GEOFILE Extension 796

The 21st-Century Knowledge Economy

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Synopsis

This **Geofile** looks at the knowledge economy in the 21st century and how this high-tech quaternary industry has particular locational requirements.

Such industries associated with bio-medical, pharmaceutical and the media tend to cluster or agglomerate close to universities and research establishments. The need for an educated workforce, access to current thinking and developments is critical. These industries and their associated research and development also benefit from government support, an efficient infrastructure and range of cultural activities to attract an academic workforce.

Even climatic conditions can play their part in providing an environment conducive to a good lifestyle. Many areas of the developed world now compete to become such centres of excellence with all the benefits that it can bring to the economy.

Key terms

Quaternary industry/sector, knowledge economy, high-tech industry, clustering/agglomeration, connectivity, biomedical sciences, footloose industries.

Learning objectives

By the end of this **Geofile** you will have learnt about:

- the increasing significance of the knowledge economy on a world scale
- clusters of excellence that have developed in biotechnology, media research and development
- the significance of locational factors relating to universities and research sites
- the footloose nature of knowledge economy industries
- the global connectivity at the core of the knowledge economy.

Links

Exam board	Link to specification
AQA A2	3.2.3.1 Urbanisation (rise in the service economy); 3.2.3.2 Urban forms – the concept of the post-modern western city p25 pdf version Click here
Edexcel A2	Topic 3 Globalisation 3.1c The 21st century has been dominated by rapid development in ICT and mobile communication p28 pdf version Click here
OCR A2	2.2.1 Global systems Option A: 2a Growth of services in the global economy p29 pdf version Click here
Eduqas AS/A2 linear	1.3.5 The service economy and its social and economic impacts – the complexity of the changing service economy; 1.3.6 The 21st century knowledge economy (quaternary) p19 pdf version Click here
WJEC AS	2.1.6 The 21st century knowledge economy (quaternary) and its social and economic impacts p23 pdf version Click here

The 21st-Century Knowledge Economy

Industry has traditionally been classified as either primary, secondary or tertiary, with the primary sector referring to the extraction of raw materials from the ground and including such activities as agriculture and mining. The processing of these products takes place in the secondary sector of industry and the manufactured or processed goods are then sold in the tertiary sector. This sector is also concerned with the marketing, and distribution of these goods and other services required in a complex economy. It is within the tertiary sector of industry that change has been dynamic, and this has led to the concept of a quaternary sector of industry, evident by its use of technology. This is the knowledge economy.

The quaternary or 'knowledge-based' sector evolved and developed in the late 20th century with the rise in computer technology. As the 21st century has progressed, information technology has been seen as the driving force in the research and development behind pharmaceutical and biotechnology industries as well as in media. It is seen as a means by which information is both generated and shared. Design, planning and education are integral parts of the knowledge economy and help disseminate information to the wider world.

By implication, it is the countries of the developed world which appear to benefit most from the knowledge economy. In such countries the majority of the work force are employed in the tertiary and quaternary sectors of the economy. With de-industrialisation, employment in the primary and secondary sectors of the economy is declining (Figure 1). The developed world is also where access to higher education is greatest, and it is around such centres of academic learning as universities that much of the knowledge-based economy can be found.

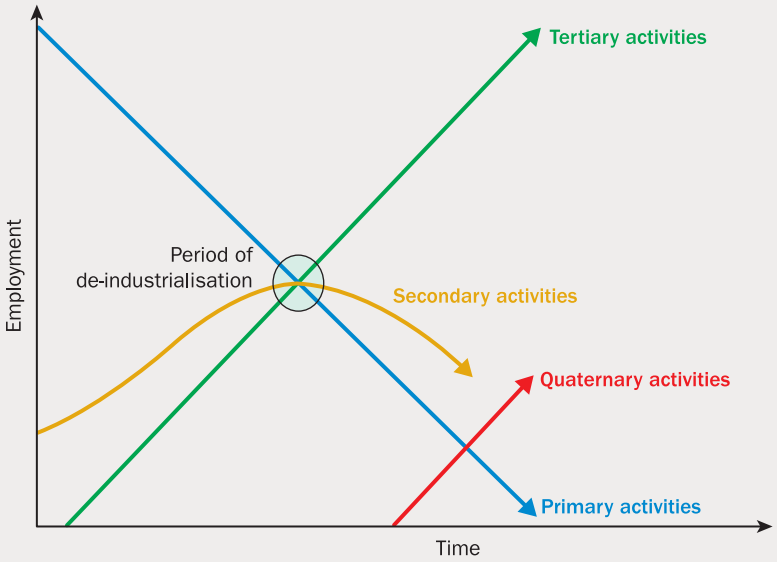

Figure 1 Colin Clark's sector model of an economy undergoing technological change

In the UK, for instance, 76% of the current working population are employed in the tertiary and quaternary sectors of the economy. This is a common trend in all developed countries, but it is to the detriment of less developed economies, where a greater proportion of the workforce are employed in primary or secondary sector economic activities. It is in such countries that lower levels of education, training and development are found, and access to the knowledge economy is more restricted. To turn this around, four pre-requisites recognised by the World Bank group need to be met.

The four pillars of the knowledge economy

First, a skilled and educated workforce is needed to create, share and use knowledge. Secondly, an information infrastructure, ranging from radio to internet access, is essential to enable information to be communicated, disseminated and processed. Thirdly, there needs to be an economic environment where the free flow of knowledge is supported by appropriate investment in information and communications technology (ICT). Fourthly, there needs to be a network of research centres, universities, think tanks and community groups to utilise the ICT available and create new knowledge.

Clustering and agglomeration of 21st-century technology, together with research and development, has led to places becoming known for their importance to the knowledge economy. Four are discussed below.

Case study 1: Silicon Valley

The invention of the silicon chip by Jack Kilby in 1958, using a semiconductor material made of germanium, revolutionised the electronics industry. One area associated with the use of the silicon chip is located in the San Francisco Bay area of Northern California, in particular the Santa Clara Valley and San Jose (Figure 2). It is a hub, or global centre, for high technology, innovation and social media and is known as Silicon Valley. It corresponds to the metropolitan area of San Jose, which now has the third highest GDP per capita in the world, owing to the prosperity it has gleaned from the high-tech industries which have established themselves in the valley. 33% of all venture capital investment in the USA is found within the valley, which is the location for the headquarters of 39 businesses in the Fortune 1000 and a hub for start-up companies using silicon-based technology. Apple Inc, Cisco Systems and Netflix are just three of the companies that operate from here on the world scale.

Figure 2 Location of Silicon Valley
Source: Garrett Nagle, *Advanced Geography* (OUP, 2000) p. 313, fig. 14.21

Case study 2: The Cambridge Science Park

Cambridge, in Eastern England is part of an economic triangle extending from Oxford in the west to London in the south of England, within which there are 24,000 jobs in life science research, development, innovation and production. The Cambridge Science Park is a key hub of recent enterprises.

In the Cambridge area itself, £2.9 billion is generated annually by 15,500 people working in 430 companies in the knowledge economy. Many work in start-up companies founded on research undertaken at Cambridge University while others are employed in the pharmaceutical industry. AstraZeneca, for example, is a pharmaceutical company that has chosen Cambridge as its global strategic research and development site. Almost 3,000 people are employed on its site on the technology and biopharmaceutical campus as Granta Park, adjacent to the world-famous Addenbrooke Hospital. Currently about 130 projects are being worked on with Cambridge University, compared to less than 10 a decade ago. Cambridge University receives about 40% of its income from research funding.

Cambridge University has helped the area develop into an area of global excellence. This part of eastern England, with its close proximity to London, has the advantage of being an area where a high standard of living can be attainable. But there is a need to improve the housing stock, and transport links for accessibility by road, rail and air are other important elements needed to attract and retain an educated workforce.

Taking into account all of the economic triangle, £8.4 billion is added to the UK's economy annually. Cambridge is likely to develop further, with new start-ups looking into the next generation of drugs. The biotech advantage gained with AstraZenica could lead to new pharmaceutical companies

moving to the area because of the depth of the knowledge economy in the area. This is evident from Figure 3, where the current importance of the knowledge economy to the area is highlighted.

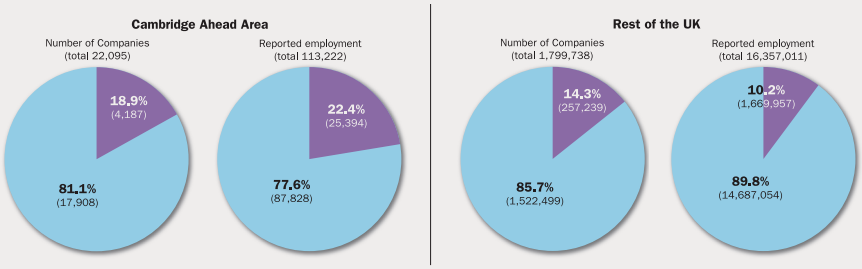

Figure 3 The importance of the knowledge economy to the Cambridge area of England

Source: Dr A Cosh, Centre for Business Research, University of Cambridge, February 2016

Case study 3: Barcelona

Barcelona, formerly referred to as the 'Catalan Manchester' because of its history of textile manufacture, is the second largest city in Spain. Following the decline of its traditional industries, and bolstered by the success of the Olympic Games in 1992, Barcelona has reinvented itself as a centre of the knowledge economy on the Mediterranean Sea. Its location and climate are seen as added bonuses for the city in attracting footloose industries, which are those whose location is not affected by raw materials or market.

Within the city of Barcelona, located in the Catalonia region of Spain, can be found the 22@ Barcelona district of innovation. This centre of intensive knowledge-based industries is located on 200 ha of land in the Poblenou district of the city, in an area once home to the cotton industry. The demise of the cotton industry left an area of built fabric without a function. The designation of the Poblenou as Barcelona's technological and innovation district centred around the Placa de las Glories Catalanes has changed that. 4 million sq m of floor space, 80% of which is used for high-tech industrial activities have been or are being developed. Old factories and warehouses have been upgraded and given new functions and are found adjacent to new buildings such as the Torre Agbar, a 34-storey building housing the headquarters of the water company of Barcelona. In contrast, the Media Tic is an old warehouse which has been adapted to demonstrate ways of saving energy, and is the headquarters of the Barcelona Digital Technological Centre.

All involve ICT technology and the Internet of Things (IoT), and use smart city techniques to ensure sustainability. There are five knowledge-intensive clusters of ICT, media, bio-medical, energy and design which maximise the potential for knowledge-sharing and this district (22 ARROBA BCN) has become a model for urban design and planning around the world.

However, it is not only in the city but in the outskirts of Barcelona that the high-tech knowledge economy can be viewed. In El Valles, north-west of the city, a high-tech cluster is also located close to the science and technology incubator park (Parc Technologic del Valles) and to universities educating students in applied sciences. The Southern European Synchrotron (accelerator) Radiation facility is located here, as is a university department dedicated to artificial intelligence research and calibration.

Catalan and Spanish government investment in infrastructure has helped secure Barcelona's reputation as a centre of excellence for urban regeneration and the application of new technology to secure an industrial future. The city also has a good infrastructure and communications, with an international airport nearby, good surface transport links by motorway and high-speed train. Barcelona has the further advantage of its Mediterranean climate, which can be seen as a draw for people who choose to live in an environment conducive to outdoor life, a good housing stock, and is a city viewed as being dynamic in its own right.

Case study 4: Cape Town

Although South Africa is considered to be a third world country in some respects, its economy is the second largest in Africa after Nigeria. It has had a thriving medical research facility since the 1960s when Christiaan Barnard carried out the world's first heart transplant in Cape Town's Groote Schuur Hospital in December 1967.

Cape Town is hoping to become the principal location for the knowledge economy in Africa. South Africa possesses six of the 15 highest-achieving universities on the continent, with the University of Cape Town (UCT) and Stellenbosch University, both in Cape Town, considered the first and third ranked of these academic institutions. Innovation on campus and use of new ideas has led to 59% of South Africa's start-up companies being found in Cape Town and the surrounding Western Cape area in 2015. Although unemployment is currently high in Cape Town even for graduates, a combination of this innovation and the skills of the graduates are attracting entrepreneurs to create a self-starter culture using high-tech skills and helping to reverse that situation.

Figure 4 Aerial view of Cape Town showing the city centre, Table Mountain and the harbour
Source: Shutterstock/Andrea Willmore

Stellenbosch University's Innovation District, to the east of Cape Town, has a range of initiatives operating such as Media Lab and Innovus, an industry interaction and innovation company. Complementing this, UCT has forged links between education and business, including the Bertha Centre for Social Innovation and Entrepreneurship.

These initiatives are seen as a way of setting Cape Town apart from other African cities, as dynamic and forward-looking. Like Barcelona, it has the four pillars of the knowledge economy in place and Cape Town is ahead of other city competitors on the African continent. If South Africa can overcome the problems its economy faces at present, all citizens of Cape Town could benefit from the knowledge economy.

Conclusion

Industries associated with the 'knowledge economy' have increased in significance in the last 30 years. They are of major significance in the economies of the USA, Japan, the UK and increasingly in China. The need for an educated workforce and suitable environments for research and development to take place has largely limited their locations to the developed world. South Africa, with the second largest economy on the African continent, will try to lure investment, and may succeed more than Nigeria with the largest economy in Africa, as GDP per capita in 2018 was $13,200 in South Africa compared to only $6,003 in Nigeria. Furthermore, levels of corruption are lower and the climate is Mediterranean or warm temperate eastern margin, compared to the equatorial of Nigeria, which may be considered more difficult to adapt to.

Perhaps a widening of the development gap is inevitable as a result of the knowledge economy. This needs to be considered by students, academics and governments alike.

Focus questions

1. What is the significance of Silicon Valley to high-tech industry?
2. What advantages does Cambridge possess with regard to the knowledge economy of the 21st century?
3. Explain how the locational factors as discussed by Gripaios can assist Cape Town in becoming a centre of quaternary industry.
4. Essay: The C21st Knowledge Economy is dynamic and ever-evolving in its locational requirements. Discuss.

Learning checkpoint

After working through this unit, consider the following questions:

1. What does the term 'knowledge economy' mean?
2. Summarise the evolution of the knowledge economy.
3. What is clustering?
4. What advantages do Cambridge and Barcelona have for location of high-tech industries?
5. What are the similarities and differences between Barcelona and Cape Town?
6. Discuss whether Gripaios' 1989 locational factors are of significance in the 2020s.
7. What role does education play in the future for less developed countries whose access to the knowledge economy is reduced? How can this be rectified?

Suggested websites

Search for 'high tech cluster' using the search box for examples in the following website:
Click here

Wikipedia entry for Silicon Valley:
Click here

