Taking publicly funded innovations to the marketplace: lessons from Germany

Sabyasachi Saha

We look at two mechanisms in Germany that concern patenting and licensing of publicly funded science. The first is the function of Ipal GmbH which undertakes patenting and licensing of technologies originating in the universities in Berlin and the second is that of the Max Planck Innovations (MPI), nodal centre for technology transfer of the Max Planck Society (Max Planck Gesellschaft (MPG)). This article presents case studies of patenting and licensing practices at the Humboldt University of Berlin (against the Ipal GmbH model) and those at MPG (the MPI model). The analysis is structured around core issues pertaining to IPR and academic research, science–industry interface and technology transfer.

Keywords: Licensing of technology, patenting, publicly funded innovations, science–industry interface.

GERMANY pursued a policy regime that concertedly promotes high levels of investment in human capital, science and industry with functional support for both large and small firms (note 1). Such consistent policy endeavour laid the foundation for Germany's strong position in manufacturing in high value-added goods. This understanding continues to inspire policy-making at the Federal level. The Federal Government adopts a concerted and overarching policy framework cutting across all domains of science, technology and industry to create a firm link among these and ensure long-run competitiveness. This feature of German policy-making has attracted academic attention leading to numerous scholarly commentaries. Although science and technology (S&T) has been vigorously pursued as government policy in rest of the world, its link with the larger economy has always been fragile and elusive. Apparently, Germany has uniquely attained a fair amount of confidence in translating research into economic benefits. The present priorities of Federal policy on S&T may be understood from the diverse range of policies and programmes concerning higher education, S&T and the industry (note 2). Evidently, the German government wants to ensure that the industry benefits from its S&T policies and reportedly goes beyond the interests of publicly funded institutions in enforcing industry collaborations on many occasions. Such explicit policy stance has been traditionally effective in reaching out to the industry and hence mitigating market failures beyond the stage of knowledge creation/ invention. Needless to mention, the German innovation system has so far thrived on pervasive science–industry interface at various levels[1] (note 3).

Sabyasachi Saha is with the Research and Information System for Developing Countries (RIS), New Delhi, India.
e-mail: sabyasachijnu@gmail.com

Innovation policy and publicly funded research in Germany

Innovation policies and public funding of research in Germany are implemented both at the Federal level and at the level of the Länders (States). However, there is a strong bias in favour of decentralized policy-making in science with significant regional orientation. For example, Baden-Württemberg, North Rhine-Westphalia and Hamburg were the first to create industry-oriented technology promotion programmes in the 1970s. Länder policies also shape industrial development (like those of sunrise industries, new technologies, etc.) with strong implications for knowledge networks as well as public and private research infrastructure[2]. However, Edler and Kuhlmann[3] argue that knowledge policy in Germany suffers from coordination challenges of fragmented systems, inconsistent policy direction and dispersed orientation.

Publicly funded research in Germany is spread across universities, technical universities, polytechnic institutions (now called universities of applied sciences) and non-university research organizations. In 2010, the Gross Domestic Expenditure on Research and Development (GERD) was 69.9 billion EUR, of which nearly 30% came from Federal and State authorities that patronize nearly 750 publicly funded research institutions and about 100 innovation clusters. There are around 390 universities that include 200 universities of applied sciences. GERD with respect to institutions of higher education

was 12.7 billion EUR in 2010 and over 80% of this was publicly funded. Accordingly, one calculates that around 50% of all government expenditure on R&D is bestowed on R&D at institutions of higher learning. Such figures speak for the importance of the publicly funded research system in Germany in general and that of universities in particular.

Apart from the universities, Germany is known for its research organizations of the highest caliber. These institutions draw significant public funding and mainly fall under the following systems – Fraunhofer-Gesellschaft, Helmholtz Association, Leibniz Association, Max Planck Society (Max Planck Gesellschaft; MPG) and include several other Federal and provincial (Länder) institutions. To understand the diversity of research mandate one may consider the extremes – Fraunhofer-Gesellschaft has the mandate to undertake applied industry-oriented research in totality, while MPG focuses on basic science research only. Fraunhofer-Gesellschaft is therefore mandated to raise 50% of its funds from the private industry.

It has been exemplified on a number of occasions that academia in Continental Europe (including France and Germany) are governed by traditional norms that are distinct from those of the US or the British academia. Employment norms in these countries are considered liberal even though employability parameters are set at high standards. In case of Germany this is evident from the fact that although tenured academic employments are forthcoming, professorships are rather hard-earned (note 4). Also, academia in Germany is somewhat distant from overt display of academic aspirations as in the US (often referred to as publish or perish kind of culture by critics). However, we believe, Germany in the recent years has tilted towards 'mainstream' academic practices engineered primarily by the US academia.

We perceive that there is a difference in approach to publicly funded research between the US and Germany. Public funding of research in the US has been less directed compared to Germany[4]. While pervasive faith in laissez faire in the US possibly motivates arms-length transactions in knowledge outcomes (inventions), necessitating the larger role of intellectual property rights even in publicly funded research, we are not sure if Germany posits a different context. It is apparent that universities and research institutions in Germany have maintained a collaborative relationship with its industry and channels of knowledge exchange between the industry and the academia does not necessarily give impressions of arms-length transactions in knowledge involving intellectual property rights (IPR). Nevertheless, patenting as a vehicle of technology transfer was implemented in several cases by some of the publicly funded R&D institutions in Germany since the 1970s. Patenting of research output by universities was however streamlined with the abolition of professor's privilege in 2002.

Publicly funded research in Germany: patenting and licensing practices

In this section we present explorative case studies on patenting and licensing practices of the Humboldt University (HU) in Berlin and that of MPG. While MPG has its own technology transfer office called Max Planck Innovations (MPI) based in Munich, HU outsources most of the activity to a common agency called Ipal GmbH. This agency is responsible for patent management for many universities in Berlin like Frieie University, Technical University Berlin, Charité Medical School and some other universities of applied sciences and research organizations in and around Berlin. This necessitates a detailed case study of the Ipal GmbH model as well. Technology transfer mechanisms are often diverse based on local perceptions about division of tasks and responsibilities involving management of technology transfers. Publicly funded institutions usually undertake technology transfer activities through subsidiary companies or external agencies to avoid direct involvement in activities that are purely commercial.

Technology transfer mechanisms

Humboldt University of Berlin: The age-old professor's privilege norm for university inventions in Germany was abolished in February 2002 (passed as law on 18.1.2002, BGBI 2002 part I no. 4, p. 414; amendment to § 42 employee inventors' act 'Gesetz über Arbeitnehmererfindungen – ArbEG'), which transferred the responsibility of patenting/licensing of inventions from the scientists to the universities. Clearly, this new legal reform in Germany was inspired by the US Bayh Dole Act and incorporates similar provisions. HU set up the Office of the Patent and Licensing Officer (we may simply call it IP office) in 2001, a year before the official enactment of this law given strong anticipation about the imminent legal changes. This office has a well-defined yet a limited mandate. This is the nodal office for reporting disclosures at the level of the university which are then passed on to Ipal GmbH. However, this office maintains a constant liaison with Ipal GmbH for all activities related to patenting and licensing of HU technologies.

Secondly, this office strives to provide comprehensive and unambiguous information related to IPR, detailing norms and clarifications of clauses pertaining to IP policy. It also orients the university academic community on the modalities of technology transfer. To this end, members of this office (along with Ipal GmbH office-bearers) try to personally visit the scientists instead of asking them to come to the IP Office for queries related to patenting and licensing. The process of orientation is reportedly a continuous one which is evident from the fact that whenever a new faculty member joins the university, the

team approaches the person to make her aware of IPR issues and the functioning of the office.

Apart from this IP Office, HU also has a 100% susbsidary company called Humboldt Innovation (HI) that serves as the nodal agency for all industry-sponsored projects and is mandated to undertake industry interface activities. HI is allowed to function with more flexibility compared to usual university bureaucracy in order to meet the expectations of the industry. HI in many cases also manages sponsored research projects of the government (DFG) as well as the European Union.

Max Planck Society and Max Planck Innovation: MPI based in Munich is the nodal agency of the MPG responsible for technology transfer, patenting and spin-off creation. MPI is a subsidiary company of the MPG and serves as its technology transfer agency, connecting science and business. MPI was founded in 1970 as Garching Instrumente GmbH and operated under the name of Garching Innovation from 1993 to 2006. Presently, it has a sizeable team of professionals as patent and license managers, start-up managers, patent attorneys and legal experts. MPI receives its operational funds from the MPG. In turn, all revenues generated by MPI go to MPG. Nevertheless, MPI may be regarded as a self-sustaining model in principle given its ability to generate revenues higher than its operational costs.

MPI in many ways may be one of the most successful technology transfer institutions in the entire world. It currently oversees more than 1190 inventions and has shareholdings in 16 companies. Since 1979, MPI has managed about 3400 inventions and has licensed 2000 technologies. It has so far promoted nearly 100 spin-offs. One may not ignore the strong support that MPI receives from the central administration of the MPG who have always been keen on achieving technology commercialization (note 5). The total proceeds from technology commercialization at MPG currently amounts to about 280 million EUR. About half of the proceeds originates in the US, the other half in Germany, Europe and Japan. Until the 1990s, the focus of Garching Innovations was on developing prototypes that could be put up for sale. However, Garching Innovations was only modestly successful and could achieve commercialization of a handful of technologies.

Ipal GmbH: As Germany sought to adopt a proactive patent regime for universities (similar to that in the US) since 2002, it was clear that universities and research institutes lacked professional expertise to manage commercialization of their research results and hence the Federal Ministry of Education and Research encouraged patent valuation agencies across Germany to facilitate evaluation, protection and commercialization of university inventions.

Ipal GmbH is a similar agency. Founded in 2001, it is a company of the Investitionsbank Berlin (IBB) and universities in Berlin. The shareholders include the main universities in Berlin and it has several other small research institutes and non-academic research institutions as cooperation partners. Ipal GmbH is primarily funded by public money, by the Federal State of Berlin through IBB. It is a fully owned subsidiary of IBB (note 6). Ipal GmbH is a for-profit company (limited liability company – Gmbh) and hence revenue generation through licensing, royalty and equity share-holding in start-ups is the primary objective. However, Ipal GmbH has so far not claimed to be a self-sustaining model and considers licensing-driven revenue generation to be only one among its objectives (note 7). The principal objective is perceived in terms of facilitating application of new technologies and towards promoting widespread absorption of technologies by making them available. The secondary objective was stated as creating start-ups to promote techno-entrepreneurship and job creation (note 8).

The company provides an extensive catalogue of services ranging from assessment of patentability and commercial viability of technologies to comprehensive patent protection, management of IP portfolios, technology development and commercialization, and IP consultancy (note 9). Apart from academic institutions, Ipal GmbH also operates for non-academic research institutes, start-ups, small and mid-sized enterprises as well as for patent and technology funds, thus significantly bridging the communication (and informational) gap between science and industry.

Patenting and licensing

Institute IP policy: HU was one of the first universities in Germany to publish its patent policy after the relevant legal amendments in 2002. This policy clearly lays down the objectives and norms with regard to patenting and licensing. The university believes that scholarly quality of research results is also reflected in optimized patent protection and patents are equally as effective in upholding the quality of university research vis-à-vis publications. This is largely a view that dismisses any conflict between free dissemination of research results through scholarly publications and proprietary ownership of knowledge outcomes in case of publicly funded research. Hence HU aims at commercialization of inventions and intends to supplement its financial resources. As stated, the central idea of patenting at HU has been to expand university's patent portfolio and promote licensing.

The MPG, on the other hand, appears fully aware of conflicts between patenting and publishing as perceived by faculty scientists. Scientists are often driven by non-pecuniary motives of research and hence prefer dissemination of research results through publications. Proprietary ownership is often rejected in favour of free and wider dissemination of research results by the academic

community. Even when scientists are keen on protecting their research results through patents, they are usually reluctant to do so not only due to lengthy patent filing process but also because they are concerned about unavoidable delays holding up publications (note 10). There have been conscious attempts by MPI to adopt a pragmatic approach in its IP policy and IP management to instill confidence among scientists and make them more willing towards patenting inventions. Accordingly, IP policy of MPG states that patents are most suitable protection for 'inventions' and highlights that a patent excludes all third parties from commercializing a patented inventive idea for a limited period only (note 11). It also states that all patent applications are disclosed after 18 months, which effectively makes it public knowledge. Further, it has been stressed that after priority has been ensured under the patent law, there is no legal impediment to publications. Inventions of the MPG scientists have always been treated equivalent to 'employee inventions' distinct from 'professor's privilege' that existed in universities prior to 2002. In accordance with the Employee Inventions Act, the employer, i.e. MPG is entitled to such inventions. Therefore, employee scientists are obligated to report all results, innovations and ideas, which may have inventive characters.

Patenting process: The IP Office of HU does not have a full mandate of a university technology transfer office (TTO) and effectively liaises with Ipal GmbH for evaluation of patent applications and for all processes involving patenting and licensing. This office is the primary channel of communication between the university and Ipal GmbH and is responsible for all negotiations with Ipal. This includes communicating all views expressed by the inventors and upholding the priorities of the university. Generally, a meeting with Ipal GmbH is scheduled every two months. The agency carries out a primary evaluation of invention disclosures and could also seek inventor cooperation (through the IP Office) in improving patent applications. Ipal GmbH and the IP Office would jointly guide faculty scientists in tightening patent applications and might ask the inventors to undertake additional experiments to improve the quality of the invention.

HU ensures close association with Ipal GmbH to avoid communication gaps and operational frictions. Patenting costs are shared between Ipal GmbH and HU, but the former necessarily bears the larger share. The reward share norm is as follows: 30% of the proceeds goes to the inventor, the rest is divided between Ipal GmbH and the university, where the share is calculated on the basis of the cost borne by each. In most cases, Ipal GmbH retains a 40% share and the remaining 30% goes to the university. The inventor(s) is entitled to some additional share if the university is able to generate a surplus. The faculty can flexibly use this additional amount for their research, conference participation, etc. We note that government sponsoring agency does not stake claim on the intellectual property.

The first patent filing by Ipal GmbH is done mostly with the German Patent Office and then with the EPO or with the USPTO or through the PCT route. Patent regimes are yet to be harmonized across Europe and hence while filing for EPO, the destination country needs to be specified and country-specific fee needs to be paid. Ipal GmbH is entrusted with deciding on patents that are to be renewed based on annual maintenance costs. In case Ipal GmbH decides not to go for patent filing after priority registration is done, both Ipal GmbH and IP Office at HU are obligated to notify the inventor well in advance/ before the priority year ends so that the inventor, if she so wishes, can file patents in individual capacity. However, in cases where the inventor scientist expresses her desire to file patent application in countries other than those decided by Ipal GmbH, the IP Office tries to accommodate the inventor's preference and might unilaterally go ahead with such patent applications.

At MPI rejection rate of invention disclosures is as high as 50%. However, at MPI patent evaluations are not arms-length dealings. The MPG scientists in many cases are already in touch with MPI experts from the time they embark on a research project. Such continuous collaborations help the scientists learn about market potential and the scope of a prospective research agenda. This also widens their knowledge about a particular genre of technology and makes them aware of experiences associated with technology commercialization. Such mechanisms help the scientists in carefully selecting patentable components as well as in timing their publications without necessarily getting into a conflict of patents versus publications. MPI earnestly ensures that patents do not hold back publications.

Licensing strategy: Licensing of HU patents and for that matter of other universities in Berlin is carried out by Ipal GmbH. So far, the agency has only pursued single-patent licenses and is taking steps towards bundling of patents. Ipal GmbH licenses patents on exclusive terms in order to generate more income. The agency considers that its strategy of exclusive licensing may not be in conflict with the publicly funded nature of the inventions because although Ipal GmbH is a for-profit company, it is a fully owned subsidiary of IBB which is a publicly funded agency. So, maximizing revenue through exclusive licensing in essence improves earnings and resources of the government (note 12). However, the general experience at Ipal GmbH suggests that in case of fairly standard technologies, industry may not seek exclusive licenses. In some such cases, non-exclusive licensing is pursued. Non-exclusive licenses are also considered optimal when a single firm is unable to pay the right price for a technology. Reportedly, on some occasions start-ups promoted by partner universities are given priority in technology licensing.

At MPI instances of exclusive licensing surpass non-exclusive licensing as well. However, in most cases of licensing of research tools, non-exclusive licensing is encouraged. While licensing strategies at MPI depend on the type of technology, in pharmaceuticals, technologies are usually licensed to bigger companies. Moreover, for platform technologies spin-offs are considered to be the more effective route for technology sale. Income from license agreements is almost completely transferred to the inventors and the MPG institute where the technology originates.

MPI also believes that exclusive licenses are unavoidable since companies have to incur significant costs on developing a technology. MPI suggests that for many pharmaceutical and medical technologies (like in oncology), bigger companies are best placed to undertake scale-up and standardization experiments of concerned technologies. MPI reportedly is not dependent on any science cluster for licensing partners. However, some MPG laboratories are individually part of some of the science parks, which facilitates licensing in some cases. In so far as locating and identifying licensing partners are concerned, MPI first explores possibilities in Germany with the intention of helping the domestic industry (given MPG is federally funded).

Academic research and technology transfer: lessons

Market failure in late-stage technology development

We cite one specific example with reference to MPG, which would illustrate how publicly funded research institutions have at times stretched to unconventional domains of organizational activities to promote technology commercialization. Originally, Garching Instruments was focused on a particular area of technology and was engaged in developing prototypes and selling a particular kind of instrument based on a MPG technology. The MPG as a publicly funded institution also took it upon itself to manufacture certain components that had their origins in MPG laboratories. This presents an example of early experiments at MPG to mitigate market failure during later stages of technology development and commercialization. It was reported that an institutional experiment of this kind was initiated with the understanding that patents carry raw ideas which are not saleable unless workable prototypes are developed and demonstrated. However, the proposition never worked out well and the company failed in the long run.

One important trend concerning licensing of patents is to create patent pools to overcome difficulties of selling single patents and finding potential licensees for each patent. However, neither MPI nor Ipal GmbH currently reports pooling of patents. In recent times, absence of markets for technology trade arising out of serious informational gaps between the creator of knowledge and the potential end-user (the industry) has led to new business models at the behest of private patent management companies. These companies buy patents from inventors and create a patent pool to be sold to potential licensees. They solicit inventions from publicly funded institutions and at the same time proactively seek potential buyers. However, MPI has shown little interest in such mediated technology commercialization, which allegedly has its own flipsides (note 13). Ipal GmbH with its overarching jurisdiction over academic institutions and the industry may be better placed for transacting in innovations. It operates not only for the main academic institutions in Berlin, but also for non-academic research institutes, start-ups, small and mid-sized enterprises as well as for patent and technology funds. This creates strong linkages and a network of clientele that serves to bridge the gap between science and industry and at the same time improves prospects of technology transfer.

Innovation priorities and academic freedom of scientists

Often, innovation priorities are considered contrary to the objectives of academia that is primarily engaged in basic research and unencumbered knowledge creation. However, for many, any distinction between basic research and innovations is artificial, and that academic research has a definite obligation towards society's immediate and long-term technological needs is undisputed. Nevertheless, TTOs have traditionally tried to strike a balance between academic objectives and innovation priorities.

It is aptly clear from the functioning of the IP Office of HU that it does not interfere with the academic freedom of scientists. Research results may be shared during occasional meetings, rather than by way of formal reporting of research outcomes. In cases where there is apparent disagreement and discontent over assessment of a patent application by Ipal GmbH, the IP Office might try to accommodate the interest of the university inventor. However, the IP Office is obligated to go by the suggestions of the agency in most cases and by doing so it necessarily safeguards the interests of the university as a shareholder of Ipal GmbH. Overall, publications are considered to be overwhelmingly important by academic scientists at HU. Faculty members are therefore asked to submit their timelines and indicate their priorities and the IP Office reportedly not only adheres to a faculty member's priorities, but also ensures expeditious processing to allay fears about patents coming in the way of publications. Therefore, the IP Office seems to address potential conflicts between patents and publications in practice despite the stated IP policy of the university that appears to downplay the extent of such a reality.

As a non-profit research organization, MPG is statutorily obliged to make the research results accessible to the general public. However, MPG also considers industry collaboration, patenting and licensing, and spin-off creation as important elements of its knowledge-transfer activities. Therefore at MPG, which had its own law that established employer's first right of refusal over all IP originating in its institutes much before the ArbEG 2002, scientists are obligated to disclose their inventions. Invention disclosures are solicited by individual institutes and not by MPI directly. In any case, it is to be noted that at the MPG institutes, the academic community is well informed of the mandate and activities of MPI. The respective directors of the MPG institutes are expected to play necessary leadership roles and motivate the scientists towards technology transfer.

Notes

1. Germany does not pursue some of the more direct policy instruments like R&D tax credits, employed by majority of OECD and EU member states.
2. '*The Higher Education Pact*, for example, is meant for fostering university research, while the *Excellence Initiative* is intensifying competition between universities to achieve outstanding results in all higher education disciplines. Although they have different emphases, both the *Joint Initiative for Research* and *Innovation and the High-Tech Strategy* are focusing on networking and science–industry interface. Furthermore, the Federal Government is devoting greater attention to the important subjects of international exchange and cross-border networking in its *Internationalisation Strategy* and *Research and Academic Relations Initiative*.' – Research in Germany portal; http://www.research-in-germany.de/dachportal/
3. Robin and Schubert[1] using Community Innovation Survey data for France and Germany find that cooperating with public research increases product innovation, but has no effect on process innovation which depends on the openness of the firm. They also find that between 2004 and 2008 increase in product innovation is much higher in Germany than in France.
4. In Germany, often professorships require fulfilling requirements like habilitation.
5. MPI acknowledges the fact that patenting is not uniform across fields. For example, basic research may not always lead to patentable results. Similarly, patentable innovations are more frequent in life sciences than other disciplines in physical sciences separately. It is only natural that research groups focused on applied research are more likely to come up with patentable innovations and some of them could be better than others on this count. MPI informally refers to such groups as hotspots.
6. IBB is a publicly funded bank. IBB's mandate is stated as follows: 'In its capacity as the development bank, Investitionbank Bank Berlin (IBB) actively supports the development of business in Berlin. Against this background, our social commitment focuses on areas like innovation and business start-ups because these are closely linked to IBB's subsidy and support mission.'
7. Moreover, Ipal GmbH appears to operate under the presumption that licensing as the sole performance parameter may be a narrow way of assessing the role and objective of a TTO.
8. Technology Development Fund (IBB TEF) focuses on a few promising patents with high innovation potential. A revolving corpus of 10 million EUR is used for supporting 4–5 projects annually with an average direct investment of 200,000 EUR and for a duration of 1–2 years. Ipal GmbH presently has a portfolio of nearly 230 patented technologies and over 450 patent applications. As of December 2011, Ipal GmbH has been successful in licensing 117 of these technologies and has earned over 16.5 million EUR as sales proceeds. Between 2002 and 2011 it generated revenues in the tune of 2.3 million EUR. Ipal GmbH reportedly strives towards break even revenue generation.
9. Ipal GmbH has a patent portfolio of 243 technologies as of May 2012 and 118 licensing and patent sales agreements. Total revenue since 2002 is around 3 million EUR. Its portfolio reveal a great variety and is composed of technologies covering pharma and biotech (28%), medical devices (19%), chemistry and environment (12%), optics and semiconductors (14%), machine and plant technologies (9%), ICT and software (7%), diagnostics (8%) and nutrition (3%).
10. Publications are considered important not only for career progression, but also for academic prestige.
11. Hence, the MPG encourages protection of marginal and minor innovations through utility patents that expire after 10 years. This is also meant to avoid mindless patenting of minor innovations and uphold a less aggressive posture in so far as IPRs are concerned.
12. Nevertheless, exclusive licensing of publicly funded inventions could make resultant products dearer, resulting in double taxation of taxpayers. However, it may not be true when a technology is licensed to a foreign company and when products are not sold locally.
13. Such patent management companies have often been accused of being patent trolls – who use patents only to generate revenues through infringement litigations. Moreover, summary sale of a technology could mean complete alienation of the inventor who is kept in the dark about how her technology is being used.

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