2. Defining a ‘knowledge society’

Introduction

To address what ‘knowledge society’ refers to means understanding how data is embedded in society and in what ways we can view society as a learning phenomenon. Society is, in many ways, shaped by the way it learns – how it can organise ways to produce goods and services and to consume those goods and services. This process of production and consumption requires knowledge and cultural interpretation and, thus, social life is defined through production, consumption and interpretation. There are different domains of knowledge, some of which are closer to production and consumption while others are more esoteric. The meaning of knowledge is discussed further in the next chapter. Nonetheless, knowledge is created socially and, over time, the production and consumption of knowledge has changed. This chapter discusses the ways in which knowledge has been produced historically and how it is produced in contemporary society.

The specific social change in question is the move from an information society based on a knowledge economy to one based on a knowledge society. There are a range of definitions of the term ‘knowledge society’, but, broadly speaking, a knowledge society is one that generates, processes, shares and makes knowledge that may be used to improve the human condition available to all its members (Castelfranchi 2007). Castelfranchi (Ibid.) asserts that a knowledge society differs from an information society, because it seeks to transform data into resources that allow society to take effective action towards creating a genuinely participative society where everyone can benefit from access to knowledge and contribute to knowledge. This differs from an information society, in which information is the key commodity in production, consumption and innovation. An information society’s economy – a knowledge economy – uses information to create knowledge to fuel innovation and economic growth. This means that an information society circulates information within selected economic, political and social networks and has a more limited social agenda of inclusion (Wessels 2010). Therefore, assessing what changes are required to transform into a knowledge society, and what role data might have in that, requires understanding how society organises the production and distribution of knowledge.

Although knowledge is produced in many areas of social life, since early modernity one of the main areas of the production of knowledge
is science. The institution of science has shaped, and continues to shape, how formal knowledge is understood. The role and position of science has changed over time, and they may well continue to change in any possible transformations into a knowledge society. Change in the role and position of science is significant in two main areas: first, the ways in which science defines knowledge and produces data; and second, how science and scientific knowledge relate to other areas of society. Together, these two points combine in terms of understanding how formal scientific knowledge is produced and shared across the social relations of society. The characteristics of the social relations of society also shape the values that underpin knowledge and determine how it should be used. To explore how one can start define knowledge, this chapter first discusses data within society, before outlining society as a social and human product. It then discusses science, knowledge production and society in general terms, then goes on to consider the position of knowledge production and distribution in post-industrial and information societies. Next, the chapter discusses the conceptualisation of information society, knowledge economy and knowledge society. It concludes by emphasising that, even though formal knowledge has become more integrated into society, there remains a limited openness to data.

Data in society

To consider how a society might be transformed from an information society into a knowledge society means understanding how data sits within that society. This is because the production and use of data is shaped by a range of social relations within sectors and across sectors of society that include the commercial and public sectors as well as scholarly research.

The term ‘data’ is widely used amongst academics, researchers, professionals in the public, private and third sectors as well as by the general public. Data, information and knowledge are often considered in relation to each other. In general terms, data is collected and analysed to create information suitable for use in decision-making, while knowledge is developed from extensive experience gained from dealing with information on a subject (Beynon-Davies 2002). Data is pervasive and is used in all aspects of social life. It is collected, coded, interpreted and used across a range of social practices, which are shaped by the production and consumption patterns of particular social contexts and sectors. Therefore, although data, information and knowledge are broad abstract terms, they also have
distinctive characteristics resulting from their respective collection and processing methods as well as the uses envisaged for them.

It is important to understand data in a social context, because the specific characteristics of data are shaped by their contexts of production and consumption. One area of society that has historically had a role in creating data is science. The role of science in society and its particular characteristics create data and assess the validity and value of particular data. Although data can be viewed as a general category, it is also specific, and different data have distinctive characteristics. As science develops and changes over time, the meaning and relevance of data also changes. Of course, science is not the only source of data, but scientific data has a particular value, appreciation and use within scholarship and, in some instances, in wider social life as well.

One way to consider data in society is to examine the way that society is organised and the sectors of its organisation, including the role of science as an institution. The characteristics of particular institutions and sectors and the relations between them are constituted within particular types of society. Definitions of society are usually based on their relations of production, types of political systems and their respective social and cultural orders. The precise configuration of these dimensions produces distinctive types of society, such as agrarian, industrial or information society (Wessels 2014). The characteristics of data and knowledge vary in the context of these different societies, while data and knowledge are both shaped by the social relations of society. The different understandings of data and the character of the data itself are generated within society and the way in which society organises and orders its material and symbolic resources. By looking at society and social relations in this way, one can appreciate how data is embedded within social relations including science, and how these social relations create and shape the data production and use.

Society as a social and human product: Learning, knowledge and institutions

The precise definition of ‘society’ is highly debated in academic sociology. However, in broad terms, society refers to the way in which humans come together to construct ways of organising life – and Berger and Luckmann’s (1967) contention that society is a human product illustrates this point well. Berger and Luckmann (Ibid.) assert that human self-production is ‘always, and of necessity, a social enterprise’ (1967, p. 51). They continue by
arguing that ongoing human production is ensured through the development of social order, which is created through human action. The ordering of activities in social life is partly achieved through habitualisation, which is any action that is repeated enough to become a pattern, which can then become reproduced. These actions have meaning and retain meaning, although they are routines that are part of an individual's stock of knowledge. The knowledge embedded in these routines and frames of action become institutionalised once there is a reciprocal understanding of these routines – something that Berger and Luckmann (*Ibid.*) call typifications. Furthermore, these ‘typifications [...] that constitute institutions are always shared ones’ (*Ibid.*, p. 55). In this way, shared understandings of ways of doing things emerge, which become shared knowledge that shapes human action and social order.

The way that humans understand the world therefore involves learning, and this learning involves institutions and sets of established actions that are created through social action. Berger and Luckmann's (1967) argument is focused on the way that the social world is shaped by human action, yet also appears objective and fact-like. In forming this proposition, they show that learning about the social world, and what is perceived as nature, requires actors to ‘go out’ and learn, and that this learning is then embedded within actions, typifications and institutions. This process of knowing creates and results in data, information and knowledge in an array of forms. What Berger and Luckmann (*Ibid.*) demonstrate is that the world gains shape, becomes ordered and is made understandable when data, information and knowledge are coded in particular ways.

There is, therefore, a relationship between what we know about the world, how we find out about the world and the ways in which we structure that data, information and knowledge. The relationship between ontology, epistemology and methodology is well documented in the way in which research is practised (Hughes 1990). The outputs of particular research practices that are built on philosophical principles result in various types of data, which are interpreted in line with current knowledge in any one discipline or interdisciplinary field of study (see Chapter Seven). The social dimension of this is the way in which research is institutionalised in society – whether in the field of science, humanities or social sciences. The question of how to identify the particular characteristics of the institutionalisation of research requires addressing the broader question of how research is embedded in wider social relations and society. This logic informed the use of disciplinary case studies within RECODE – to capture how data practices within scientific research are embedded within wider society.
Science as an institution: Knowledge production and society

Changes in society include relationships between science and society. These changes are wider than just the relationship between science and society, because, as Merton (1973) argues, the production and role of knowledge needs to be understood through the ‘modes of interplay between society, culture and science’ (Merton 1973, p. 175). To illustrate the complex relationship between society, culture and science, Merton (1973) explores the relationship between the development of science and religion. Becker (1992) supports this approach and asserts that the development of science involves understanding the way that the exploration of the natural world moved from being part of ‘the greater glory of God’ to the role of mathematics in understanding the natural order.

In relation to this move, Merton (1973) shows that seventeenth-century English Puritanism and eighteenth-century German Pietism shaped the development of science away from a theological approach in the generation of knowledge to one where science itself has authority. This move created a shift in understanding the position of science in society, in both cultural and social terms. This can be seen in the transformation from science as a ‘handmaiden’ to theology during the Middle Ages to the ‘modern’ science of the seventeenth and eighteenth centuries. Modernity challenges established and entrenched Christian thought about science, and many of the metaphysical and theological underpinnings of science in the premodern period were questioned in modernity (Dillenberger 1960). This resulted in the change from a science that was based on Christian perspectives to a ‘new science’ that was founded on norms of institutional science (Merton 1968b).

The premises of modern science and the norms of institutionalised science include a detached objectivity about the research under question, a focus on logical and empirical proof (scepticism), and the following of established impersonal criteria in scientific process and towards its knowledge claims (universalism) (Becker 1992). Merton outlines some of the key characteristics of this new science or modern science, which are often called ‘Cudos’. Cudos refers to four key themes of science:

– Communalism – the common ownership of scientific discoveries, according to which scientists give up intellectual property in exchange for recognition and esteem.
– Universalism – according to which claims to truth are evaluated in terms of universal or impersonal criteria, and not on the basis of race, class, gender, religion or nationality.
Disinterestedness – according to which scientists are rewarded for acting in ways that outwardly appear to be selfless.

Organised scepticism – all ideas must be tested and be subject to rigorous, structured community scrutiny (Merton 1942).

This shift from science as an adjunct of theology to modern science is sometimes referred to as the ‘Scientific Revolution’. The transformation of science into an autonomous discipline began in Europe towards the end of the Renaissance period and continued through the late eighteenth century. This scientific turn also influenced the Enlightenment or Age of Reason – a cultural and intellectual movement based on reason, analysis and individualism. There were a series of innovations in science during this period across a range of disciplines, including theories of gravitation, heliocentrism and a range of medical discoveries. The new modern science included mathematics, physics, astronomy, biology (including human anatomy) and chemistry. These disciplines featured in changing ways of understanding society and nature. The institutionalisation of modern science was marked by the establishment of the Royal Society in England in the 1660s and the Academy of Sciences in France in 1666.

One of the main features of this new science was that it sought to control and exploit nature (Cunningham and Jardine 1990). However, there was a response against modern science and the Enlightenment by the Romantic Movement in the eighteenth century, which criticised the Enlightenment’s mechanistic natural philosophy. The Romantic reaction was based on a view that science should benefit both nature and society, and it advocated a ‘reflective science’ that would acknowledge the self in the generation of knowledge (Bossi and Poggi 1994). The focus was on how humans gain knowledge through self-understanding and working with nature (Cunningham and Jardine 1990). However, this approach declined during the 1840s with the re-establishment and further development of positivism and the strengthening of the objective scientific method. Even though there were many debates about the scientific process during the nineteenth century, such as the Popper-Kuhn debate (Fuller 2006), the practice of science became professionalised and institutionalised in ways that continue into twenty-first-century contemporary society.

1 The dates of the Enlightenment period are debated, but key publication dates mark its beginning and end. The beginning is marked by the publication in 1543 of Nicolaus Copernicus’s *De revolutionibus orbium coelestium* (*On the Revolutions of the Heavenly Spheres*) and its end is marked by Newton’s 1687 *Principia*. 
Within this institutionalisation there were – and continue to be – debates about the nature of knowledge. The philosophical debates were concerned with abstract reasoning and argument, but these tended to be situated in specific historical periods, scientific and social contexts. They also included methodological debates – so the concerns were not just about what can be known (ontology), but also how we can know those things (epistemology), and in what ways we can examine these things (methodology). Toulmin (1972) traces the way that epistemology is rooted in particular historical periods and relates to the available practical procedures and to particular historically-conceived disciplines. For example, Descartes and Locke were two key figures in Western philosophy, and although they were intellectuals, they were also people of their age. They each discussed the principles of human knowledge in the context of their historical period and contemporary ideas about nature and people's place within that. This can be seen in what Toulmin (1972) calls their 'commonplaces', which is how he refers to the things these scholars took for granted. In Descartes and Locke's period, these were that:

- nature is fixed and stable;
- there is a dualism between mind and matter;
- the criterion of knowledge is a certainty built on geometry (Hughes 1990).

These 'commonplaces' provide an 'ontological description of the world and epistemological prescriptions about how the world could be investigated' (Hughes 1990, p. 8). Hughes (1990) argues that these commonplaces tend to guide and direct the work of scientists and that, over time, these commonplaces gain authority and become established views of the world. Views based on the three commonplaces cited above were widely held by scientists and philosophers at that time, and this was the basis on which further and more detailed work was undertaken in a range of disciplines. This work, in turn, gave an intellectual credibility to the underlying commonplaces. The way in which 'commonplaces' were reinforced and became justified in the scientific process was through the way that science reflexively establishes its own validity (Ibid.).

Part of the process of science is the interaction between developments in technology for scientific work and the way that knowledge is produced. Some technological innovations have supported the ability to discover new findings, which then create new possibilities and approaches to a range of established and emerging scientific issues. Examples of this include telescopes and calculating devices for scientific and related work. Other
technological developments, such as the ‘steam digester’, had uses beyond the laboratory and acted as precursors to – and could be patented for – wider industrial usage. These movements in science and their respective revolutions in scientific understanding resulted in changes in how the world was understood in broader society. This book argues that the role of open data in research, and the technologies and processes required to take full advantage of this data, could also bring about an evolution in technology, culture and society that informs and is informed by changes in the ways in which data are used.

Within historical worldviews of early modern science, there were many different theoretical schools as well as disciplines (for example, rationalists, empiricists and vorticists) and, even though there might be different disciplinary foci and approaches, they were nonetheless all based on a consistent ontological and epistemological framework. There was, therefore, a set of core principles that together had intellectual authority and, when strongly legitimated, form paradigms. Kuhn (1962) argues that when scientists are working within an established framework or paradigm that holds intellectual authority, they are undertaking ‘normal science’. However, Kuhn (Ibid.) also identifies what he calls ‘paradigm shift’, which happens when there are anomalies that cannot be explained by the existing scientific paradigm. Kuhn (Ibid.) argues that paradigm is not about any one theory, but rather is a worldview in which theory exists and which frames research and knowledge production.

This discussion of the interplay between society, culture and science shows how science and the knowledge it creates is embedded within wider social and cultural processes. It also shows that there are several layers of social relations that together form the context in which the meaning of data becomes apparent. The meaning of data and the particular forms and content of data are therefore informed by the society in which that data is embedded. Part of this involves recognising the particular role of the characteristics of science in society, because its work produces distinctive senses of the natural and social world. The role of data is at the centre of shaping these senses of what is known – since data and its interpretation generates information and knowledge – and its interpretation is made possible by knowledgeable agents and social actors within particular social institutions. Given this, RECODE used precisely these agents and social actors as informants to better understand shifts in the ways in which data is used.

2 The steam digester was a high-pressure cooker invented by French physicist Denis Papin in 1679.
being produced, used, preserved, curated and re-used to further understand broader shifts in science, society and knowledge.

Post-industrial society: Positioning knowledge in the wider socio-economic process

The Scientific Revolution established science as a distinctive and autonomous institution and it formalised a particular process of knowledge production. Although there are debates about the scientific process and revolutions in science and in scientific paradigms, science is still seen as an autonomous institution that is responsible for developing new knowledge. However, during the mid-twentieth century, changes occurred that were not so much changes in terms of the position of science as a source of knowledge, but rather shifts in where science and scientific knowledge were positioned within broader social and cultural life (Bell 1973).

During the industrial period in the Global North, the sciences and humanities knowledge base was kept within science institutions and universities. Knowledge outside of what could be referred to as the ‘pure sciences’ and ‘disinterested scholarship’ was lodged in industries such as steel making, manufacturing, mining, transportation and gas and electrical infrastructures as well as agricultural work. Although new knowledge in science and engineering contributed to developments in industry during this period, there was no direct link between science, technology and economics (MacKenzie and Wjacman 2002). However, in the mid-twentieth century, the position of science in economic life and the position of knowledge production changed. The processes of de-industrialisation and post-industrialism ushered in changes in the role of knowledge in the economy and society more broadly. Although it is highly disputed because it overemphasises change from an industrial society, Bell’s (1973) work on post-industrial society points to the repositioning of knowledge in the economy, and in society more widely.

3 The rise of positivism in science was first generated during the scientific revolution and was followed by a reassertion of positivism by philosophers such as Comte in the late 1700s to mid-1800s and then further considered in the early 1900s by the Logical Positivists of the Vienna Circle as well as the Berlin Circle. The more reflective approach within science did not, however, disappear, but has followed, and continues to follow, an established anti-positivist and critical theory approach. New turns in science include more socially distributed, application-oriented, and trans-disciplinary research (Jankowski 2002).
In broad terms, a post-industrial society is one in which an economic transition has occurred from a manufacturing-based economy to a service-based economy, where there is a diffusion of national and global capital, and mass privatisation. What is distinctive about Bell’s (Ibid.) argument is that he claims that scientific knowledge has a more central position in society. Bell (Ibid.) uses the notion of an axial principle to define the character of society, asserting that this acts as an energising principle for all the other dimensions of society and that, in post-industrial society, the axial principle is knowledge. In post-industrial society, Bell argues, ‘theoretical knowledge’ increases the importance of science and technology in the economy, which also involves the rise of professional, scientific and technical groups in society. Ritzer (1993), following on from Bell (1973), notes the growing importance of the role of scientists such as specialised engineers (genetic, electric and so on), arguing that such knowledge is seen as the basic source of innovation (for example, the knowledge created by scientists involved in the Human Genome Project is leading to new ways of treating many diseases). Advances in knowledge also produce a need for other innovations, such as ways of dealing with ethical questions raised by advances in cloning technology.

All of this involves an emphasis on theoretical rather than empirical knowledge, and on the codification of knowledge. The growth of theoretical and codified knowledge, in all its varieties, is central in the emergence of the post-industrial society. The development of new technologies also requires new intellectual technologies, which can monitor the increasingly information-driven enabled innovation, such as cybernetics, Game theory and Information theory. These processes and the new view of the role of theoretical knowledge are resulting in a new relationship between scientists and the systematic technological growth at the centre of post-industrial society. The university gains significance in such a society because it produces experts who can create, guide and control the new and dramatically-changing technologies.

Although Bell’s (Ibid.) argument is highly debated, it does describe how the role of knowledge, scientific institutions and universities changed during the post-industrial period. The main change was that knowledge, including scientific knowledge, became more central in social and economic life. When these trends were combined with innovations such as the internet and factors including globalisation and the rise of neo-liberalism, they developed into an information society (Wessels 2014).
Information society and the knowledge economy

The move to the idea of an information society is based on the use of information and communication technologies (ICT) to manage information and communications (Webster 1995), and on the growth of the information industries (Machlup 1962). These developments prompted claims that focused specifically on information, stating that information is at the centre of the economy and thus denotes a shift away from an economy of goods into an economy of information. In this context, the organisation of information is seen as the prime creator of wealth (Porat 1977a, b). Freeman (1992, 1994) linked the development of ICT and the proliferation of information more deeply, arguing that technology is embedded within innovation cycles that produce socio-economic change. Freeman (in Mansell and Steinmuller 2000) predicted that an information-based economy was set to mature early in the twenty-first century and supports Piore and Sabel’s (1984) argument that much of this economy will be characterised by flexible specialisation, in which small production units respond rapidly to niche markets with customised products made by adaptable, multi-skilled craftspeople.

This type of production is related to the idea of a network – both the network as an organisational form (Castells 2001), and as a networked society (Castells 1996). Castells (Ibid.) argues that the rise of networks that link people, institutions and countries characterise contemporary society. The purpose of these networks is for information to flow in what Castells (Ibid.) defines as an ‘informationalized society’ – one in which ‘information generation, processing, and transmission become the fundamental sources of power and productivity’ (Ibid., p. 21). Castells considers this significant because it is ‘the new information technology paradigm (which) provides the material basis for (the network’s) pervasive expansion throughout the entire social structure’ (Ibid., p. 469). Thus, the network underpins and comprises the infrastructure of society. The logic of these networks is that they connect locations globally and, as Goddard (1992) argues, they provide an infrastructure for information, which is a ‘key strategic resource’ in the world economy. This relates to the rapid growth of the ‘tradable information sector’ seen in the expansion of new media and online bases of information as well as in the reorganisation of the world’s financial system with the development of high finance trading. The growing ‘informatization’ of the economy is, with supporting policy and infrastructures, facilitating the integration of national and regional economies (Goddard, cited by Webster 1995, p. 18).

As far back as in 2000, Mansell and Steinmuller were asserting that the development of an information society would be extremely difficult to
predict. They stress that any new development has to be carved out from incumbent legacies and must embrace insurgent strategies – not only for economic competitiveness and to improve political engagement, but also to facilitate a virtual community strategy that will underpin an ICT-literate society. Mansell and Steinmuller (2000) continue by arguing that these dimensions of change involve the mobilisation of society across all dimensions and require the dynamic players and emergent communities to expand the vision of an information society. This observation suggests that any analysis of an information society involves addressing broader social and economic issues, because they interact with cultural and political dynamics.

The development of an information society illustrates the way in which digital technology, social, economic and technical networks, and information are key features in contemporary society. The value of information is recognised by those in the service and finance industries as well as the information sector. Furthermore, information and its interpretation is a component in contemporary innovation. This is an important point because, in a globalised capitalised world, the economy is based on rapid innovation cycles. The information society is a speeded-up world of rapid innovation in the circulation of goods (Wessels 2010). This acceleration of innovation in an information society has generated an increasing interest in data and the ways that it could be utilised for economic purposes. This, combined with the repositioning of science and universities more centrally in the economy, created the context in which scholars could start to discuss the idea of a knowledge society.

**Defining a knowledge society and changes towards Mode 2 knowledge production**

Although the term ‘knowledge society’ was coined by Peter Drucker back in 1969, it was not developed further until the mid- to late 1990s by scholars such as Robin Mansell (1998) and Nico Stehr (1994). Instead, as discussed above, change was discussed in terms of an information society and in many ways that focus is apt because the term ‘knowledge society’ is distinctive and differs from the definitions of an information society. Discussions about the information society tend to focus on commercial and economic networks in society. There has, of course, been some commentary about the social and cultural aspects of such a society, which indicate that digital processes and digital content are pervasive and integrated into daily life (Wessels 2010). Nonetheless, the strong focus on economic networks and information in
discussions about an information society misses some of the claims made by the developer of the World Wide Web (WWW), who suggested that the WWW could open up society and enable the sharing of information and data freely amongst people (Berners Lee 1999).

Mansell (1998) and Stehr (1994) note that the debates about an information society cannot be separated from considerations about a knowledge society. This is because the notions of information society rest, to some degree, on commercial and economic networks of society that are technologically supported, whereas the concept of knowledge society encompasses other dimensions, such as ethical and political concerns within social life. Yet, despite these social issues being raised, most attention has been paid to notions of an information society and a knowledge economy – and further, little attention has been paid to how they relate to each other. The most well-established approach is Castells’ (2001), stating that the organisational form underpinning both a knowledge economy and an information society is the network based on digital technology. Castells (2001) clearly states the potential that an informational and networked society would have if there was an appropriate institutional framework that would support an inclusive society. However, he notes that there are also negative aspects of informational and networked developments, which include concerns such as greater control and administrative power through surveillance of populations, greater inequality in terms of both production and consumption, and challenges for ensuring privacy. The points Castells raises are made in relation to an information society scenario. These points are still relevant when discussing the knowledge society today.

Currently, there is no agreed definition of ‘knowledge society’, so the term is often used to refer to a range of possible concepts of a knowledge society. The term or similar terms, are not new. Back in 1966, Robert Lane used the phrase ‘knowledgeable society’ to refer to the growing social relevance of scientific knowledge. His view relates tightly to a specific understanding of science during the early 1960s, which thought that science would enhance social life by replacing common sense with scientific reasoning. He draws parallels with the political sphere, arguing that democratic society is founded on governmental and interpersonal relations as well as the affluent society, which is built on an economic foundation. His concept is based on the normative framework for science as set out by Robert Merton and he considered that a knowledgeable society would be rooted in epistemology and the logic of inquiry. Drucker (1969) defines the term ‘knowledge society’ in a more open way, placing the role of knowledge at the centre of society, where it provides the basis for the economy and social action. These early
concepts about a knowledge society dovetail closely with Daniel Bell’s (1973) thesis, that knowledge is at the centre of society, and they lay a foundation for the notion that, in late modernity, ‘knowledge’ in seen in terms of both codified knowledge and scientific knowledge.

These early definitions and conceptions of knowledge society are based on a Mertonian understanding of science. Furthermore, they reflect the optimism and belief that science had the power to transform society that was prevalent in the mid-1900s. However, not only has the world stage changed in social, economic and political senses, but science and the practice of science has also changed. Gibbons, Limoges, Nowotny, Schwartzman, Scott and Trow published ‘The New Production of Knowledge: The dynamics of science and research in contemporary societies’ in 1994, which examined changes in forms of knowledge production. The authors proposed that there had been a move in knowledge production from what they termed ‘Mode 1’ to ‘Mode 2’ knowledge production. Although their thesis simplified the changes and practices, it did nonetheless sensitise commentators and policymakers to an apparent trend. Mode 1 was characterised by ‘the hegemony of theoretical or, at any rate, experimental science; by an internally-driven taxonomy of disciplines; and by the autonomy of scientists and their host institutions, the universities’ (Nowotny, Scott and Gibbons 2003, p. 179). Mode 2 was seen as a new paradigm of knowledge production that is characterised by ‘socially distributed, application-oriented, trans-disciplinary, and subject to multiple accountabilities’ (Ibid.).

The ‘Mode 1 to Mode 2’ thesis was well received by policymakers, who were looking for better ways to link science with innovation, with professional disciplines such as management studies, and with researchers in new universities or institutions outside of the traditional university and scientific system. The argument was not so well received, however, by researchers based in what we can term ‘the establishment of science’ – that is, those working in established scientific disciplines and institutions – who sought to retain their autonomy. These groups were concerned that the quality of the science might be compromised through the more open levelling of ideas, and they feared that their own autonomy would be under threat if there were closer links between research and innovation (Nowotny, Scott and Gibbons, 2003). The main controversy around this book was that the move from Mode 1 to Mode 2 proposed a move to relativism, which undermined the established scientific adherence to objectivity within specific paradigms. To respond to these concerns, Nowotny, Scott and Gibbons further developed their thinking and wrote ‘Rethinking Science: Knowledge and the Public in an Age of Uncertainty’ in 2001. In this book, the authors sought to defend
some of the characteristics of academic discourse, whilst analysing how that discourse was being changed. To do this, they identify three trends that are part of a changing research environment:

- The tighter steering of research priorities at supranational and national level.
- The commercialisation of research or ‘engaged’ research.
- The accountability of research.

The effects of these trends are feeding into a new discourse of science and into the role of scientific institutions within discourse (see Chapter Five regarding their role in open data). The drive for a more engaged science whose impact can be measured has resulted in the demise of what is variously termed as ‘pure’, ‘blue skies’ or ‘disinterested’ research. This is illustrated in the UK through the government’s research assessment exercises, which include lay appraisers as well as expert reviewers, and the call for detailed impact studies and evaluations (Nowotny, Scott and Gibbons, 2003). Nowotny, Scott and Gibbons (Ibid.) argue that this change means that knowledge is no longer seen as a public good, but rather is seen as intellectual property, ‘which is produced, accumulates, and traded like other goods and services in the knowledge society’ (Ibid. 2003, p. 185). In this process, they argue, a new language has been created – one of application, relevance, contextualisation, outreach, technology transfer and knowledge management. These changes have been met with various responses, from a ‘literature of regret’ as articulated by the Campaign for Academic Freedom and Democracy (now http://www.cafas.org.uk/) and other concerns of academic scientists.

Another response that is contrary to the one above is the literature of ‘modernisation’, which stresses the importance of research in a knowledge society (Nowotny, Scott and Gibbons, 2003). This literature stresses the need to align research priorities with social, economic and political priorities which, in the UK, was articulated in the White Paper: ‘Realising Our Potential’. Although this paper proposed a high-level focus on change in knowledge production, there was no attempt to make a deeper analysis of the changes in knowledge production in terms of how knowledge is produced, validated and disseminated (Ibid.). This meant that the inner core of the practice and framework of research was not addressed and was seen to be in the domain of the scientific community. This combination of changes to the role and position of science, the way that knowledge is produced, assessed and shared, how research is practiced, alongside developments in an economy based on knowledge, are all constitutive of
society. Despite all these changes, though, one question remains: how do these changes relate to Drucker's point that knowledge also underpins the ability for agency and social action?

Stehr (1994) picks up on the fact that this idea of knowledge underpinning agency and social action is not fully considered in debates about information society or transformations to a knowledge society. He notes that the focus tends to be on an information society and knowledge economy agenda, rather than fully considering what would constitute a knowledge society. He starts by asking what the distinction might be between a knowledge society and what he terms a ‘science society’ (which includes many of the characteristics of information society and post-industrial society). His choice of term is important since he builds on the discussion cited above, noting that the main concerns of these are 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’ (Stehr 1994, p. 12). Taking into account that information in various forms has always been part of society historically, and continues to be so, Stehr (1994) points to some of the gaps in the analysis of knowledge society. He notes that there is little discussion about the genesis of the information’s substance or about changes brought about by the information’s content. Furthermore, there is a lack of attention to questions the use of data in regard to solidarity or domination in society – data can be used to foster an open participative solidarity and society, or can also be used dominate and oppress people in society in repressive regimes (Ibid.). Stehr (Ibid.) analyses changes in terms of the forms and dominance of knowledge, addressing knowledge and science and then going beyond that, to assess the relationship between scientific and everyday knowledge, and knowledge as a capacity for social action.

To do this, Stehr (1994) suggests that there is a need to address the specifics of knowledge to identify how that knowledge can be used in society, by whom and for whom. This extends beyond the rather narrow focus of post-industrial or information society analyses, which consider the position of knowledge on the one hand and the way it can be distributed on the other hand. Stehr (1994) puts aside the point that discussions about how the impact of science serves the development of an assessment of the value of science (Holzner et al. 1987), to consider its impact more widely. He writes that, in ‘most conventional accounts, science is said to generate, first and foremost, if not exclusively, new types of possibilities for, or constraints on, practical action’ (Stehr 1994, p. 12). He expands on this by considering:
That science and technology not only allow for new forms of action but they also eliminate others and have an impact on the experience of action.

They also assure the ‘survival’ (in the sense of continued relevance) of existing forms of action and, in some sense, even generate occasions that affirm traditional action (Stehr 1994, p. 13).

This focus goes beyond scientific and technological determinism, whilst recognising that science and technology do feature in change and continuity. What Stehr (1994) seeks to show is that, in knowledge societies, science and technology can be used as agents of change, but can also be used to resist homogeneous transformation. What this suggests is that science and technology have ‘enabling features’ that ‘increase the number of available strategies, heighten flexibility or effect the ability of the powerful to exercise control and constraining forces which limit choices, reduce options and impose penalties and risks’ (Ibid., p. 13). Scientific knowledge as well as other types of knowledge, can therefore both enable and constrain social action and, when knowledge of various forms becomes a central feature in societies – such as a proposed knowledge society – then those societies become both ‘more standardised and more fragile’ (Ibid.). Therefore, defining what a knowledge society is requires going beyond the definitions of information society – whilst recognising their legacy – by recognising the way in which ‘knowledge’ features in social action, how it can be generated, shared and acted upon by social groups. This means addressing the concrete ways in which knowledge is produced and consumed, by examining the politics of data and data sharing, because who has access to data and can interpret it influences how data can be used in generating knowledge. It also determines who has knowledge and who has the capacity and capability – the agency – to use it.

In overall terms, Stehr (1994, 2004, 2012) argues that the development of a knowledge society is a gradual process that is not deliberately triggered by human design, but, instead, is shaped by the ways that new technologies, new data fields, new needs and new imaginations interact and configure to produce new possibilities and innovations. In the consideration of the knowledge society, there is a need to define what knowledge means in the context of such as society. Stehr defines knowledge as a capacity for action which, he argues, has multifaceted implications. For example, some knowledge may not be used and knowledge can be employed for irrational ends as well as for progressive purposes. Stehr’s (1994) definition of knowledge as a capacity for action indicates that the material realisation and
implementation of knowledge is open and is dependent on, or embedded within, the context of specific social, economic and intellectual traditions. In general terms, knowledge is different from information in that it requires frameworks or commonplaces and resources to create it as well as the intellectual and cultural interpretation to analyse it and put the data to use.

A broad definition of knowledge is also evident in the way the term has been used in some policy documents, especially those published by UNESCO. The ‘UNESCO World Report’ (2005) claims that ‘knowledge’ needs to be considered as an object that has huge stakes in society in economic, political and cultural terms. The report raises some critical points about the kind of knowledge implied in a knowledge society, and it questions a techno-scientific definition of knowledge. Instead, the report asserts that there are different types of knowledge, such as local knowledge, for example. It also highlights the inequalities of access to knowledge and capacities to interpret and use it. In this context, UNESCO makes some ethical and normative suggestions within a development paradigm, claiming that, to ‘remain human and liveable, knowledge societies will have to be societies of shared knowledge’ (Ibid.). It is thus arguing for an open approach to knowledge, with data being a central part of this dynamic. Relating to the ideal of a knowledge society being a progressive open society there are, of course, a range of understandings about knowledge society that are more restrictive while, in the struggle between standardisation and fragility, there is a strong call from regional to global policy actors for ‘activating knowledge’ (Soete 1997). This call raises questions about how knowledge can be activated and by whom.

Conclusion

The Scientific Revolution challenged the role that existing institutions such as the church played as the key source of knowledge and authority, instead designating science and the institution of science as the primary place for the growth of knowledge. The way in which knowledge was, and is, produced creates debate within broader social and cultural life and during social and cultural change. For example, Kuhn focused on science as a knowledge enterprise, whilst Popper gave science symbolic importance because it expressed a critical rationality that was relevant to all aspects of life. The role of science is also positioned politically in terms of its funding and contribution to society, as seen in Mode 2 knowledge production. As the role of scientific knowledge grew in society, and continues to grow, it has
become incorporated into many aspects of society (Stehr 1994). However, the level at which knowledge is integrated into society is limited and this is especially the case in terms of access to data, including scientific data. So, although the position of science in society has changed, access to scientific data is controlled by the scientific community. Therefore, not only do the social relations of a society – its institutions and their agency – shape the way that knowledge is produced, they also interpret the role of science in society. This role goes beyond the focus on knowledge production towards considering the economic, social and environmental roles of science, which are discussed in more detail in Chapters Six and Nine. This relates to Berger and Luckmann’s (1967) thesis on the way shared understandings of ways of doing things are created and, thus, the way that shared knowledge shape human action and social order.

The RECODE project examined each of these theoretical issues through the lens of recent approaches to providing open access to the data generated by scientific research practice. It examined how this changing understanding of data is being shaped by larger policy changes within particular political contexts (e.g. Europe, the USA and Australia) and how this reflects and reinforces new relationships between science, society and culture. This is evidenced by the changing nature of knowledge production that positions data as a product or piece of intellectual property rather than a means to a scientific conclusion and an imperative to treat data as a commodity and manage it accordingly. RECODE also examines how technology functions as both a push and a pull factor to enable and promote changes in producing, managing and re-using scientific data. Finally, it examines authoritative figures within these practices, including scientists, librarians, policymakers and industry and how their perspectives are integrated, including how this compares to those of actors with less relative influence within these spaces, e.g. students, activists, citizens and others.