**Institution: BRUNEL UNIVERSITY (H0113)**

**Unit of Assessment: 19 – Business and Management Studies**

**Title of case study: Estimating the Economic value of Intellectual Property in the UK**

**1. Summary of the impact** (indicative maximum 100 words)

The lack of understanding about what patents do in the UK has the potential to inhibit technology knowledge circulation and technology markets. BBS research on the role of intellectual property (IP) policies has addressed this issue, demonstrating the economic benefits to innovating firms which patent their R&D output and providing economic estimates of increased technology licensing. This has had *practitioner* and *policy* impact at both national and international levels.

**Specific UK Impact**

- The research represents first data gathered by Intellectual Property Office (IPO) on linked corporate licensing and patenting activity and has generated the first estimates of the market for technology in the UK and of the patent propensity
- The IPO and ONS (Office for National Statistics) together with Brunel University developed a proposal for a UK-wide estimation of the role of patenting in innovation. The IPO is making this a regular survey to run concurrently with the Community Innovation Survey.

**Specific International Impact**

- Informed by this research, WIPO (World Intellectual Property Organisation) has recognised the increased prevalence of distributed innovation strategies by firms and placed this at the forefront of innovation policy.
- WIPO message on distributed innovation as an advantage for developed and developing countries rests on data generated by Brunel.

Brunel research has provided a benchmark with patenting and licensing activity in the US, Japan, Australia, France and Germany.

**2. Underpinning research** (indicative maximum 500 words)

A key issue in the research on technology markets concerns the ownership of Intellectual Property and its social utility. Although patents were devised as a formal arrangement that conveys monopoly powers to owners of inventions in exchange for the willingness to share information with others, scholars and policy makers have long worried that the arrangement contributes to increased monopoly but not much else. One mechanism of technology diffusion that is enabled by patents is through increased technology licensing – so that the patents that are licensed to other firms contribute to wider innovative activity in economic sectors other than from where the patents first originated.

A key gap in the relevant empirical research is the extent of the licensing market (and hence technology knowledge circulation) and barriers to its wider use. This evidentiary gap has been noted in the Hargreaves Report and by the UK IPO. Research undertaken by Athreye and Cantwell in 2004/5 (Athreye and Cantwell, 2007) reported the first measures of international technology licensing based on data produced by countries in their international balance of payments. In Nov. 2008, Professor Athreye (then Reader at Brunel Business School) was awarded an EU Framework 7 grant on 'Internationalisation of Innovation in Europe', and she probed these data sources much more closely. In 2010, WIPO commissioned Professor Athreye to prepare a background report on the trends in international technology licensing for use in their Annual Report. Her estimates (used in their annual report) were also reported widely in the news media. Downloadable chapter at: http://www.wipo.int/export/sites/www/econ_stat/en/economics/pdf/wp3.pdf

As part of the EU FP7 grant, Athreye probed UK data on international trade in services to obtain firm-level estimates of out-licensing and in-licensing of technology. Her analysis of UK firm level data highlighted that R&D services often arose in sectors where patents were not very effective, while licensing took place in sectors where patents were effective. She also demonstrated that

traded technology helps innovative firms to stay innovative and for other (non-innovative) firms to catch up with latest technology. This result is significant in that the perception that buyers will steal technology and product markets is an important constraint in the minds of firms wishing to sell technology - when in fact the research found firms that buy in technology through licensing depend mostly on their own efforts to produce future innovation.

In 2010, Athreye won a competitive tender from the UK IPO to estimate the returns to patenting and inducement to R&D in the UK. The final report, authored by Aurora and Athreye, published on November 2012 (*http://www.ipo.gov.uk/ipresearch-patincentive.pdf*) showed that stronger patents added incremental profits of between 30-62% for patented inventions. Furthermore, she found that stronger patenting provided an inducement for R&D and increased R&D expenditures by about 18%. Through the report, the IPO also became aware of several gaps in the data bases used for making policy decisions and in 2012, with the UK IPO as partner, Athreye won an ESRC research grant to study patent use and the extent of technology licensing in the UK with the intention of designing a short survey on patent use that will be used to collect data by ONS on behalf of the IPO.

**3. References to the research** (indicative maximum of six references)

*Key Publications*

Athreye S & Cantwell J. (2007), Creating Competition? Globalisation and the emergence of new technology producers**, Research Policy, Vol. 36(2): 209-226**. http://dx.doi.org/10.1016/j.respol.2006.11.002

*Commissioned Policy papers*

Athreye S & Yang Y. (2011), Disembodied Knowledge Flows in the World Economy, **WIPO Economic Research Working Paper No. 3**., World Intellectual Property Organisation, Geneva. Accessible at http://www.wipo.int/export/sites/www/econ_stat/en/economics/pdf/wp3.pdf

Arora A. & Athreye, S (2012), **Returns to Patenting and the Inducement for R&D**, Report submitted to the UK Intellectual Property Office, February 2012, published on November 2012. Accessible at *http://www.ipo.gov.uk/ipresearch-patincentive.pdf*

Arora A. & Athreye, S (2013), Innovation, Patenting and licensing: Evidence from the SIPU. Unpublished Mimeo. Presented at the Conference on Patent Use, Big Innovation Centre, 9 September 2013.

*Research grants used for the studies*:

1. **Patent Use, Technology Licensing and IP Management in UK Firms**" (Athreye as PI), £67,218 from the ESRC Knowledge Exchange Programme with matched contribution from UK Intellectual Property Office. Period: October 2012 - September 2013.

2**. Intellectual Property Rights and Returns to Technology Investment**. (Athreye as PI), £91,430 from the UK Intellectual Property Office. Period: July 2010 - September 2011.

3. **The Changing Nature of Internationalisation of Innovation in Europe: Impact on Firms and Implications for Innovation Policy in Europe**", (Athreye as Co-I with Coordinator Dr. P Patel, Science Policy Research Unit, University of Sussex), €243,070 (£170,000) from EC-FP7 grant. Period May 2008 - May 2011

**4. Details of the impact** (indicative maximum 750 words)

Athreye's unique work highlighting the economic benefits from patenting and the effects on R&D spending has profound implications for understanding firms' investment behaviours and for policies relating to investment strategies. The significance of the research not only relates to the UK, through the direct involvement of the IPO and the effect on their policies and practices, but also reaches to the international community as evidenced by the uptake of the findings in the influential World Intellectual Property Report (WIPO, 2011): The Changing Face of Innovation. The findings have informed policy debate on IP and have been used by the IPO and the WIPO to formulate policy and define best practice.

Athreye's early research demonstrated that patenting and formal ownership of IP greatly facilitates the international trading of technological knowledge in the form of international licensing. In 2005 The Economist used Athreye' estimates of international licensing in a special issue devoted to investigating *The Market for Ideas.* Hitherto, much of the evidence for technology markets had rested on anecdotes and special cases, but Athreye generated the first estimates of the possible extent of such markets by using International trade data.

Later in 2011 updated figures using Athreye's data and methodology shaped WIPO corporate strategy, placing IP at the forefront of innovation policy. The research outcomes were used in the WIPO annual report *Changing Face of Innovation* to support the argument that the increasing demand for intellectual property had made the model of distributed innovation more prevalent - where firms buy R&D services and licensing from other firms, in addition to their own R&D, to generate value-adding innovations for themselves. Such distributed innovation would not exist without a market for technology marked by strong ownership rights. Athreye's data showed that over the period 1990-2009, royalty and licensing receipts (and payments) in the world economy grew at a sustained rate of 9.9% per annum. ***These estimates of the growth of international licensing were included in the above report as well as in a press release issued by WIPO. They were then cited by the business media (e.g. Washington Post).*** Data generated by Brunel supported the central message from the report that distributed innovation is an advantage for both developed and developing countries.

In recent research (2010-2013) undertaken in collaboration with Prof. Arora (Duke University) Athreye developed and estimated a frequently used model of innovative behaviour where firms invest in R&D due to the anticipation of patenting some activity and receiving higher profits on products that embody patents. Their estimates suggested that on average, a unit increase in perceived patent effectiveness results in incremental profits of just over 32%, and would induce an increase of between 11 - 27% in R&D expenditures. ***In November 2012, these estimates were presented to corporate stakeholders of the IPO (firms that license innovation and firms that own patents) and other policy making institutions at a workshop organised by the IPO's Economic Research and Evidence Team at the Big Innovation Centre. They also formed the basis for the patent incentives report (Returns to Patenting and the Inducement for R&D, 2012)***

In 2012, Athreye designed the questionnaire for the Survey of Innovation and Patent Use (SIPU) which aimed to collect information needed to estimate patent propensity (of innovations) and technology in-licensing in the UK, as well as shed light on the factors associated with greater patent propensity and in-licensing. This survey has provided the first estimates of the market for technology licensing in the UK and the distribution of licensing activity among different types of firms *(Arora and Athreye, 2013)*. ***The IPO is making this a regular survey that runs concurrently with the Community Innovation Survey***. The SIPU showed that whilst only 11% of firms surveyed take advantage of patenting, when looking at those firms which innovate new to the market products this number rises to 40%. About 28% of firms used patenting to protect their most significant innovation. Further, the analysis showed that the size of the organisation does not influence the likelihood of patenting; rather it is the ability to create novel innovations and the volume of R&D which is the strongest factor in determining whether a business is likely to patent. ***This information has been requested by the IPAN (Intellectual Property Awareness Network) for dissemination to SMEs.***

Another key finding of the SIPU survey was that firms are relying more often on technology licensing to keep up with the market, especially when innovation is limited by constraints on resources. Between 2009 and 2012, the expenditure on technology in-licensing was estimated to be around £6.9 billion a year in the UK- almost 40% of the total business enterprise spending on R&D. ***These results along with the estimates for other countries were presented to stakeholders and discussed at conference organized by the IPO on September 9, 2013 in London. The conference was attended by 65 delegates, most of whom were businesses involved in patenting activities and/or IP professionals.*** Informed by Athreye's research, discussion centred on the policy measures designed to increase the use of licensing to enable greater circulation of technological knowledge in the UK economy. Further, UK findings based on Brunel research were bench marked against findings from surveys in the US, Japan, Australia,

France and Germany.

**5. Sources to corroborate the impact** (indicative maximum of 10 references)

1. DTI (1998), Competitiveness in a knowledge based economy.

The Economist (20th Oct, 2005), "A market for ideas", Accessible at <http://www.economist.com/node/5014990>

2. WIPO (2011), The Changing Face of Innovation. See in particular the section on acknowledgements and pages 60-67 of the report.

http://www.wipo.int/export/sites/www/freepublications/en/intproperty/944/wipo_pub_944_2011.pdf

3. WIPO press release: http://www.wipo.int/pressroom/en/articles/2011/article_0027.html

4. A letter from the Head of Research Development and Strategy at the Economics, Research and Evidence team at the IPO confirms the significance of the 'patent incentives' report:

Arora A. & Athreye, S (2012), **Returns to Patenting and the Inducement for R&D**, Report submitted to the UK Intellectual Property Office, February 2012, published on November 2012. Accessible at *http://www.ipo.gov.uk/ipresearch-patincentive.pdf*