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# BRITISH TECHNOLOGY GROUP

The UK has more Nobel prizes per capita than any other nation. Yet many see weaknesses in our ability to turn scientific discoveries into commercially successful products. The British Technology Group was set up to assist in this process, and is currently the subject of Parliamentary scrutiny as a result of provisions for its privatisation in the British Technology Group Bill[1].

***This briefing reviews requirements for effective technology transfer and factors relevant to debate on BTG's form after privatisation.***

## EFFECTIVE TECHNOLOGY TRANSFER

There is no standard 'formula' for exploiting a scientific discovery. Some may indeed be obvious enough to justify the cry 'Eureka', but more often, the usefulness of a discovery emerges only after careful enquiry, technical development and market research - often requiring a sustained injection of resources over a long period. Indeed, much of industry is so specialised that applications for some discoveries may only be identifiable by specialists in very narrow fields completely unknown to the inventor. When these factors are combined with the legal difficulties of establishing a patent which is capable of being defended against well-funded attack, it is clear that the commercial exploitation of scientific discovery and technological innovation can be difficult and complex.

While there is no standard approach to technology transfer a number of essential ingredients include:

- A means of **identifying** discoveries with the potential to lead to an exploitable development.
- **Protection** of intellectual property by patents etc.
- **Development** of the basic scientific discovery towards a product or process which can be used.
- Identifying and/or developing the **market**.
- **Producing** and marketing the invention's products - either through a new company or via a licence agreement with an existing company.
- Ensuring that **returns** are realised on the invention; this requires the monitoring of licensing agreements, royalty audits, infringement detection and enforcement.

In much of industry, all these stages can take place in the same company. But in the case of publicly-funded research via the Research Councils, in Government laboratories, and at Universities and Polytechnics, special mechanisms have been put in place. Since 1949, one of these has been a State-owned corporation - started as the National Research Development Corporation, which became the BTG in 1981. Initially, NRDC/BTG had rights of first refusal to publicly funded research, but these were removed in 1985. Options for technology transfer have expanded since then and include:

- *Ad hoc* arrangements made by individual researchers who may use their own patent agent, and seek themselves to find a customer for the patented idea.
- In-house groups which provide a service for that institution on patenting and industrial exploitation (e.g. university-industry liaison offices, wholly owned university companies and joint university/private sector ventures).
- Integrated technology transfer organisations such as BTG offering a complete service from initial patenting, through development and exploitation, to maximising and protecting license income over the full lifetime of the patent.

Some examples of successful developments resulting from public sector research exploited through the BTG are shown in Box 1. These and other examples demonstrate the importance of all the factors listed earlier, with particular emphasis on the following:

- **Patents**: importance of proper drafting to stand up to challenge later
- **Development**: expense and time involved in taking an idea to the point when it can be saleable to a company or a financial backer.
- **Enforcement**: getting the license income can require vigorous follow up and legal action.

## BTG ACTIVITIES

**Technology Transfer.** BTG provides the British research community with a technology transfer service, for which there is no direct charge; costs of patenting (which can be substantial) are supported wholly from license income on successful inventions. Where necessary, BTG also funds development work by the inventor(s)

1. See House of Commons Library Research Note 91/7 for more details.

to enhance the prospects of successful licensing to industry. In return for assigning all development rights to BTG at the start, BTG undertakes to protect and where justified develop the invention with its own resources, and to return 50% of any net license income to the inventor and his/her organisation. BTG handles more UK patent cases to arise from public sector R&D than any other body; total revenues in 1990 were £29.5m with an operating profit of £6.8m.

Over its lifetime, BTG has assembled a portfolio of over 8200 patents in 1500 different technologies. The sources of these have been mainly UK institutions where publicly-funded research is carried out (Figure 1 shows the variety of organisations whose inventions have been licensed to industry by BTG). Some current and future projects are listed in Table 1.

**Commercial Funding.** BTG also provides funding on a commercial basis for UK companies undertaking development projects involving a significant degree of technical innovation. For instance, BTG provided some of the initial investment to launch the new biotechnology companies, Celltech and Agricultural Genetics.

**International activities.** The majority of BTG's license income originates from overseas exploitation of UK inventions. However, since UK research is only around 5% of the world total, BTG has also sought to sell its expertise in technology transfer outside the UK. To this end, it has begun to set up arrangements to license inventions from centres of academic excellence abroad.

## CURRENT ISSUES

### *BTG's Role and the Alternatives*

In the debate over privatisation, doubts have been expressed as to how far BTG's services would be sustained after privatisation, or available from other sources. These and related issues are discussed below:

**Integrated service.** BTG's relatively large size allows it to support the necessary blend of skills, experience and corporate reserves to pursue difficult and costly development projects and patent infringement cases[2]. The breadth of BTG's portfolio allows it to encourage multi-disciplinary research and its application. Such capabilities are not so available in smaller organisations such as university-based technology transfer offices.

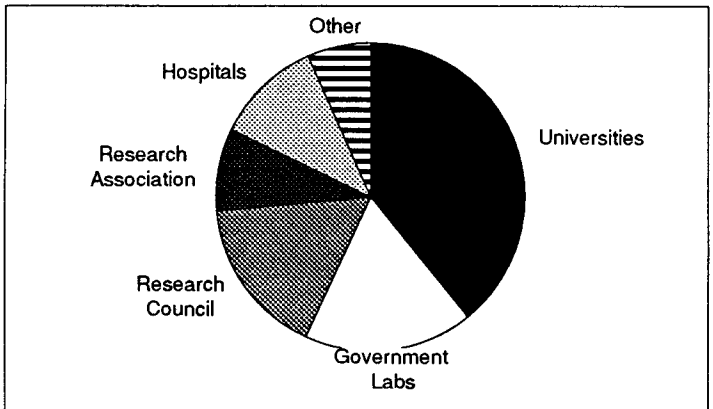


**Figure 1: Sources of BTG's Intellectual Property licensed to Industry**

**Table 1: TECHNOLOGIES DEVELOPED THROUGH BTG**

| *Mature* | *Current* | *Future* |
|---|---|---|
| Cephalosporin Antibiotics | Magnetic Resonance Imaging | Continuously Variable Transmission |
| Pyrethrin | New Pyrethrins | Monoclonal Antibodies |
| Insecticides | Cholesterol tests | Anti-cancer drug |
| Hovercraft | Grain-stripper | Anti-anxiety drug |
| Glass fibre | Personal pagers | |

Many believe it is important to maintain the necessary range of core skills - from patent drafting to legal enforcement - in any future successor organisation (indeed, this has been emphasised by BTG as a qualification to their support of privatisation). However, some private sector technology transfer companies now offer a similar comprehensive service under similar revenue-sharing arrangements to those of BTG.

**Technical development.** BTG also supports highly speculative investments to take an innovation from the experimental stage to a point where its commercial potential can be seriously evaluated. For example, cephalosporin required 10 years of additional funding from NRDC before the technology could be widely licensed; Magnetic Resonance Imaging (MRI) continues to attract BTG developmental funding 17 years after the first investment.

Last year, BTG invested £9.67m in such 'embryonic' developmental work. Some have claimed that this amount is an insignificant part of the **total** UK spend on R&D. Others have pointed out that the amounts invested in **very early** technical development of public sector research are quite small, and the BTG spend is a significant if not dominant source of this type of funding. Unfortunately, it is not easy to quantify the amounts of such support available from other sources. Industry (including BTG) spends £85m per year in the universities, but much of this supports basic research or applied research specific to a company's specific projects.

Other potential sources include certain venture capital groups - particularly those offering 'seed-corn' venture capital. There are now 10 or more such companies in the UK, ranging from 3i to small specialist firms. In 1990, the British Venture Capital Association report that £215m was invested in 'start-ups and early stage' financing. Technology-related investment accounted for approx 10% of the Industry's investment, so perhaps £20m of

**2. BTG won $6m from the US Government over patent infringements on its Hovercraft patents; license income from MRI patents also required expensive litigation before large biomedical companies overseas were prepared to pay royalties.**

## SOME MAJOR INVENTIONS FROM BRITISH RESEARCH

***Cephalosporin antibiotics***

| | |
|---|---|
| 1948-54 | MRC-funded work at Univ. Oxford. |
| 1953-9 | R & D funding from NRDC |
| 1953-9 | Series of patents taken out |
| 1956 | Glaxo initial involvement |
| 1964 | Licensing agreements world-wide |
| 1975 | Court action to protect and extend patent cover |
| 1984 | Expiry of key patents |
| 1990 | Cephalosporin antibiotics market is over £4,000m, and licensing income has totalled £150m. |

***Hovercraft***

| | |
|---|---|
| 1958 | NRDC approached |
| 1959 | Hovercraft Development Ltd formed |
| 1959 | First Channel crossing by hovercraft |
| 1960 on | Craft development by industry |
| 1961 | First UK licensee |
| 1962 | Key patents filed |
| 1963 | First US & Japanese licensees |
| 1972 to date | US Gov't prototypes and production |
| 1979 | UK 10-year extension of key patent in High Court |
| 1985-90 | US Court action |
| 1986-9 | Expiry of key patents |
| 1990 | Out of Court settlement with US Government |

***Magnetic Resonance Imaging***

| | |
|---|---|
| 1973 to date | Research at Universities of Nottingham & Aberdeen |
| 1974-80 | NRDC involved in patenting basic principles |
| 1980 to date | License agreements world-wide |
| 1984-6 | Litigation to recover royalties |
| 1990 | New investment of £1.1m by BTG at Univ. Nottingham |

this start-up funding went to supporting commercial exploitation of technology. However, even within this specialised sector, there is little evidence that financial institutions are willing to inject significant amounts of 'embryonic' capital to realise the potential of research-based inventions - a process which requires a sustained and consistent long-term (more than 5 year) view.

In this respect, the Committee of Vice-Chancellors and Principals (CVCP) has emphasised BTG's importance as a provider of financial support for the development of research, and have expressed fears that a privatised BTG would have shorter term financial objectives which could lead to less support under more demanding conditions. They contrast the typical development path of BTG's successful inventions (10 years or more) with the shorter periods (5-7 years) typically required for returns in the private sector. They and others thus see BTG's medium and long-term support as critical to the exploitation of many discoveries in basic science, and believe that it is important to ensure that this function is maintained in any successor organisation.

Where there may be more direct overlap with other sources of finance is in the area of 'hitech' company investment. For instance, in the early '80s, BTG was encouraged by the DTI to act as a nucleus around which other investors could gather (e.g. in the setting up of Celltech and Agricultural Genetics Company). Venture capital funds have however, become more plentiful in recent years, so that now BTG is only one of several alternative sources for such funding.

**'Public Service'**. Although BTG is run according to commercial principles, it retains the function of "securing, where the public interest so requires, the development or exploitation of inventions resulting from public research". Many see this basic requirement to examine, evaluate and protect publicly funded research portfolios as justified on both economic and public service grounds, and argue that it is as important today as in the past. There is concern that a privatised BTG could concentrate on fewer, more developed, technologies which could leave the broader role of evaluation and protection unfilled.

The degree to which this 'public service' philosophy is maintained in a privatised BTG is thus seen as important -for instance, the CVCP argues that the opportunities for exploitation of university research by a privatised BTG should be no less favourable than they are now. There is concern that a private company might not be prepared to offer the same breadth of service or to provide as fair and satisfactory a rate of return from successful exploitation.

Some also support keeping BTG in public ownership on the basis that royalties arising from the exploitation of basic science funded by the tax-payer should benefit the tax-payer rather than shareholders. Some inventors responsible for certain of BTG's successes have stated that they chose BTG because it was a public body, and have suggested that they should be consulted on the fate of their discoveries. There is, however, no contractual obligation to consult the inventor, since he/she has assigned all rights to BTG in the initial agreement. However, BTG continues to rely to a significant extent on unsolicited approaches from scientists at the universities, research institutes, etc. Thus if there is widespread sympathy for the current public enterprise, a privatised BTG could lose some of its source material for the future.

A further point arises from the fact that NRDC and BTG were originally established to exploit UK discoveries within **UK industry**. While this has not proved possible in all cases, several of the major products (e.g. cephalosporin, pyrethrins) have initially been taken up by UK companies. Increasingly however, inventions have to be marketed globally, and BTG now receives 70% of

its income from overseas sources. Nevertheless, the original bias in favour of finding UK companies to exploit an invention still operates through the strong links existing between BTG and UK industry. Some are concerned that this component of a 'public service' philosophy would be lost if BTG were to become owned, as has been suggested, by Japanese or other foreign interests. Others point out that technology transfer recognises no national boundaries and has to be developed internationally from the beginning.

**International Trading.** With the increasing emphasis on international business, the attitudes of other countries to public sector ownership can be important. BTG have cited cases where barriers were raised due to their being seen as a government organisation (in France, a contract with Ministry of Agriculture research institutes encountered objections from the Quai d'Orsay; in Spain, a proposal for a joint project with a public sector company required cabinet approval). In other countries, public ownership can provide an official status which is advantageous, but such cases are believed by BTG to be in the minority.

Some have also argued that BTG would not have been as successful in pursuing infringement cases against governments and large international companies had they not been perceived as having the authority and resources of a public body. Others suggest that a privately held organisation could have pursued cases more effectively still.

### *The Form of a Future BTG*

Those opposed to privatisation point out that a number of countries have established similar organisations to encourage technology transfer from publicly-funded research. Within the EEC, France has the State-owned National Agency for the Exploitation of Research (ANVAR) with a turnover of around £100m per year; the Frauenhofer Gesellschaft in Germany is a heavily subsidised non-profit-making organisation which assists private inventors; the Danish Invention Centre is a public body which can acquire and exploit patents.

Others accept the principle of privatisation, but argue that the ultimate form of a privatised BTG may have important implications for the future effectiveness of technology transfer from publicly-funded research[3].

**Sale without restriction.** This has been put forward as an option to realise the largest immediate return from a sale. But a number of concerns have been expressed:

- The danger of 'asset stripping', which would destroy the integrated service upon which public sector research still relies. For this reason, BTG oppose any sale to an industrial concern with an interest in the success or failure of an individual technology area.
- The possible loss of the generally satisfactory service provided on a broad range of technologies to public sector researchers.
- Possible reduction in the amounts or terms of development support to accomodate a shorter term outlook. In this context, some say the failure of Defence Technology Enterprises (established in 1985 to exploit technologies in the Defence Research Establishments) shows the difficulty of applying fully commercial financial objectives to technology transfer from government-funded research.

**Conditional Privatisation.** As a result of these concerns, several bodies have suggested that there should be specific constraints on the conditions under which BTG is privatised. BTG itself has emphasised that arrangements should ensure that their reputation for "integrity, impartiality and independence is maintained, together with the critical mass of corporate know-how and experience developed with the skills of its staff". The CVCP has argued for some form of university involvement in the running of any privatised BTG, or for structures which would guarantee the retention of the services seen as invaluable by the universities. These could be a private foundation or trust which would re-invest any profits in the further exploitation of research.

Models for such arrangements exist abroad (e.g. state-owned technology transfer trusts and foundations in the USA). Other suggestions include the retention of a 'golden' share by the DTI, or conditions in the articles of association spelling out the requirements relevant to BTG's 'public service' activities described above. In any case, the CVCP sees a need for existing technology transfer agreements to be safeguarded, since the BTG holds a large number of patents arising from universities, some of which will produce royalties to universities and academic inventors for some time.

## FURTHER READING

Additional information and background information are available from P.O.S.T., 2, Little Smith St., London, SW1P 3DL. Tel: (071)-222-2688.

**3. The Bill provides for BTG to be transformed to a company whose shares will initially be owned by the DTI. No details have been announced on how the company will subsequently be sold off, although the DTI has received a report (as yet unpublished) from Coopers and Lybrand on options for privatisation.**

The ***PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY*** has been set up by the Parliamentary and Scientific Committee to inform Parliamentarians on scientific and technological issues. 