinarity that crosses not only the traditional sciences but also recognizes the contribution of the social science and humanities.

The forms of protection include both statutory systems of protection such as patents from the 15th century, and copyright, to the 18th century, trademarks and design protection. The new global environment has focused attention increasingly on international agreements as a new way of trying to enforce IP protection. Examples here are the passing of a directive on the legal protection of databases by the European Union (EU) in 1996. Since then the EU has continued to work for a treaty on this issue. The World Intellectual Property Organization administers currently 23 treaties on Intellectual Property and WTO members are required to abide by the standards set out in the agreement on the Trade Related Aspects of Intellectual Property Rights (TRIPS) (David, 2005; Drahos, 2005). These various agreements and statutes have given rise to the growth of national and international bureaucracies and forms of administration. In all these contemporary debates we can see the interconnection of economic, legal and political arguments and decision making surrounding the need for and ways to control the flow of ideas.

The globalization of IP protection has largely benefited the advanced economies, particularly the USA and EU. Such protections are part of the ways that these countries and the corporations based in them but operating globally seek to maintain their dominance. Here the increased prominence of transnational companies, many of which have a turnover greater than many nation states, as key global players is increasingly significant (Held, 2000). The awareness of the value of IP amongst developing countries and indigenous people has also stimulated attention to the protection of such IP from the activities of global corporations. An example here would be the recent UNESCO convention on cultural indigenous knowledge protection (see also Marinova and Raven, 2006). Some of these attempts at protection, however, come up against WTO free trade agendas and the desire of the advanced countries to include trade in services and ideas within the general debates surrounding freer trade across the globe. Interestingly, the development of the Internet, especially in its earliest stages, was not through commercial imperatives, but more as a result of the work of researchers and enthusiasts exploring the possibilities of a new form of communication. The ethos of this group was about openness, hence the open source nature of much of the Internet. It is interesting to note that high-tech developments in ICT have occurred largely in the absence of IP protections.

As David (2005) notes, there has also been a long running moral argument about the accessibility of information. Advocates for the openness of government and commercial activity to public scrutiny suggest this is best achieved by the free flow of information and the encouragement of debate on social improvement. Those who support a more open system of exchange generally favour a move towards a greater balance between the interests of the IP holders and users. Drahos (2005, p. 149) argues that

> The current problem facing knowledge economies is that their law-making processes have been heavily influenced by owners of intellectual property. As a result the rights of owner have strengthened.

Thus, the debate about openness and free dispersal of knowledge versus restriction and exclusivity is not new. In recent times, however, international law has focused on strengthening exclusivity of IP rights rather than making knowledge more accessible, for example, the Digital Millennium Copyright Act (1998). Prosecuting and policing the increasingly borderless transmission of information is proving difficult. The solution that is being sought is the harmonization of IP rights laws. However, this is likely to provide the greatest advantage to the developed countries. Alternatively the rights and participation of users could be strengthened creating a more even contest around the access to and use of knowledge. Increasing knowledge becomes the key resource for future economic growth. As a consequence, the struggle over IPRs will intensify making it even more important that we undertake robust analysis of whether IP protection facilitates or restricts the flow of new innovations and creative activities in twenty-first century societies.

8. Conclusions

The concepts of knowledge society and economy are clearly related as both leverage off the idea of transformation to create fundamentally different features of society and economy. Both see information as having a special and significantly different place. Speed and forms of storage and transmission emerge as key elements in its newness. Information as a central driver of production requires new forms of organization favouring the more flexible and responsive idea of networks rather than institutional structures. Thus we see a new form of society emerging characterized as a ‘network’ society where flows and movement and less certainty are characteristic. Forms of explanation have shifted from linear causality to a greater appreciation of path dependency and complexity. 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 sustained empirical analysis than is seen in much of the debate about either the knowledge society, knowledge economy or information society.

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 are derived from the 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 period of the 'great transformation' has occurred and although one might debate the relative importance of patents as a cause or effect of the Industrial Revolution, in the absence of new evidence the historical events have occurred. For those studying the 'knowledge society' the twin problems of definitional limitations and 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.

Assuming, for the moment, we can revolve the definitional issues of what constitutes the knowledge economy or the knowledge society and what set of changes is 'fundamental', what evidence could we call upon to test such hypotheses, in particular the role and consequences of innovation, IP, its creation and protection?

Innovative entrepreneurship operating in a world of uncertainty, where profit seeking innovation creation leads to new product creation with and from new technologies, where IP has an important role to play, could equally describe the Industrial Revolution or the Information Revolution. The technologies differ and the relative mix of land, labour, capital and knowledge differs, but the general paradigm has explanatory power. The historical forms of IP protection remain in place although the mix of users differs. It is interesting to note that one of the simplest and less formal, secrecy, with resultant geographic proximity, has made a resurgence when faced with the challenges of protecting digital goods. New challenges for IP protection arise with the rise of 'digital goods', but this technology generated the need for a technologically new IP protection system that is not, in itself, new. The actual goods produced differ, the *relative* role of knowledge-led produced goods differs, but is the economic world *fundamentally* different?

What has the weightless economy done to workers, firms, ownership and control? The traditional neoclassical 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.

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. Here access to a knowledge base of trusted information was potentially 'exclusive' – the knowledge 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.

In terms of societal transformation that could be fundamental are the ways that work, leisure and relationships across a whole range of aspects of life are being changed by the impact of digital technologies and new forms of connectedness. Here speed and availability via computers, Internet and cellular technologies is potentially transformative, opening up new ways of knowing and choosing and organizing aspects of life from shopping, to travel, to working practices to dating, gambling and selecting and listening to music on the iPod. The technologies in their broadest sense also create new means of sifting and sorting populations from the web base 'Up My Street' systems in the UK to the marketers' databases on tastes and preferences to police and social welfare databases on where at-risk populations are concentrated (Burrows and Ellison, 2004). The new technologies of storage and retrieval also raise issues around protection and authentication of material; we now have the Wiki encyclopaedia alongside more established ones claiming its place as a repository of knowledge. Such sources create new challenges to the establishment of authenticity and accuracy of the text. The growth of more 'open source' ways of discovery also poses challenges to established gatekeepers of knowledge and have been seen to open the way to more democratic practices of knowledge dissemination and use. However, will these constrain innovation by undermining its commercial value or enhance it? This is the old debate in the new clothes of the 21st century digital and Internet world. To move forward we need a clear understanding of the key elements of change in past transformations to guide us in determining the present and possible future transformations. In finding a way forward it is important to acknowledge both the continuities with the past and the discontinuities and to further see how technological innovations and economic, social, political and cultural opportunities both facilitate or resist innovation and change.

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Notes

1. Hausman, 'Real options and damages in Intellectual Property cases'; Verspagen, 'University research, intellectual property rights and European innovation systems'; Towse, 'Copyright and artists: A view from cultural economics'; Marinova and Raven, 'Indigenous knowledge and Intellectual Property: A sustainability agenda'; Ramello, 'What's in a sign? Trademark law and the economic theory'; Liebowitz and Watt, 'How to best ensure remuneration from creators in the market for music? Copyright and its alternatives'.

2. One might argue with this terminology 'great transformation' in that it may have been no 'greater' than the move to settled agriculture in Neolithic times or the transformation that ensued with the invention of writing.
3. Again, one might challenge this rather contrived demarcation of history if we identify the creation of writing and the printing press as the 'first information society'.
4. Lipsey *et al.* (2005) argue that the evolution of technological knowledge has driven economic growth and social transformation since at least the Neolithic agricultural revolution.
5. However, there is a body of literature that would argue that the lowest classes of serfs and roaming labour were far better off in industrial working activities than they were in the feudal agricultural system.
6. 'When a man's wages went up in the eighteenth century the first beneficial effects might be expected to occur in the brewing industry, and in the commercialisation of sport and leisure ... gambling, boxing, horse racing and the like. When a woman's wages went up the first commercial effects would be expected in the clothing industries, which provided consumer goods for the home. Her increased earnings released her desire to compete with her social superiors – a desire pent up for centuries or at least restricted to a very occasional excess' (McKendrick, 1974).
7. '...workers that had once been forced to work out of poverty or coercion ... now men are forced to labour because they are the slaves to their own wants' (Steuart, 1767).
8. Other engines of technological change include basic science, public and to some extent privately funded research. Worker 'learning by doing' using and adapting human curiosity.
9. Though much was State sponsored.
10. Here technological innovation is being used more broadly than simply 'physical' technologies (see Lipsey *et al.*, 2005).
11. One could also argue that this shows the importance of the political process linked ultimately to the development of the Nation State.
12. Knowledge is non-rivalrous in the sense that one individual's use of knowledge does not preclude another's use of the same knowledge in the same way that one person's consumption of a loaf of bread precludes another's consumption of the same loaf of bread.
13. This assumes that economic and social objectives are themselves aligned – an heroic assumption.
14. Intellectual property laws and patents are synonymous in these earlier periods, but this is certainly not the case today where IP is protected via a range of other legal means.
15. Knowledge is typically 'non-rivalrous'.
16. See here the paper by Verspagen (2006) in this issue.
17. The 'weightless economy', as compared with the label 'weighty economy' of the industrial era.
18. The view of Lipsey *et al.* (2005) is that it is the ongoing creation of new technologies that frees us from diminishing returns and not any specific technology in any period of time. ICTs may be a suffient technology to achieve this at this point in time, but it is not necessary in the light of other new GPTs that might arrive.
19. However, it is easy to conceive of the knowledge economy as simply being encompassed, or nested within, the concept of the knowledge society.

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Appendix 1. Definitions of a Knowledge Economy

Knowledge Economy

Houghton and Sheehan (2003)

In an agricultural economy land is the key resource. In an industrial economy natural resources, such as coal and iron ore, and labour are the main resources. A knowledge economy is one in which knowledge is the key resource (p. 1).

David and Foray (2002)

The crux of the issue lies in the accelerating (and unprecedented) speed at which knowledge is created, accumulated and, most probably, will depreciate. This trend has resulted *inter alia* in intense scientific and technological progress (p. 21).

Munro (2000)

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 privatization and commercialization of knowledge (p. 5).

Powell and Snellman (2004)

We define the knowledge economy as production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance, as well as rapid obsolescence. The key component of a knowledge economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources (abstract).

Rooney *et al*. (2003)

We take the term knowledge economy to mean that part of the economy that creates wealth essentially through intellectual activity... (p. 16)

Foss (2002)

Whatever we think of this journalistic concept, it arguably does capture real tendencies and complementary changes. These include, on the organization side, a shrinking of the corporate boundaries and new ways of structuring these, falling firm sizes and a flattening of internal organization; increased differentiation of tastes on the demand side; acceleration of innovation and technological development on the supply side; and changes in the composition of labour on the input side (p. 48).

The Enterprise Development Website (2005)

For the last two hundred years, neo-classical economics has recognized only two factors of production: labour and capital. This is now changing. Information and knowledge are replacing capital and energy as the primary wealth-creating assets, just as the latter two replaced land and labour 200 years ago. In addition, technological developments in the 20th century have transformed the majority of wealth-creating work from physically-based to 'knowledge-based'. Technology and knowledge are now the key factors of production. With increased mobility of information and the global work force, knowledge and expertise can be transported instantaneously around the world, and any advantage gained by one company can be eliminated by competitive improvements overnight. The only comparative advantage a company will enjoy will be its process of innovation – combining market and technology know-how with the creative talents of knowledge workers to solve a constant stream of competitive problems – and its ability to derive value from information. We are now an information society in a knowledge economy.

Nokkala (2004)

One of the buzzwords featuring prominently in the higher education policy documents, and used to legitimize the Lisbon agenda, the Bologna process as well as committing education to the GATS agreement, is the concept of knowledge economy or knowledge society. It is often used to illustrate the shift from an economy based on the low skills industrial production to knowledge intensive production and services as the back bone of the economy, or the shift from a fordist to a post-fordist society, marked by denationalization and transnationalization of state regulation, transnational flow of capital and ensuing global competition. The discourse of knowledge economy emphasizes the shift to knowledge intensive high skills labour force, international circulation of brains, life long learning, transferable skills and competences and knowledge management as a key individual and organizational capacity. In the age of globalization, the knowledge economy discourse has become a way to characterize the new relationships between the state, society and economy and rendered higher education increasingly important for the international competitiveness of the nation states through their central tasks of generation, application and dissemination of knowledge and training high skilled labour force.

Foss (2005)

More specifically, it (the knowledge economy) is concerned with important parts of the theorizing that has emerged within the strategy and organization fields to accommodate the emergence of the knowledge economy, or, more precisely, accommodate those tendencies that we may think of as characterizing the knowledge economy. Among these – real, alleged, and imagined – tendencies is the increasing importance of human-capital inputs, the generally increasing importance of immaterial assets and scientific knowledge in production, the increasing importance of immaterial products, the need to control in-house an increasing number of technologies (even if product portfolios are shrinking) and in general to tap an increasing number of knowledge nodes, not just internally but also through an increasing number of alliances and network relations with other firms as well as public research institutions. These tendencies – that in turn co-evolve with a host of other tendencies that may be placed under the knowledge-economy heading, such as increasing competitive pressure and an increasing extent of the market stemming from increased deregulation and internationalization, increasing technological modularity, improved methods of measurement and cost allocation, and the increasing importance of ICT – profoundly impact on economic organization and competitive advantages (pp. 1–2).

Smith (2002)

What does it mean to speak of the 'knowledge economy' however? At the outset, it must be said that there is no coherent definition, let alone theoretical concept, of this term: it is at best a widely-used metaphor, rather than a clear concept. The OECD has spoken of knowledge-based economies in very general terms, as meaning 'those which are directly based on the production, distribution and use of knowledge and information'. This definition is a good example of the problems of the term, for it seems to cover everything and nothing: all economies are in some way based on knowledge, but it is hard to think that any are directly based on knowledge, if that means the production and distribution of knowledge and information products (pp. 6–7).

Leaving aside such general definitional problems there seem to be four basic views about the changed significance of knowledge: Firstly, there are those who believe that knowledge is quantitatively and in some sense qualitatively more important than before as an input. Peter Drucker, for example, suggests that 'Knowledge is now becoming the one factor of production, sidelining both capital and labour'. Along the same lines, the OECD has suggested that '. . .the role of knowledge (as compared with natural resources, physical capital and low-skill labour) has taken on greater importance. Although the pace may differ, all OECD economies are moving towards a knowledge-based economy'. Secondly, there is the idea that knowledge is in some way more important as a product than it has been hitherto – that we are seeing the rise of new forms of activity based on the trading of knowledge products. Thirdly, there is the view that codified knowledge

(as opposed to tacit, person-incorporated skills) is in some ways more significant as a component of economically relevant knowledge bases. Thus Abramowitz and David argue that 'Perhaps the single most salient characteristic of recent economic growth has been the secularly rising reliance on codified knowledge as a basis for the organization and conduct of economic activities. . .'. Finally, there are those who argue that the knowledge economy rests on technological changes in ICT, since innovation in computing and communications changes both physical constraints and costs in the collection and dissemination of information. So for some, the rise of ICT technologies and the complex of ICT industries is coterminous with the move to a knowledge society. Lundvall and Foray argue a more sophisticated view: 'Even if we should not take the ICT revolution as synonymous with the advent of the knowledge-based economy, both phenomena are strongly interrelated . . . the ICT system gives the knowledge-based economy a new and different technological base which radically changes the conditions for the production and distribution of knowledge as well as its coupling to the production system' (pp. 7–8).

Knowledge-Based Economies

Foray (2004)

. . . essentially, economies in which the proportion of knowledge-intensive jobs is high, the economic weight of information sectors is a determining factor, and the share of intangible capital is greater than that of tangible capital in the overall stock of real capital (p. ix).

. . . a scientific development corresponding to the emergence of a new economic subdiscipline of which the research object – knowledge – poses new theoretical and empirical problems; and a historical knowledge heralding the advent of a particular period in the growth and organization of economic activities. I stress the importance of this twofold change, which some authors fail to recognize. For them, the only new development of any relevance is theoretical, and the historical period in which they are living follows earlier periods without any discontinuity whatsoever. Because one believes, on the contrary, in the dual nature of the economics of knowledge – as a discipline and as a historical period – it is naturally around that duality that this volume is organized. By convention, so as not to confuse the two phenomena, I call the discipline 'the economic of knowledge' and the historical period 'the knowledge-based economy' (p. xi).

Harris (2001)

. . . the notion that economic wealth is created through the creation, production, distribution and consumption of knowledge and knowledge-based products (p. 22).

Rooney *et al.* (2003)

. . . a knowledge-based economy to be an economy in which knowledge is the most important productive factor (p. 16).

Australian Bureau of Statistics (2002)

The term 'knowledge-based economy' was coined by the OECD and defined as an economy which is 'directly based on the production, distribution and use of knowledge and information' (OECD, 1996). The Asia-Pacific Economic Co-operation (APEC) Economic Committee extended this idea to state that in KBE 'the production, distribution and use of knowledge is the main driver of growth, wealth creation and employment across all industries' (APEC, 2000). According to this definition, a KBE does not rely solely on a few high technology industries for growth and wealth production. Rather, all industries in the economy can be knowledge intensive, even so called 'old economy' industries like mining and agriculture. Further, the APEC Economic Committee states that 'the knowledge required by a knowledge-based society is wider than purely technological knowledge; for example it includes cultural, social and managerial knowledge'.

OECD (1996)

. . . economies which are directly based on the production, distribution and use of knowledge and information (p. 7).

Asia-Pacific Economic Cooperation (2000)

A Knowledge-Based Economy is an economy in which the production, distribution, and use of knowledge is the main driver of growth, wealth creation and employment across all industries. In this context, being a KBE means more than simply having a thriving 'New Economy' or 'information economy' that is somehow separate from a stagnant 'old economy'. In a truly knowledge-based economy, all sectors have become knowledge-intensive, not just those usually called 'high technology'. Important features of an ideal KBE include: an openness to trade, new ideas and new enterprises; sound macroeconomic policy; the importance attached to education and lifelong learning; and the enabling role of information and telecommunications infrastructure. Note that the knowledge required by a knowledge-based society is wider than purely technological knowledge; for example, it includes cultural, social, and managerial knowledge. The knowledge possessed by an organization is much more than the information written in its files, and includes its culture, the way in which people interact within the organization, knowledge about the contacts they use to gain information from outside, and so on. The organization's knowledge consists of its capability in integrating information with experience and expertise to take action. This assimilation is no mean feat; as one wit put it: 'Today we are drowning in information but starving for knowledge' (p. vii).

Neef (1998)

The phrase (knowledge based economy) has been used enthusiastically to describe a new interconnected economy and the positive effect of newly emerging technologies in the workplace and home. Equally, it has been used to lament the effect of

downsizing on the blue-collar sectors of the labor force. For some, 'knowledge-based economy' describes the ever-increasing proportion of the nation's GNP dedicated to computerization and high-technology electronics industries. For others, it is the impetus behind 'knowledge management' – adaptation of traditional organizational structures in a way that better accommodates the highly skilled 'knowledge workers' who populate the high-performance workplace and provide complex problem-solving services. The knowledge-based economy is a phrase that has been used to describe both a coming age of global prosperity and a coming economic apocalypse (p. 1).

Knowledge-Driven Economy

Department of Trade and Industry (1998)

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

Weightless Economy

Quah (2003)

Instead, it is the weightless economy where the economic significance of knowledge achieves greatest contemporary resonance. The weightless economy, in this view, comprises four main elements: 1. Information and communications technology (ICT), the Internet. 2. Intellectual assets: Not only patents and copyrights but also, more broadly, namebrands, trademarks, advertising, financial and consulting services, and education. 3. Electronic libraries and databases: Including new media, video entertainment, and broadcasting. 4. Biotechnology: Carbon-based libraries and databases, pharmaceuticals.

Harris (2001)

. . . economic value seems to be increasingly concentrated in non-material objects (p. 23).

Knowledge Economy/ Weightless Economy

Danabalan (1999)

Knowledge economy is the ability to create, distribute and exploit knowledge and information for increasing economic wealth and improvement in the quality of life. It is also described as the 'weightless economy', in comparison with the label 'weighty economy' of the industrial era.

Goldilocks Economy

Gordon (1998)

Freed from the restraint of restrictive monetary policy that had choked earlier expansions, and with its fires stoked by the lowest medium-term and long-term nominal interest rates in three decades, the economy charged ahead and achieved a state of high growth-noninflationary bliss that some have dubbed the 'Goldilocks economy' (neither too hot nor too cold, but just right) (pp. 297–298).

Thus far, I have characterized the major surprise in the Goldilocks economy as the low rate of inflation given the low rate of unemployment, and indeed, this has been the focus of the media as well. Stated another way, the real questions about the Goldilocks economy are why inflation has been so low relative to changes in wages and why the unemployment rate has declined when utilization has not increased (p. 300).

Information Economy

Harris (2001)

. . . focuses on the important role that information and communication have come to play in the modern economy (p. 23).

Taler and Gaudette (1996)

A new kind of economy – the information economy – is emerging where trade and investment are global and firms compete with knowledge, networking and agility on a global basis. A corresponding new society is also emerging with pervasive information capabilities that make it substantially different from an industrial society: much more competitive, more democratic, less centralized, less stable, better able to address individual needs, and friendlier to the environment (abstract).

Revolutionary advances in information technology reinforce economic and social changes that are transforming business and society. From this revolution emerges a new kind of economy – the information economy – in which information is the critical resource and the basis for competition. Old ways of doing business will be challenged and sometimes defeated (section 1, p. 1, How is information shaping the economy and society?).

Digital Economy

Department of Trade and Industry (1998)

The 'digital economy' is shorthand for the transformational impact which information and communication technologies (ICTs) are having on every single aspect of business activity.

New Economy

Ittner *et al.* (2003)

Talks about New Economy firms by which it means 'organizations competing in the computer, software, internet, telecommunications, or networking fields'.

Quah (2002a)

Digital goods are bitstrings, sequences of 0s and 1s, that have economic value. They are distinguished from other goods by five characteristics: digital goods are non-rival, infinitely expansible, discrete, aspatial and recombinant. The New Economy is one where the economics of digital goods importantly influence aggregate economic performance.

As documented elsewhere in this Handbook (and attested to by journalistic frenzy in the late 1990s' dotcom boom) the New Economy means different things to different observers. Possible dimensions to the New Economy range from e-commerce, e-government, the Internet, the productivity paradox, knowledge-intensive work, social mass-mobilization, and globalization, all the way through auction proliferation, electronic payment systems, venture capital financing saturation, and business restructuring. In less guarded moments, popular conception held that with the New Economy, inflation might be forever conquered, explosive income growth might be hereafter the norm, and stock markets be always stratospheric (p. 4).

Quah (2002b)

This paper attempts to draw lessons for the New Economy from what economists know about technology dissemination and economic growth. It argues that what is most notable about the New Economy is that it is knowledge-driven, not just in the sense that knowledge now assumes increasing importance in production, thereby raising productivity. Instead, it is that consumption occurs increasingly in goods that are like knowledge – computer software, video entertainment, gene sequences, Internet-delivered goods and services – where material physicality matters little. That knowledge is aspatial and nonrival is key. Understanding the effective exchange and dissemination of such knowledge-products will matter more than resolving the so-called productivity paradox (abstract).

Coyle and Quah (2002)

Definitions of the 'New Economy' tend to cluster into two main types. The first equates the New Economy with ICT and its sectoral consequences; either on certain core industry sectors, mainly professional services, or wider economic effects on all economic structures, mainly through cost reduction and networking enabling processes. The second sees the New Economy as the post-industrial economy as

a whole. Equal emphasis is placed on symbolic analysis and frontline services as areas for employment growth (p. 6).

Samuelson and Varian (2001)

Some have asserted that the 1990s witnessed the emergence of a 'New Economy'. That term dates back to the 1980s when it referred to an economy driven by services rather than manufacturing. The fear then was that the services economy would result in slow growth, rising prices, and low-wage jobs. In 1996 Michael Mandel published an article in Business Week called 'The Triumph of the New Economy' which emphasized the development of a technology-driven, fast-growing, low-inflation economy, which he referred to as 'the New Economy'. The latter connotation came to dominate popular discussion, although economists as a whole remain somewhat sceptical of the concept.

Abramovitz and David (2001)

The term 'New Economy' itself acquired a variety of quite different connotations: for many commentators, it continues to refer primarily to the altered macroeconomic configuration that saw an accelerating rate of growth of real GDP and a steadily falling unemployment rate which, unexpectedly, did not give rise to inflationary pressures on wages and prices. Some connected this with evidence of the revival of labour productivity growth that became increasingly visible in the aggregate statistics for the private sector, and emphasized that as the key development heralding a permanent escape from the US economy's poor performance record during the preceding two decades. For others, however, the productivity growth picture beneath the aggregate level was less than entirely clear, and the core of the 'New Economy' was peculiarly associated with the growth of output and employment in 'hi-tech' industries, particularly those involving information technologies and computer mediated telecommunications, and with the on-going restructuring of business organizations and markets that are driven by advances in the latter (ICTs). The high and rising stock market valuations of companies in this sector, and the wave of venture capital that poured into new enterprises launched after 1993 to exploit the commercial possibilities of the explosively expanding Internet, seemed for still other observers to be the very essence of what was new and positive in these developments. Indeed, in the exuberance that marked the century's close, the Nasdaq stock market index came to be identified with the New Economy, whereas the comparatively weak performance of the Dow-Jones index was disparaged as representative of 'the Old Economy' (p. 116).

Micklethwait and Wooldridge (2003)

The New Economy is difficult to define, largely because it encompasses three things. The first, now fortunately gone for good, had to do with the stock market in

the 1990s: that it somehow justified crazy equity prices. But the other two things have survived the bubble. The second has to do with the organization of business: the idea that corporate life, particularly in America, is being transformed by the Internet and by Internet companies. This seems very hard to quarrel with. The third, most complicated debate has to do with macroeconomics and how its laws and assumptions need to be rewritten in the light of all this new technology and, to a lesser extent, globalization (p. 107).

Progressive Policy Institute (nd)

The term New Economy refers to a set of qualitative and quantitative changes that, in the last 15 years, have transformed the structure, functioning, and rules of the economy. The New Economy is a knowledge and idea-based economy where the keys to job creation and higher standards of living are innovative ideas and technology embedded in services and manufactured products. It is an economy where risk, uncertainty, and constant change are the rule, rather than the exception.

Notes (2001)

The world is currently undergoing a fundamental economic transformation. A combination of technological developments – powerful personal computers, high-speed telecommunications, and the Internet – has created a new market environment variously referred to as the 'information economy', the 'network economy', the 'knowledge economy', or simply the 'New Economy'. This New Economy is anchored primarily in the production, processing, and dissemination of such information goods as software, content, or expertise. To be sure, there is nothing new about the existence of information goods; music and books, for example, have existed as information goods for quite some time. What is new, however, is the dominance of information goods in the total marketplace and the present pace of major technological advances. The technological revolution impacts the cost and distribution of such goods in a way that fundamentally alters how their purveyors must operate (pp. 1627–1628).

OECD (2000)

The term 'New Economy' has been used extensively in recent years to describe the workings of the US economy and in particular the part of its economy that is linked to ICT. It reflects a view that something has changed and that the economy now works differently. Few studies clearly define the term 'New Economy' and it seems to mean different things to different people. The three main characteristics of the New Economy appear to be the following: The New Economy may imply higher trend growth. Due to more efficient business practices linked to ICT use, the New Economy may experience a pick-up in trend growth,

due to higher MFP growth. The New Economy may affect the business cycle. ICT, in combination with globalization, may change the short-run trade-off between inflation and unemployment and lower the NAIRU (non-accelerating inflation rate of unemployment). As a result, the economy can expand for a longer period without inflationary pressures emerging. In this view, ICT puts downward pressure on inflation, while increased global competition keeps wage inflation in check. More extreme views have argued that the New Economy may mean the end of the business cycle. The sources of growth are different in the New Economy. Certain parts of the New Economy may benefit from increasing returns to scale, network effects and externalities. The value of communications networks and Internet applications, for instance, increases as more people are connected. This situation entails considerable spillovers, and these contribute to higher MFP growth and fuel further growth. These three characteristics are closely related and the US experience of the past decade provides some support for all, although there is no support for extreme claims about the end of the business cycle (p. 17).

Godin (2004)

The New Economy referred to data that indicated the appearance of new economies in the USA and in a number of smaller OECD countries not very 'vibrant' in terms of entrepreneurship. What characterized new economies was the acceleration of trend growth and productivity. Technologies, particularly information and communication technologies (ICT), were believed to be at the heart of the phenomenon (p. 679).

Today, alongside the OECD, it is the European Commission that most faithfully pursues work on productivity gaps between Europe and the USA in its annual reports on competitiveness (European Commission, 2000, 2001). The failure to close the gap appears, according to the commission, what characterizes the New Economy in the USA: higher employment rates and higher labour productivity as a consequence of investments in information and communication technologies (ICT) (pp. 667–668).

Editors (2000)

The authors examine the data for 'New Economy' companies, defined as those engaged in the manufacture of computers or other electronics products or in software or telecommunications, and 'old economy' companies; they also examine the data by manufacturing industry (p. xix).

'New Economy' proponents credit the success to the information revolution, which they see as driving a fundamental transformation of the economy that will lead to faster productivity growth for many years. Sceptics of this view acknowledge the importance of the high rates of investment stimulated by the computer revolution, but attribute much of the economy's success to a series of favourable but temporary shocks (p. xx).

Thompson (2004)

Of course, in large part this depends upon how one defines the idea of a 'New Economy'. The difficulties here are legion. Just to give two examples, the US Council of Economic Advisors (2002, pp. 58–60) restricts its analysis very much to the dominance of ICTs, whereas an analysis for the Bank of England by Wadhwani (2001, p. 495) includes a wider set of structural changes, including 'globalization', intensifying product market competition, financial market liberalization, changes in labour market flexibility and other factors. Both these argue that there is a 'New Economy' in the USA and possibly the UK, but not elsewhere. In addition, McGuckin and van Ark (2002), for the US Conference Board, see a New Economy only appearing in the USA, as US productivity figures soar away from the rest of the world (p. 565).

Wadhwani (2001)

There is no generally accepted definition of what one means by the NE. Recall that the term NE, in the early 1980s, implied an economy that was driven by services rather than manufacturing. Then, the worry was that a service-driven economy was going to create poor, low-wage jobs. More recently, the use of the term NE has been transformed radically. Unsurprisingly, there are those who see the NE as being synonymous with an acceleration in the diffusion of Information and Communications Technology (see, e.g. Gordon, 2000). However, I regard that as a rather narrow definition. Recall that John Travers was, of course, active in the free trade movement during the mid-19th century. Indeed, much that might be different about the economy today relates not just to ICT advances, but also to the effects of globalization, intensifying product market competition, labour market reform, financial market liberalization and several other factors (pp. 5–6).

Browne (2000)

My own preferred definition relates instead to features of the aggregate macro economy itself rather than to technology – three features are isolated for attention. 1. A permanently raised potential growth rate of the economy (using the 1970s, 1980s and early 1990s as a benchmark) attributable predominantly to the revolution in the Information and Communications Technologies (ICT); 2. The second feature is a permanent reduction in structural and frictional unemployment to which it is argued the ICT also contributes through a number of channels; 3. The third feature is a permanent reduction in the variation in the growth rate of output in the 1990s, and possibly to some extent in the 1980s, relative to previous decades (p. 210).

Elmeskov (2000)

The conjunction of a number of economic developments in the USA has contributed to an impression that something fundamental may have changed in that country.

These developments include: strong non-inflationary growth, coupled with high labour utilization; the spread of information and communication technology (ICT); and microeconomic evidence of continued restructuring of production processes. Taken together, these developments have been seen as representing the emergence of a 'New Economy' (p. 57).

Internet Economy

Choi and Whinston (2000)

... the Internet economy is defined as that part of the economy that deals with information goods such as software, online contents, knowledge-based goods, the new media and supporting technology industries that provide computers and network devices.

Multiple Terms

Knowledge economy, knowledge-based economy, innovation economy, high-technology civilization, knowledge society, information society

Makarov (2004)

The term 'knowledge economy' was coined by the Austrian-American economist Fritz Machlup (1962) in reference to one of the sectors of the economy. Today this term, together with the term 'knowledge-based economy', is used to designate a type of economy in which knowledge plays a crucial role and the production of knowledge is the main source of growth. Such widely used concepts as 'innovation economy', 'high-technology civilization', 'knowledge society' and 'information society' are close to the knowledge economy concept (p. 19).

Digital economy, information economy, knowledge-based economy, weightless economy, virtual economy, Internet economy, electronic commerce, e-commerce, e-conomy, New Economy

Piazolo (2001)

Various catchwords have been coined to capture the essence of the economy-wide consequences resulting from an increased use of processed digital information and from the application of the Internet for a wide array of services (software programming, webpage maintenance, ticket and hotel reservations, on-line information and support, ordering facilities, publishing, indexing or abstracting etc.) as well as transactions (delivering music, movies, documents, literature or software in digital form). The following catchwords aim at different characteristics of this phenomenon but are frequently used as synonyms: 'digital economy', 'information economy', 'knowledge-based economy', 'weightless economy', 'virtual economy', 'Internet economy', 'electronic commerce', 'e-commerce', 'e-conomy', or maybe

more capacious 'New Economy'. Some authors have tried to assign distinguishing concepts to this variety. For example, Kling and Lamb (2000) suggest to use the term 'information economy' to include all informational goods and services like publishing, research, legal and insurance services, entertaining, and teaching in all of its forms, and the term 'digital economy' to address (only) the goods and services whose development, production, sale, or provision is critically dependent upon digital technologies. Furthermore, the term 'New Economy' is associated for them to the possible consequences of the information economy and the digital economy, namely high growth, low inflation, and low unemployment. However, in many papers – including the present one – the concept of the 'New Economy' is wider and includes the characteristics of the 'information economy' and of the 'Internet economy' as subsets. In the following, the term 'New Economy' describes an economy where both final output and intermediate input predominantly consist of information and where the modern (digital) information and communication technologies provide world-wide access to almost any available information. These new technologies might have the potential to enable an increase in the productivity of conventional business practices, but also facilitate the establishment of new processes and products. Consequently, the evolution of the New Economy should not be considered as being restricted to the information sector, but as a far reaching process that might alter and extend the products and production processes within the whole economy. This means also that the consequences of being excluded from the progress of the New Economy might be rather detrimental for (developing) countries (p. 29).

Appendix 2. Definitions of a Knowledge Society

Knowledge Society

Rooney *et al.* (2003)

A knowledge society is a broader term than 'knowledge economy' or 'knowledge-based economy' in that it encompasses more intellectual activity than narrow economic, commercial and industrial concern (p. 16).

Fuller (2001)

'Knowledge society', 'knowledge management', and especially the burgeoning employment prospects of 'chief knowledge officers' ('CKOs') are peculiar signs of what is supposedly distinctive about our times. To those innocent of social theory, it should be perfectly obvious that knowledge has always played an important role in the organization and advancement of society. In that sense, saying that we live in a 'knowledge society' would seem to be no more informative than saying that we live in a 'power society' or a 'money society' or a 'culture society' (p. 177).

Lyotard's image of the knowledge society comes closest to a knowledge dispersion, in which a competitive labour market reduces 'skill' to a scarce locally

relevant knowledge, the value of which may be expected to change (and may even be converted to non-human capital) according to market conditions. Thus, your knowledge is most valuable if it complements that of others in your immediate situation, thereby enabling all of you to collaborate in activities that will benefit each of you individually (p. 179).

Marginson (2006)

In sum, Habermas's theorization of the public sphere, which is heterogeneous to the public/private goods distinction drawn from political economy, is suggestive of the forms of life associated with democratic public political projects inside the university. Community, criticism and social awareness might make a platform for regenerating a public university that has been boxed into a losing position by status competition. Habermas's later focus on communicative action points to the potential of an institution combining high communicative competence with specialized expertise. This is a more fertile, open-ended notion of the 'knowledge society' or 'knowledge economy' than accounts that subordinate the university to global economic competitiveness (p. 54).

Hassan (2003)

Prior to the rise of the industrial revolution, all societies, be they tribes, bands, empires or civilizations, were always already 'knowledge societies'. These produced forms of everyday and specialized knowledges, some that are still with us, some that are irretrievably lost, that correspond to each society's 'structures of organization' and the temporalities that suffused them. The arrival of the industrial revolution changed this world of perpetual flux of temporalities and knowledges forever, and humanity embarked upon what we can see in retrospect was the first knowledge epoch (p. 228).

Thorlindsson and Vilhjalmsson (2003)

The label 'knowledge society' is rooted in the belief that science, innovation and expertise are the moving forces of social and economic development. It is backed up by increasingly popular buzzwords such as 'knowledge organizations', 'knowledge management', 'knowledge workers' and 'intellectual capital'. Knowledge work and knowledge management within the knowledge society organizations imply continuous knowledge production and revision of existing knowledge, emphasizing the skills and expertise of workers. The production of knowledge is not limited to higher education and academic research settings. Furthermore, the notion of the autonomy of science is under increasing attack, as science becomes an important part of political debate and economic policy. Social forces outside academia attempt to gain control over science, shape its nature, channel its course, and control the social and economic consequences of its findings (Nowotny *et al.*, 2001) (p. 99).

The concept of knowledge society rejects a linear view of science from basic to applied. Instead, it portrays science as a complex non-linear process where social forces intervene at any stage. However, it is safe to say that the concept is not well developed. A central source of ambiguity is 'knowledge' itself. Although its importance is stressed in every definition, there is neither consensus nor clarity about its meaning. Contemporary society contains all sorts of knowledge. Some is developed in scientific settings and published in scientific journals scrutinized by academic peers. Some is developed by various communities of workers in their worlds of everyday work (pp. 99–100).

Although the definition of 'knowledge society' can include all these different kinds of knowledge, there is a strong tendency to focus on the most prestigious or credible kinds, namely scientific knowledge, produced and certified by scientists, as well as professional knowledge, acquired by formal credentials of university-educated professors, such as engineers, psychologists, medical doctors, lawyers and similar experts. In this narrower sense, knowledge is suppose to be reliable and even true, practical and powerful, and give competitive edge in individual and economic strife, war and politics. Its relationship to science and technology is meant to set it apart from other, more ordinary forms of knowledge (p. 100).

Today, science and its products influence people's daily lives to the extent that some scholars have come to view science as the main defining characteristic of contemporary societies (Nowotny *et al.*, 2001). Second, science is increasingly contextualized, i.e. influenced by social, economic and political forces that shape the direction of scientific activity and grasp control over its applications. In the process, science becomes less of a demarcated subsystem of society, and more of a transgressive system with fluid and porous boundaries (Gibbons *et al.*, 1994; Nowotny *et al.*, 2001) (p. 100).

Adhikari and Sales (2001)

Today it is clearer that efforts to construct a definition and theory of the knowledge society which concentrate on the manifest features of a particular historical moment generally express analytical perspectives that lead to 'self-exemplifying' explanatory positions in which, to borrow a phrase, the 'logic of the society becomes the logic of the theory' (Bohme and Stehr, 1986, p. 17). Consequently, such non-processual approaches are unable to adequately take in the dynamic of knowledge as also the sources of the constitution of the knowledge–economy–society relation, inter-temporal and inter-country differences in the constitutive processes, and the variable interrelation between social forms such as states, economic organization, educational systems and the professions. They tend towards identification with modern, western society (or, more exactly, with some of its parts) and to restrictive theoretical use for investigating knowledge-related societal variation and temporal change over a wider field (p. 1).

Although knowledge society and kindred concepts (e.g. knowledge economy, information society/economy) refer primarily to the problem of 'what distinguishes a knowledge society ... from its historical predecessors' (Bohme and Stehr, 1986,

p. 19), as procedures for distinguishing the contrasting, prior phases of the operation of knowledge in the economy and connected social structures, such as tradition-modern, western/non-western, pre-industrial/industrial/postindustrial and so forth, they are not methodologically distinct (p. 5).

Is knowledge society to be understood now as a theoretical construct of academic sociologists to represent those transitions which cannot be accommodated by the traditional tenets of industrial society theory? Or, is it rather to be distinguished, in its combination of in various ways with the political criteria of national governments and supranational entities for the conceptual ordering of coming developments in advanced capitalist society, by its ideological and utopian uses as a goal, but also by its low instrumental value for goal implementation (p. 17).

In none of the contributions does *knowledge society* (and its variants) interpreted as an already realized historical state, suffice as an adequate construct for the description and differentiation of the present mode of this relation in western society; nor in the explanation of continuities and change in knowledge conceived like a natural force as a 'variable' acting upon economy and society. Instead, the crucial aim is to identify the specificity of sociological processes around knowledge, their organizationally embedded operation, and the sense in which knowledge processes, structures and forms are constituted by and constitutive of society and economy at the same time (p. 22).

Nassehi (2004)

One of the most successful self-descriptions of contemporary modernity is the concept of knowledge society (Stehr, 1994). At first sight this characterization has in mind knowledge as the most leading productive power in our apparently post-industrial epoch. But a closer view shows that on one hand, knowledge has indeed become a propelling power not only in economic affairs. On the other hand, knowledge is increasingly more reflexive and explicit, making it increasingly unreliable. Even scientific knowledge cannot guarantee security. As a matter of fact, science refers to the contingency of all knowledge because it has to explicitly reflect on how to achieve it. But as we know from the sociology of science, scientific knowledge also produces cultured routines, methods, and conventions which are able to cover up the latent functions of those limitations of observation for the every-day life of research (Knorr Cetina, 1999). Only this limitation enables science to produce 'true knowledge' (p. 5).

We are accustomed to accounting for the idea of the knowledge society with the accentuation of knowledge as the decisive resource, especially in technical and economic terms (p. 5).

Above all it has to be recognized that expert cultures no longer have the power to present definite knowledge without alternatives. From the perspective of demand for professional expertise, knowledge begins to get insecure and ambiguous because one can always find tomorrow another expert with a different expertise than the one he or she believed today. Thus in the so-called knowledge society, the 'truth' of expertise has to be identified by the audience of demanders, not by the suppliers

of knowledge. For the latter, this means that their expertise has to switch from the 'objective' conditions of their knowledge to their social conditions. They have to take into account for whom and under what expectations expertise is required – and the expected forms of criticism and needs seem to become the most important source of what can be expected to win currency as knowledge (p. 7).

Talking about the knowledge society hints at the fact that knowledge has become a problem, one which cannot be solved by more or better knowledge. Not knowledge is falling into short supply, but security that we once gathered from knowledge (p. 7).

Stehr (1994)

One of the first authors to employ the term 'knowledge society' is Robert E. Lane (1966, p. 650). He justifies the use of this concept by pointing to the growing societal relevance of scientific knowledge which defines a knowledgeable society, in a 'first approximation', as one in which its members

(1) inquire into the basis of their beliefs about man, nature and society; (2) are guided (perhaps unconsciously) objective standards of veridical truth, and at the upper levels of education, follow scientific rules of evidence and inference in inquiry; (3) devote considerable resources to this inquiry and thus have a large store of knowledge; (4) collect, organize, and interpret their knowledge in a constant effort to extract further meaning from it for the purposes at hand; (5) employ this knowledge to illuminate (and perhaps modify) their values and goals as well as to advance them. Just as the 'democratic' society has a foundation in governmental and interpersonal relations, and the 'affluent society' a foundation in economics, so the knowledgeable society has its roots in epistemology and the logic of inquiry.

In other words, Lane's conception of a knowledgeable society is tied rather closely to the promise of a particular theory of science and reflects, also, the great optimism of the early 1960s which suggested that science would somehow allow for the possibility of a society in which common sense would be replaced by scientific reasoning (p. 5).

Bell also employs the term 'knowledge society' in the context of his discussion of the emergence of *post-industrial* society, a designation he prefers. Bell at times uses the concept knowledge society interchangeably with the notion of 'post-industrial society' (pp. 5–6).

I choose to label the now emerging form of society as a 'knowledge' society because the constitutive mechanism or the identity of modern society is increasingly driven by knowledge (p. 6).

The appearance of 'knowledge societies' does not occur suddenly; it represents not a revolutionary development, but rather a gradual process during which the defining characteristic of society changes and a new one emerges (p. 6).

Contemporary society may be described as a knowledge society based upon the penetration of all its spheres of life by scientific knowledge (p. 9).

In the knowledge society, most of the wealth of a company is increasingly embodied in its creativity and information. In short, the point is that for the

production of goods and services, factors other than 'the amount of labor time or the amount of physical capital become increasingly central' (Block, 1985, p. 95) to the economy of industrial societies (p. 10).

Much of the discussion about the information society is animated by a concern with the 'production, processing, and transmission of a very large amount of data about all sorts of matter – individual and national, social and commercial, economic and military' (Schiller, 1981, p. 25) (p. 12).

Bell (1973, p. 212) argues that post-industrial society is a knowledge society for two major reasons: (1) 'the sources of innovation are increasingly derivative from research and development (and more directly, there is a new relationship between science and technology because of the centrality of theoretical knowledge)', and (2) 'the weight of the society – measured by a larger proportion of Gross National Product and a larger share of employment – is increasingly in the knowledge field' (p. 14).

Ungar (2003)

The idea of a knowledge society is a gloss, since it is frequently evoked but seldom defined or explored in a systematic way. All too often, it emerges as an extension of the more concrete knowledge economy, or is simply deduced from the existence of information technology and the sheer quantity of available information (p. 4).

I employ Webster's (1995, p. 218) heuristic concept of the 'informatization of life' to differentiate the knowledge society from the knowledge economy. The informatization of life holds that the development of specialized occupational knowledges does not constitute a knowledge society. Informatization necessitates a broader diffusion of knowledge, including social processes that foster socially relevant knowledge among an educated public (p. 4).

The informated workplace typically provides employees with the technology, applications, networks, data bases, training and technical assistance required to carry out their specialized tasks. Hence a knowledge economy – and of course society – does not just depend on the efforts of individuals, but on the institutional arrangements and the social expectations for being knowledgeable and using knowledge (p. 5).

Following Lane's lead, a knowledge society at the institutional level can be regarded as one that provides for the widespread distribution and access to knowledge (and hence minimizes secrecy); provides access in forms or displays that are as interpretable as feasible; promotes and sponsors public discussion of ideas and issues, including networks and venues for doing so; recognizes and rewards the public use of knowledge; and employs such knowledge in decision-making processes (p. 5).

Perhaps the greatest problem with the knowledge society is that it is an unfruitful metaphor, an unenlightening addendum to the idea of the knowledge economy. Whereas the latter continues to attract interest, commentary and linguistic innovation, the former remains sterile (p. 8).

McLennan (2003)

Charles Leadbeater, for example, a much-quoted proponent of KS ideas, argues that we are now 'living on thin air', that is to say, in an economy which operates as a system of 'distributing intelligence', and which generates products, like Coke cans, the substance and value of which is *constituted by knowledge* where once they were mostly *composed of materials* (Leadbeater, 1999, pp. 8–10) (p. 4).

Of course, they say, any human form of organization is in some sense a knowledge society. But what is uniquely distinctive about the current informational regime is that, in Nico Stehr's rendering (2001, p. ix), 'we increasingly arrange and produce the reality within which we exist on the basis of our knowledge'. Manuel Castells, for his part, summarises that what is new in the information age is not the importance of knowledge per se, but rather 'the action of knowledge upon knowledge itself. (Castells, 1996, p. 17) (p. 4).

Further illegitimate elisions in KS discourse include all-purpose talk about the 'knowledge revolution', when it is often the transformation of knowledge *communication* rather than knowledge *production* that is being characterized; and the persistent equation of knowledge *economy* with knowledge *society*. The latter merger has two possible connotations, but they run in opposite directions. One involves a strenuous reductionism – something that is not, incidentally, much favoured in KS-style figurings of epistemological complexity – whereby cultural and social forms are seen as the functional prerequisites of an endogenous *techno-economic* momentum at the heart of the post-industrial order. The other connotation, which emphasizes knowledge society in a broad sense, is about intrinsic *socio-educative* goals: that it is intrinsically good to be educated and informed in an ongoing, self-realising kind of way (p. 7).

This is an economy/society which is populated by an increasingly reflexive and active citizenry of 'wired workers', those who know that knowledge is the principle factor of production, and who own know-how is now the most valuable form of property that economic organizations have recourse to. These people work with computers in non-hierarchical settings, and they have engaged in problem solving activities rather than repetitive tasks (p. 11).

Network Society

Castells (2000b): 'the contours of the network society'

I do think we live in a new society already, not in the future but right now. I call that the network society, not the information society for the reasons that I hope will become apparent soon. What is new about this society is something very simple to start with – the technology. The technology is new. It does not mean that the technology produces society. Technology is part of the society. It is one inextractable dimension of the society at large (p. 152).

The fact that we have new technologies allows possibilities of social and economic organization that did not exist before. In other words, the information

technologies are not the cause of the social transformation, but without these technologies the processes that lead to social transformation could not happen. Hence, it is a different argument that this new technology is not a sufficient but a necessary condition for the kind of society we live in, the network society (p. 152).

What is new in this society is the prevalence of networks. It means that we have entered not only a new technological paradigm, but a new form of organizational structure for everything we do. We have shifted from the vertically organized, standardized, rationally structured, hierarchically structured forms of activity to networking forms of activity. A network is simply a set of interconnected nodes. Networks have always existed, so this is not a new form of organization. Networks have now generalized and are generalizing their presence in economy, society, politics and culture because of the new technologies. Here is the conversion between social change and technological change (p. 152).

We should abandon the notion of information society per se because it is ambiguous. It does not capture the essence of what is happening. If we say information technology society we are much closer to what is happening. On the other hand, it would imply technological determinism, which would assume that information technology determines society (p. 156).

Post-Industrial Society

Brint (2001)

In the case of postindustrial society, two economic changes were regarded as particularly important. The first of these had to do with the increasing importance on non-profit services. Bell argued that as societies develop they move from a reliance on agriculture and mining (primary sector) to a reliance on manufacturing (secondary sector) and finally to a reliance on services. Further, the pattern of services-based industrial growth follows a trajectory of population wealth. Industrial centres move from services related to the production and movement of goods (such as transportation and repair) to personal services (such as restaurants, hotels, travel, entertainment) and, at the last stage, to knowledge-based services providing access to the 'good life', especially health, higher education, recreation and government (p. 108).

Wisdom

McKenna and Rooney (2005)

... wisdom is that which: coordinates knowledge and judgments about the 'fundamental pragmatics of life' around such properties as (1) strategies and goals involving the conduct and meaning of life; (2) limits of knowledge and uncertainties of the world; (3) excellence of judgment and advice; (4) knowledge with extraordinary scope, depth, and balance; (5) search for a perfect synergy of mind and character; and (6) balancing the good or well-being of oneself

and that of others. Such a characterization, then, implies that wisdom includes both rational (scientific) intellectual practices and 'other' more transcendent and unscrutinizable (tacit) mental processes like imagination, intuition, creativity and so on. Fundamental to our theorization of 3 wisdom is a commitment to ethical behaviour, consistent with its Aristotelian (secular) and Thomistic (religious) European origins (p. 2–3).