The Dynamics of Knowledge Creation in Open Regional Economies

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Abstract

Schumpeter's view of creative destruction has helped to foster a dynamic approach to the analysis of economic change. This approach has been enhanced in recent years by contributions to our understanding of how culture and institutions affect the process of economic change. Parallel developments have also emphasised the role of knowledge in modern economies and the increasing returns that result from knowledge creation, especially in open economies. This paper attempts to synthesise these ideas in the context of regional development and to explore the implications for regional policy.

Key words: knowledge, region, policy, complexity, creativity

1 Introduction

The purpose of this paper is to explore the way in which knowledge is created in open regional economies. The paper considers the implications of knowledge creation for regional development and regional policy. 'Knowledge' in this context is distinct from 'information'; whereas information might be defined as a set of qualitative or quantitative data on a particular subject, knowledge involves the ability to use information for a specific purpose. In his history of the role of knowledge in economic development, Joel Mokyr uses the term 'useful knowledge' and distinguishes between 'propositional knowledge' (beliefs about natural phenomena and regularities) and 'prescriptive knowledge' (techniques for the application of propositional knowledge) [1]. Knowledge resides in people and is a major component of human capital, but people invest their knowledge in technology which is used to produce goods and services. In this way, knowledge is contained within machinery, computers, software, products, services and artefacts, from basic goods like sheet steel or wheat to the most sophisticated computer programme or work of art. Of course, some industries and products are more knowledge-intensive than others, so knowledge is more important to their development. This generally increases the added value in these products. Knowledge is transferred through the movement of people, including graduates and researchers from universities, people moving from one firm to another or moving across regional or national borders, and also through the movement of goods, services and equipment, and through social or technological networks.

2 The Dynamics of Knowledge Creation

Joseph Schumpeter's analogy of biological mutation to describe the process of economic change in capitalist societies, a process he termed 'creative destruction', provides a useful picture of the dynamic forces at work in an economy [2]. Creative destruction implies the continual ebb and flow of firms, products and ideas, as new ones replace or adapt and recreate old ones. Knowledge seems to develop in much the same way. Technology, which embodies large amounts of knowledge, is continually being improved and replaced and early versions become unrecognisable in their later forms. Schumpeter's work was in fact a forerunner of modern evolutionary ideas in economics. If we consider an economy to be evolving and adapting over time, it possesses the characteristics of what complexity theorists call a complex adaptive system, a term first applied in this context by Brian Arthur [3]. A complex system is a structure made up of many elements that operate independently and also interact with each other, absorbing information from their surrounding elements.

One of the features of a complex system is that there is increased likelihood of positive feedback, where interaction between elements in the system causes accelerating, self-reinforcing effects or increasing returns. Conventional economic analysis assumes the predominance of decreasing returns to production and consumption as a result of negative feedback, leading to a stable equilibrium. Increasing returns occur, for example, with the use of networks. Each new user of a telephone network or the Internet creates additional benefits for existing users and, since prices for the use of these networks do not fully internalise the network effects, positive network externalities arise. Increasing returns from the use of the Internet are reinforced by the availability of search engines such as Google which help to link each user and website. Another curious example of increasing returns occurs with the use of 'wikis' such as the online encyclopedia, Wikipedia, as each new contributor adds, deletes or amends entries to form an increasing body of information. This phenomenon is discussed at length by Tapscott and Williams [4].

The idea of increasing returns in relation to knowledge has been developed in what has become known as endogenous growth theory, arising out of the pioneering work of Paul Romer [5]. Endogenous or new growth theory emphasises the importance of human capital as a determinant of economic growth. Knowledge plays a central role in the development of human capital and increasing returns stem from the characteristics of knowledge as a quasi-public good. Although not necessarily guaranteeing non-exclusion, knowledge possesses the other main requirement of a public good: non-rivalry. This characteristic enables knowledge to be shared, sold or transferred without loss to its originator, thereby adding to the total stock of knowledge. In this way, knowledge can play a significant role in human capital formation and economic growth.

3 Characteristics of Knowledge in Regional Economies

Given the ease with which knowledge is able to flow across regional and national borders, in principle regions should be able to benefit from all existing knowledge. Whilst this may apply if knowledge is codified and freely available, it is unlikely to be the case where it is uncodified or where access is restricted or costly to obtain [6]. Even where knowledge appears to be perfectly non-excludable, as for example with published academic research, firms may still find it beneficial to be in close proximity to and form close relationships with researchers, leading to the formation of regional clusters such as Silicon Valley and Stanford University in California or 'Silicon Fen' and Cambridge University in the UK. Clusters are examples of social networks which appear to play an important role in knowledge transfer and in turn contribute to regional development. Indeed, evidence suggests that differences in

patterns of knowledge diffusion and barriers to knowledge diffusion help to explain differences in growth rates of output and income between regions [7]. Even more significantly, sustained income differentials have been found to persist where the quality of human capital varies between regions, indicating endogenous growth with decreasing and increasing returns in regions with poor- and good-quality human capital respectively [8].

A particular feature of regional economies that are open to trade, investment and labour migration with other regions and countries is their exposure to goods, services, companies and labour skills from outside the region. Enterprises belonging to multinational companies have been found to be more likely to engage in innovation than domestic businesses [9]. A further benefit of economic openness is derived from the spill-over effects of knowledge; these effects depend on factors such as the mobility of labour (and their 'embodied' knowledge) between regions and internationally and trade in goods and services which carry product-related knowledge [10].

The extent to which knowledge is created and diffused within a region will depend on the type of industries located in the region, the degree of regional specialisation of industry, the number of new firms and industries, links between industry and universities or research institutes and the way in which knowledge diffusion occurs within the region's industries. Whatever the industrial structure of a region, the stock of knowledge is likely to increase over time, but the rate of increase will clearly depend on the above factors. In principle, individual firms benefit both from their private inputs, including the stock of private or company-specific knowledge, and from the aggregate public stock of knowledge. Each firm therefore has an incentive to invest in company-specific knowledge, but in doing so is likely to add to the public stock of knowledge, thus contributing towards and benefiting from an externality [11]. The private return on investment in knowledge creation depends on the degree of protection provided by intellectual property rights. The above discussion clearly indicates potential sources of differentiation in the rate of knowledge creation and diffusion between regions. Despite greatly increased access to knowledge in the modern world, the spatial dimension still seems to be important at the regional level [12].

4 The Role of 'Social Technology': Culture, Institutions and Firm Organisation

In his fascinating account of the nature of wealth creation from a complexity economics perspective, Eric Beinhocker stresses the importance of 'social technology' in providing a framework for the operation of an economy [13]. This view builds on the work of Douglass North and others on the crucial role of formal and informal institutions in creating the rules by which societies and economies operate [14]. Recent work on culture also increases our understanding of the way in which beliefs and values help to shape the institutions that societies create [15]. Beinhocker adds another element to the make-up of social technology: the organisation and strategies of firms [16]. The way in which firms and industries are organised may well affect the rate of knowledge creation and diffusion. North focuses particularly on the concept of 'adaptive efficiency', where an economy has institutions that enable it to be productive but also flexible in response to uncertain political and economic conditions [17].

Institutions that are generally accepted as helping knowledge creation and diffusion, especially in relation to 'prescriptive' or applied knowledge, include the absence of barriers to market entry and exit, the availability of venture capital agencies to coordinate or set standards, close cooperation between industry and universities, and the reduced uncertainty

created by a large source of demand [18]. The question as to whether knowledge creation and new product developments are stimulated and sustained primarily by supply-side factors such as developments in technology [19] or by the need to satisfy demand [20] is important for regional development. However, regardless of the answer to this question, the growth of many of the more successful firms based in small economies (e.g. Nokia, Ericsson, Nestlé) would have been severely constrained without the opportunity provided by a large international market. Economic openness therefore contributes to the flexibility of the institutional environment.

5 Middlesbrough's DigitalCity Project: Regional Regeneration through Creativity

Middlesbrough is a medium-sized town in North-East England with a legacy of urban decay following the decline of shipbuilding, steel and other heavy industries in the region. Among a number of regeneration initiatives is the DigitalCity project. This project is jointly sponsored by the University of Teesside, Middlesbrough Borough Council, the North-East regional development agency (One NorthEast), and a number of local business agencies. The DigitalCity project builds on the existing expertise of the University of Teesside in media technology and computer animation, and aims to combine this expertise with new and growing businesses by providing business units with close access to academic researchers. It will also serve as a vehicle for the commercialisation of academic projects. Although primarily focused on the digital media, the emphasis is on creativity rather than purely technical expertise. The University's School of Arts and Media already hosts an annual international festival of animation (Animex), which attracts high-profile animators and related personnel, and has achieved animated film awards.

The first phase of the development has involved the construction of a new building on the University campus. The building combines business units for companies seeking to develop or strengthen links with the University, studios for DigitalCity Fellows and postgraduate students developing new ideas, and specialist laboratories, innovation rooms and conference facilities. The intention, however, is to encourage the development of creativity and new ideas beyond the digital industries into other creative industries. To this end, the project has now moved into a new phase with the establishment of a creative district in a previously run-down area of the town. This district has been named the BoHo Zone, aiming to combine the creative feel of London's famous Soho district with Middlesbrough's (and its football team's) nickname, 'Boro'. New buildings are being built alongside refurbished historic buildings to provide space for digital businesses and supporting services in a collaborative and supportive environment. The BoHo Zone will later encompass live-work accommodation for digital and creative professionals and specialist business units for artists.

The DigitalCity project is still in its early stages of development, but it aims to link business with the academic community by stimulating a cluster of creative industries and professionals, whilst at the same time helping to regenerate the town. Technology clusters are not new, of course, and, like other clusters, the University is acting as the initial catalyst. The project is also being supported by regional development assistance. Perhaps a more unusual feature is the extension of the creative aspects of digital technology to other creative industries. How encompassing the term 'creative industries' will become is a matter of conjecture at present. However, it provides an interesting example of Richard Florida's idea of the 'creative class' and its potential impact on economic growth more generally [21]. It will be interesting to see how creativity develops in a region which has been better known for its heavy industries than for its creativity in recent years.

6 Implications for Regional Policy

In broad terms, the policy issue relates to the extent and type of intervention by the public authorities or their agencies. A useful starting point is to consider market forces as the most efficient underlying mechanism for coordinating resource decisions in a market economy, whether at the international, national or regional level. Such a starting point would be accepted both by neoclassical microeconomics and by a complexity view of economics. In neoclassical microeconomics, market forces allocate resources in order to achieve welfare maximisation under competitive general equilibrium conditions. From a complexity perspective, markets are simply the most effective way of coordinating the many interacting elements under conditions of uncertainty - a problem that F. A. Hayek earlier described as the 'knowledge coordination problem' [22]. However, under the complexity view, the interminable arguments about intervention versus market forces can largely be avoided. In a complex adaptive system, the role of government is to shape what Beinhocker describes as the 'fitness environment', that is to create the 'social technology' that enables society to achieve its objectives – an environment that is 'fit for purpose' [23].

To the extent that knowledge is freely available across regional and national borders, the role of government is to promote greater and lower-cost access to this knowledge, for example by encouraging increased use of the Internet and competition among Internet service providers. Where access to knowledge is restricted, government will need to consider the reason for the restriction. At the regional level, this may be the result of firms working in isolation or lacking access to finance and other support services; here, the role of government is to provide networking opportunities or incentives for support services to be provided. It is also important to remember that differences between regional income and productivity levels may reflect differences in the quality of human capital or industrial structures. Increasing the quality of human capital or the pattern of industrial development in a region is clearly a long-term objective, but it may nonetheless by necessary. If knowledge is transferred more effectively through close personal contact between firms and universities or by day-to-day interaction between related and supporting firms, then government may need to encourage these activities.

7 Conclusion

Knowledge creation is clearly important for the development of regional economies. Whilst openness to trade and inward investment increases a region's access to knowledge, there also appear to be barriers to knowledge creation at the regional level. In the longer term, improvements in the stock of human capital are likely to produce significant benefits. It may also be necessary to encourage the development of more knowledge-intensive industries, not so much by promoting national champions but by shaping the appropriate 'fitness environment'. In the shorter term, initiatives such as Middlesbrough's DigitalCity project may offer potential benefits by providing the conditions for creative industries to flourish. Creativity, in this sense, is not restricted to the arts but is about the generation of knowledge: ideas and designs that lead to new technology, products and services.

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