

Arbitrary rights

Intellectual property rights have produced strikingly large financial gains for some individuals and corporations, but the big winners have seldom been involved in the creation of new “big knowledge”. John Kay looks at examples to how the system has operated and concludes that it has little economic or commercial logic.

It is a cliché that we live today in a knowledge economy. But what are the economics of the process of knowledge creation?

The evidence of history is that intellectual property rights have made at best only a minor contribution to the development of the knowledge economy. But occasionally, and in an almost arbitrary way, they have conferred extraordinarily large rewards. There seems to have been little economic logic involved.

Albert Einstein devised the general theory of relativity in his spare time, while employed as a clerk in the Patent Office at Zürich. (His Swiss Patent Office salary is arguably the most important contribution that the system of intellectual property rights ever made to knowledge.) Once his genius was recognised, Einstein was never again without a university appointment and was honoured wherever he went. But he never became a rich man. Certainly not in the way in which Bill Gates or

Michael Eisner became rich men.

Along with the theory of relativity, probably the most significant single pieces of new knowledge obtained in the twentieth century were the invention of computing and the unravelling of DNA. A machine that can do sufficiently long strings of calculations can do almost anything. This is now taken for granted, but it was once an insight of startling originality. While Babbage was the builder of the first “analytical engine”

in the nineteenth century, the mathematical and philosophical concepts behind the modern computer were established by Alan Turing, a fellow of King's College, Cambridge, at the time. When the Second World War broke out, Turing joined the code-breakers at Bletchley Park. This group – one of the most astonishing concentrations of intellectual firepower ever assembled – built what is generally thought of as the first operational computer. Turing – a lonely, tortured homosexual who committed suicide – spent the rest of his short life working for the British government.

The structure of DNA was specified in 1953 at Cambridge University by Francis Crick and James Watson, both postdoctoral research workers in the university. Like Einstein, Watson became a *fêted* scientist. Neither ever became what the City would describe as seriously rich.

Business people have sometimes argued that contributions to knowledge such as the discovery of relativity, the invention of computing and the unravelling of DNA were not "commercial". But relativity led directly to the discovery of nuclear power and, by redefining the basis of modern physics, has influenced the design of devices from spaceships to computers. If the idea of computing is not commercial, it is hard to imagine what is. And genetics and biotechnology will almost certainly transform medicine and nutrition in a very few decades.

Not even business people would deny that antibiotics, television and improved seed varieties are "commercial". The discovery that certain moulds would kill bacteria is generally ascribed to slovenly practice in Alexander Fleming's laboratory in St Mary's Hospital, Paddington, in 1928. Despite the apparently obvious practical significance of this discovery, it was a decade before research by Howard Florey and Ernst Chain at Oxford University, sponsored by the

Rockefeller Foundation, led to the creation of a drug that could be administered to patients. The result was the development of the modern pharmaceutical industry and the virtual elimination of infectious disease as a cause of death in otherwise healthy adults in rich countries.

Television was invented more or less simultaneously in several countries. As is common with new technological products, when all the necessary pieces of science and engineering are available it is a matter of chance who happens to put them together first. In the United States, the individual concerned was Philo T. Farnsworth. Or so the courts decided when they upheld his patents. After years of costly litigation with the Radio Corporation of America (whose chief executive was famously reported as saying: "We don't pay royalties; we receive them"), Farnsworth ultimately won the credit for the invention. But he was almost ruined in the process and received little financial return,

eventually selling out to RCA for a modest sum.

The most important economic event in Palanpur in the last fifty years was the introduction of semi-dwarf wheat – the new "green revolution" crops that have made India self-sufficient in grain. These discoveries were the result of research in Mexico promoted (again) by the Rockefeller Foundation.

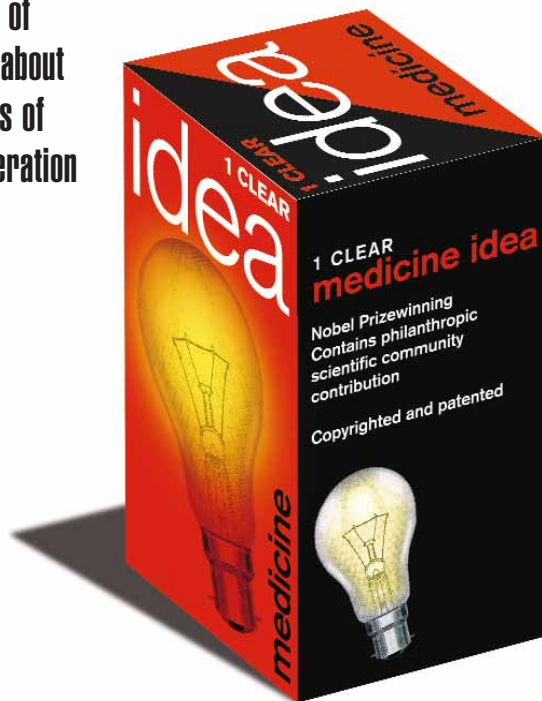
My sample of major twentieth century innovations is small and controversial. Still, few people would disagree that it includes some of the twentieth century discoveries which most changed our economic lives. What motivated these innovations?

The American business model has little of interest to say about these processes of knowledge generation. Whatever may have inspired these discoveries, it was not a combination of great greed and little government. Neither Einstein nor Turing "did it for the money". Einstein was spurred by the desire to get a better job, but, in general, the excitement of the process

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of discovery itself, and the social rewards offered to a renowned discoverer, appear to be the dominant factors.

Indeed, the record of twentieth century history is that none of its most important inventions was made by private sector companies. The strongest private sector contender is the transistor, discovered by William Shockley in Bell Laboratories in 1947. But this is an exception which proves the rule. Bell Labs was owned by American Telephone and Telegraph but had much of the character of a rich man's hobby, since regulatory restrictions prevented it from developing innovations directly relevant to the AT&T business. In the event, the transistor proved rewarding for Shockley and the company, Fairchild Semiconductor, that he established, but not for AT&T. Indeed, when the parent company spun off its research laboratories as a separate company, the resulting business, Lucent Technologies, was not particularly successful.

So neither commercial businesses, nor the prospect of large rewards to individuals, played any large part in the creation of "big knowledge". Nor did state control of innovative activity. Despite the active promotion of research by the Soviet government, the country's record in the development of original knowledge is lacklustre. Russia and the USSR have won 11 science Nobel Prizes, compared with 13 each for Switzerland and The Netherlands. Despite high standards in Russian medicine, no important new drugs were developed there and the evolution of computers and electronics – even for military use – lagged far behind the West. The worst episode in Russian science was the era of Lysenkoism. The absurd theories of an undistinguished biologist who had captured the ear of Stalin had a major influence on Soviet agricultural policy in the decade before the Second World War. Until the Great Leap Forward in China, the Russian and Ukrainian famines of the 1930s

were the worst in world history.

In fact, of all the inventors I have discussed, the only one employed by a government at the time of his principal discovery was Einstein. And the Swiss government employed Einstein as a clerk in the Patent Office, not to discover relativity. The remarkable fact is that the principal funding of major twentieth century innovations came from private charitable foundations. The record of the Rockefeller Foundation alone – as the principal source of finance for both the development of penicillin and the green revolution – is remarkable. When you add in the contributions to knowledge – good and bad – to have come from the University of Chicago, the economic significance of Rockefeller's philanthropy proved far greater than the economic significance of his creation of Standard Oil.

Philanthropy is important to knowledge, because it is the vehicle of pluralism in research. Of the six innovations described, three – antibiotics, computing and DNA – occurred in Britain. The institutions in which the research occurred were not dependent on state funding at the time, but are so now. The growth of government finance and control of universities in Europe has been directly paralleled by their decline as important centres of research. Europe accounted for 75% of Nobel Prizes in science before 1939; the US has taken over 75% of Nobel Prizes in science since 1969. It now seems that the new "big knowledge" is most likely to be discovered in the pluralist higher education system of the United States.

Of course, not all knowledge achieves the exquisite level of abstraction of the theory of relativity, the concept of a computer, or the nature of life. Much of it is the product of diligent record keeping. Information like the times of television programmes, or of buses, trains or planes. Lists of plumbers. Share prices. Where to find Bristol

Gardens. This is the kind of information we need and use every day.

Broadcasters compile their programme schedules well in advance. They want to disseminate that information widely – no one will watch a programme they don't know is on – but broadcasters also want to maximise the value of their information as a commercial asset. Until 1990, British broadcasters balanced these interests by themselves publishing weekly magazines, Radio Times (for the BBC) and TV Times (for commercial broadcasts), carrying their own programme listings, for which they held the copyright, but not those of their rivals. The only way to obtain comprehensive information about future programmes was to buy both magazines. Both were extremely profitable. A change in the law in 1988 removed the broadcasters' copyright in their listings. As a result, competitive listings magazines appeared, greatly reducing the profits of Radio Times and TV Times.

The first maps were compiled as products of art and scholarship. But map production became a business. Mapmakers plagiarised information and competed against each other on the basis of the clarity and accuracy of their mapping. Reputation was important to a mapmaker from the beginning: you would not know a map was defective until you had bought it, used it, and gotten lost.

Mapping gained importance as military organisation developed, since the movement of large armies required careful logistics that demanded accurate mapping. So maps were commissioned and paid for by governments. The British government's maps agency is still called the Ordnance Survey, reflecting its military origins. The needs of the armies for maps no longer seem so pressing, so governments have expected their agencies to find more commercial outlets for their data and skills. Also, the needs of the army are not the same as the needs of the

person invited to dinner for the first time at a house in Maida Vale.

This insight led Phyllis Pearsall, rain-soaked by her attempt to find Bristol Gardens, to compile the first street atlas of London. Mrs Pearsall walked London, recording junctions, house numbers and construction that had taken place since the last comprehensive Ordnance Survey nearly twenty years earlier. Today there are many different street atlases of London (and of most other towns).

In March 2001, the Automobile Association paid £20 million to settle a legal dispute with the Ordnance Survey. Copyright law prevents the AA from copying Ordnance Survey maps. But it does not protect the knowledge that the M1 runs from London to Leeds. There is clearly a large grey area in between and the AA seemed to have moved too far to one side of it.

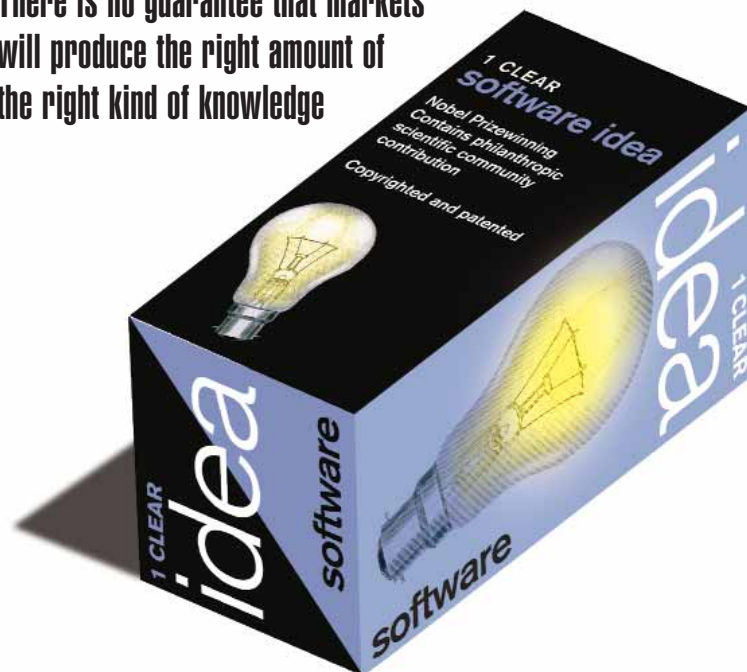
So can you "own" knowledge? Not really. But, if you can't, won't that discourage you from acquiring it?

Probably not, if that knowledge is of the path-breaking kind developed by Einstein or Turing. But, if it is the dull but essential knowledge of the location of every house in London that can be acquired only by trudging its streets, perhaps it will. This is an issue with which the law and regulation of market economies struggles.

For there is no guarantee that markets will produce either the right amount or the right kind of knowledge. Markets may fail to produce new knowledge, because once knowledge is obtained the discoverer cannot keep it to himself or herself. Conversely, the knowledge economy may lead to monopoly, because the costs of knowledge are fixed and sunk.

Still, rich states do not, as a whole, seem to be doing badly in developing a knowledge economy. Big knowledge – relativity, computing, the structure of DNA – is produced with philanthropic support, most often in the reflective environment of

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universities, and motivated by the creative instincts of its authors. Small knowledge – television listings, maps, financial information – is generated and distributed by the market like any other product. Surprisingly small amounts of differentiation seem sufficient to ensure competitive supplies of most kinds of small knowledge.

Big or small, to be precious, knowledge must be of kind that can be protected by copyrights or patents and leveraged by firms to establish commercial monopolies. By this standard, the two most precious pieces of knowledge of the twentieth century are not relativity, or the structure of human life. They are the software code for Microsoft's operating system, MS-DOS, and the chemical formulation of anti-ulcerant drugs.

Microsoft has benefited from several idiosyncrasies of US legislation. The law allows Microsoft exclusivity in the software code of MS-DOS, but denies Apple exclusivity in the concept of the graphical user interface. This gives the Seattle company sole rights in Windows. At the same time as US law permits this monopoly, it controls it only weakly.

Copyright and patents can often be converted around. This is what happened when James Black discovered a drug for blocking receptors on the walls of the stomach and hence reducing the acidity which causes ulcers. Following this invention, a British pharmaceutical company, Glaxo, refocused its related research and came up with another anti-ulcerant, Zantac. Zantac is similar in pharmacological effect to Black's drug but has fewer side effects. Like most best-selling drugs, it does not cure the underlying condition, but it relieves or eliminates its adverse effects. Sufferers need drug treatment for extended periods, possibly for life.

At around the same time as Glaxo launched Zantac, two Australian physicians, Robin Warren and Barry

Marshall, discovered that many ulcers were caused by a bacterium, *Helicobacter pylori*, and could be cured by an intensive programme of antibiotics. Chemical substances such as Zantac are patentable. Treatment protocols are not. Zantac became the world's best selling drug and its \$10 billion or so profits made Glaxo one of the world's largest pharmaceutical businesses. Warren's and Marshall's rewards for their discovery are limited to the academic kudos they enjoy and the gratitude of those patients who know the origins of their successful treatment.

The random incidence of precious knowledge is striking. The copyrights in Microsoft's operating system and the patents in Glaxo's Zantac are probably the most valuable copyrights and patents in history. But the work they relate to was of little originality and the truly innovative work was undertaken by other companies. The returns seem altogether disproportionate to either the costs or the consequences of the activities concerned. We can be confident that there would still have been personal computers and anti-ulcerants even if no copyright or patent protection had ever existed – as there would have been relativity, transistors, radios and television.

These strikingly large but arbitrary rewards attract very considerable resources into areas where the possibility of such returns exists – such as the production of user-friendly software and drugs that relieve chronic conditions – and into essentially imitative production of popular music and pulp fiction. It also concentrates resources and market powers in a few hands, threatening the very pluralism on which innovation depends. The behaviour of Microsoft demonstrates that this is no imaginary threat.

John Kay is an associate member of the CEP and Visiting Professor at the LSE. This article is based on a chapter in his forthcoming book "How Markets Work", due to be published by Allen Lane/Penguin Press in March next year.

The Centre for Economic Performance and the Intellectual Policy Institute have launched a joint research initiative to improve knowledge and understanding of the economic and professional issues involved in Intellectual Property.

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