

A Page of History: Patents, Prizes and Technological Innovation

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“A page of history is worth a volume of logic.”

—Oliver Wendell Holmes (1921)¹

Introduction

During the past two centuries technological change has made a significant contribution to advances in human welfare.² However, the nature of inventive activity and the processes through which individual creativity are transmuted into outward shifts in the production possibility frontier are still not well understood. Kenneth Arrow recently suggested that an important research agenda for the future comprises “measuring the significance of the patent system as an incentive for invention, including bringing the new product or process into the market”.³ As such, current policy discussions would benefit from more systematic investigations into the function of patent institutions and other incentive systems and their impact on the course of technological change.

The patent and innovation controversies of the twenty-first century reveal a general lack of information about the evolution of intellectual property and allied rights. In a reprise of debates from the nineteenth century, scepticism has increased of late about whether state grants of property rights in patents and in copyright comprise the most effective incentives for increasing creativity and promoting social welfare. Gary Becker, who was awarded the Nobel Prize in Economics, has declared:

“Probably the best solution would be to maintain the patent system on drugs and a few other products that are expensive to innovate and cheap to copy, and eliminate patents on everything else.”⁴

Some economists today even consider patent systems to be “an unnecessary evil”, creating “costly and dangerous” intellectual monopolies that should be eliminated.⁵

Pivotal Supreme Court decisions have in part been justified with references to history that exhibit a faulty understanding of the actual development of intellectual property markets.⁶ Whereas, extensive markets have always existed that allowed some patentees to license or sell their patent rights, without

¹ *New York Trust Co v Eisner* 256 U.S. 345, 349 (1921).

² E.g. Joel Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress* (Oxford: Oxford University Press, 1990).

³ Kenneth J. Arrow, “The Economics of Inventive Activity over Fifty Years” in Josh Lerner and Scott Stern (eds), *The Rate and Direction of Inventive Activity Revisited* (Chicago: University of Chicago Press, 2012).

⁴ “Reforming the Patent System toward a Minimalist System—Becker”, available at <http://www.becker-posner-blog.com/2012/09/reforming-the-patent-system-toward-a-minimalist-system-becker.html> [Accessed October 1, 2013].

⁵ Michele Boldrin and David K. Levine, *Against Intellectual Monopoly* (New York: Cambridge University Press, 2008).

⁶ In *eBay Inc v MercExchange L.L.C.*, Justices Kennedy, Stevens, Souter and Breyer noted in a concurring opinion that injunctive remedies might not be as appropriate because “the nature of the patent being enforced and the economic function of the patent holder present considerations quite unlike earlier cases. An industry has developed in which firms use patents not as a basis for producing and selling goods but, instead, primarily for obtaining licensing fees.” 547 U.S. 388 (2006). See, for instance, Naomi R. Lamoreaux and Kenneth L. Sokoloff, “Market Trade in Patents and the Rise of a Class of Specialized Inventors in the Nineteenth-Century United States” (2001) 91 *Am. Econ. Rev. Papers & Proc.* 39.

engaging in production of the goods. From the first decades of the nineteenth century, strongly enforced property rights in patents facilitated trade and commercialisation, with all the attendant benefits of market exchange. These included price discovery and valuation, the ability to mobilise capital and resources, and the co-ordination of supply and demand. Impecunious inventors in particular benefited from technology markets, because they were able to specialise in inventive activity and obtain returns in the market place by selling or licensing their rights to others who wished to produce their discoveries. An extensive network of specialised intermediaries facilitated sales and licensing and helped to reduce the transactions costs of trades in new technologies, in both national and international markets. Although the nature of patent institutions has important implications for structuring incentives for innovation, recent debates tend to be based on anecdotal evidence, rather than reliable empirical analysis.

A parallel development to the anti-patent movement is that a growing number of economists have been persuaded by theoretical models of prizes and subsidies, and they lobby for these nonmarket-oriented policies as complements or superior alternatives to intellectual property rights.⁷ Increasingly, the US Government has begun to fund prizes as a means of generating new ideas and products.⁸ Little attention has been paid to the potential challenges and consequences that prizes and similar administered nonmarket-oriented awards have historically encountered. These include difficulties in assessing the value of the invention (owing to asymmetric information, delays in the determination of value and the difficulty of aggregating benefits which might accrue from sequential innovations), corruption or bias in awards, and a potential misallocation of resources.

The most extensive empirical studies of the economic history of technological change have relied on patents to gauge progress in the “useful Arts”. The evidence on the nineteenth-century patent system in the United States suggested that the specific design of this institution played a substantial role in influencing the rate and direction of inventive activity.⁹ Moreover, the ability to protect their ideas through strongly-enforced property rights was successful in inducing relatively ordinary individuals to reorient their efforts to exploiting market opportunities. Still, it is quite possible that such findings owe to the generally more open economic and social institutions of the United States rather than to the nature of patent institutions per se. Similarly, Europeans were more apt to use prizes as policy instruments, but their inefficiencies could have derived from the general elitism in institutions of the time. At the same time, current policy proposals for national technology institutions cannot be fairly evaluated in light of the limited amount of actual evidence regarding the functioning and consequences of prize systems.

In a prescient 1862 publication, Samuel Sidney asked the question “Whether . . . manufacturing inventions [can be] stimulated, by invitations to compete for substantial or honorary awards?”¹⁰ He rejected the purely theoretical approach others had adopted and spent 10 years investigating the data on prizes at exhibitions as well as distributions by various societies for encouraging industry. His conclusions were decidedly in the negative; instead, improvements in market demand and competition were the most likely to induce inventive activity, and consumers were more effective judges of success in the marketplace.

Administrative attempts to replicate the role of the market confronted significant obstacles. Judges had to combine technical competence and industry-specific knowledge with impartiality; decision-making

⁷ Joseph Stiglitz, an economist who was awarded the Nobel Prize for his work in other areas, proclaims: “[T]he alternative of awarding prizes would be more efficient and more equitable. It would provide strong incentives for research but without the inefficiencies associated with monopolisation. This is not a new idea—in the UK for instance, the Royal Society of Arts has long advocated the use of prizes. But it is, perhaps, an idea whose time has come.” “Give Prizes Not Patents” *New Scientist*, September 16, 2006, p.21.

⁸ The America COMPETES Reauthorization Act of 2010 granted all federal agencies the authority to administer prize competitions to increase innovation, claiming that prizes “have a good track record of spurring innovation”. Office of Science and Technology Policy, “Implementation of Federal Prize Authority: Progress Report”, available at http://www.whitehouse.gov/sites/default/files/microsites/ostp/competes_report_on_prizes_final.pdf [Accessed October 1, 2013].

⁹ B. Zorina Khan, *The Democratization of Invention: Patents and Copyrights in American Economic Development* (Cambridge: Cambridge University Press, 2005).

¹⁰ Samuel Sidney, “On the Effect of Prizes on Manufacturers” (1862) 10 *J. Soc’y Arts* 374. Sidney was trained as a lawyer, and was also an Assistant Commissioner of the Crystal Palace Exhibition in London in 1851.

among panels was complicated by differences in standards, interpretation and sometimes language barriers. The necessary tests of the items displayed were complicated by a lack of comparability, poor information on marketability and price, and variations in taste. The most novel items were associated with the greatest risk, and therefore less likely to be selected. Such difficulties tended to lead to haphazard decisions, or were often overcome by simply making the award to the person or firm with the most established reputation.

As for the inventions that prevailed, the prize system merely encouraged “a long list of machines which, for practical purposes, are no better than toys”.¹¹ The market value of useful inventions was far greater than any prize that could be offered, whether by private or state initiative. Even specialised institutions such as the Royal Agricultural Society and the prestigious Royal Society of Arts had failed to develop truly significant inventions.¹² However, prizes were useful to the winners because they were valuable advertisements. The competitor for the prize had an incentive to over-spend on the item in an attempt to win, regardless of whether such investments were practicable in the marketplace. As a result, winners tended to be among the wealthiest of the competitors:

“The theory that prizes encourage humble merit is only a theory, for experience shows that in a series of yearly contests wealth wins, as it must when hundreds of pounds must be expended to win ten”.¹³

Empirical analysis of patents and prizes

In order to address such issues, I have conducted empirical analyses of large panel datasets of patents and prizes that were awarded for technological innovations in the United States, England and France between 1750–1930. The data for prizes in England were drawn from the archives of the Royal Society of Arts, whereas the French data include awards made by the Society for the Encouragement of National Industry and the National Conservatory of Arts and Trades. These original datasets are sufficiently extensive in subject-matter and geographic scope to allow us to determine the specific impact of these institutions on individual inventors and innovations, as well as on the nature of technological change more broadly.

American economic progress was directly influenced by favourable institutions, most notably its legal and patent systems. The United States devised an intellectual property system which soon succeeded in its aim to “promote the Progress of Science and useful Arts”. Other countries had already introduced patent and copyright systems, but the United States was unique in its emphasis on markets and the pursuit of benefits to the many rather than those of a narrow elite. Unlike those in France, Britain and elsewhere in Europe, the US patent rules and standards encouraged widespread participation. When transportation networks improved market access, the prospect of profit opportunities induced a diverse array of relatively ordinary individuals to participate in inventive activity, in a process of “democratisation”. In the United States inventors of so-called great inventions and incremental inventions obtained property rights to their discoveries. Extensive markets in patent rights, both assignments and licenses, developed from the first decades of the nineteenth century, and soon comprised national and international networks. This response in patenting to the remarkable expansion of markets that accompanied industrialisation helped to propel the United States to the forefront of the world economy by the end of the nineteenth century. In direct contrast to the patent system, the American copyright regime was one of the weakest in the world, and the United States was reviled throughout the nineteenth century as a flagrant copyright pirate. I argue that such a distinction between patents and copyrights was economically efficient and accorded well with the objectives of a market-oriented democracy. Since the detailed results regarding such comparative intellectual

¹¹ Sidney, “On the Effect of Prizes on Manufacturers” (1862) 10 J. Soc’y Arts 374, 376.

¹² Sidney cited Balzac, who declared that “artists raised under this hot-house process are forgotten as soon as crowned”. *New York Trust Co* 256 U.S. 345, 375 (1921).

¹³ Sidney, “On the Effect of Prizes on Manufacturers” (1862) 10 J. Soc’y Arts 374, 376.

property institutions are available in several other publications, here I will highlight the more recent research findings on prize systems.¹⁴

Prizes in Britain

The proponents of prizes tend to cite the award that was offered for a means of gauging longitude at sea; although it is ironic that the experience of the humble artisan John Harrison with the Board of Longitude would better serve as a caution against administered incentive systems.¹⁵ This is especially true in the case of inventors who were not politically astute or those who were relatively uneducated and more likely to have been drawn from the “lower classes”. Insights into the relationship between incentives and innovation can be gleaned from a large sample of British inventors who were responsible for the great inventions of the period before the Second World War.¹⁶ These inventors were typically drawn from elite or professional backgrounds, and tended to be socially well-connected, even though productivity at invention was unrelated to such factors.

The sample includes information on all of the prizes and other forms of official recognition the British great inventors received, and close to 40 per cent of these inventors were recipients of awards. Statistical analysis of the probability that an inventor would receive a prize shows that patentees were more likely to get prizes, so the incremental incentive effects of an additional prize were likely quite low. Many observers attributed awards, medals and prestigious appointments to nepotism, bias and even corruption. The grants of prizes to British great inventors seem to have owed to personal connections rather than to factors that might have enhanced the technical value of the discovery. The most significant variable affecting the award of a prize was an elite or Oxbridge education, which doubled the likelihood of such winning recognition. At the same time, specialised education or employment in science or technology, which might be expected to increase inventiveness, had little effect on the probability of getting a prize. The growing disillusionment in Europe with prizes as an incentive mechanism for generating innovation was evident when the Royal Society of Arts abandoned the practice in 1900 because of its acknowledged lack of social value.¹⁷

Industrial prizes in the United States

In the United States prizes were not as prevalent as in Europe and, indeed, the most prominent of these honorific awards were introduced in the United States at the instigation of foreigners.¹⁸ However, industrial promoters sponsored private industrial fairs in most large cities in the United States, on a roughly annual basis, and these can be used to construct a panel dataset of innovations that were submitted for prizes.

¹⁴ E.g. Khan, *The Democratization of Invention* (2005); B. Zorina Khan, “Looking Backward” in Douglas Irwin and Richard Sylla (eds), *Founding Choices: American Economic Policy in the 1790s* (Chicago: University of Chicago Press, 2010); B. Zorina Khan, “Selling Ideas: An International Perspective on Patenting and Markets for Technology, 1790–1930” (2013) 87 *Bus. Hist. Rev.* 39.

¹⁵ For more details, see Dava Sobel, *Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time* (New York: Penguin Books, 1995). The Longitude Act awarded as much as £20,000 for a “Practical and Useful” means of determining longitude at sea. Candidacy for the award was judged by a Board of Longitude, members of whom were drawn from the scientific, military and public elite, some of whom were themselves competing for the prize. These individuals were scornful of Harrison as a common uneducated artisan and hindered his attempts to collect the prize, which was never awarded. Instead, as Harrison was close to death, the King intervened and provided payment for achieving the task that had eluded the finest theoretical scientific minds up to that date.

¹⁶ B. Zorina Khan, “Premium Inventions: Patents and Prizes as Incentive Mechanisms in Britain and the United States, 1750–1930” in Dora L. Costa and Naomi R. Lamoreaux (eds), *Understanding Long-Run Economic Growth: Geography, Institutions, and the Knowledge Economy* (Chicago: University of Chicago Press, 2011). The British sample of over 400 inventors and several thousand inventions was compiled from a broader series of biographical dictionaries, including the 2004 *Oxford Dictionary of National Biography* and the *Biographical Dictionary of the History of Technology*, among others.

¹⁷ For an account of a similar development in France, see Maurice Crosland and Antonio Galvez, “The Emergence of Research Grants within the Prize System of the French Academy of Sciences, 1795–1914” (1989) 19 *Soc. Stud. Sci.* 71.

¹⁸ For instance, the John Scott Medal and premium was funded by a legacy from the London pharmacist, who bequeathed \$4,000 in 1815 for “premiums to ingenious men or women who make useful inventions”. Awards from foreign governments and institutions were liberally bestowed on famous American patentees such as Thomas Edison, Hiram Maxim and Samuel Colt.

The sample of US prizes comprises some 20,000 innovations from major cities, including Boston, New York, Philadelphia, San Francisco, Cincinnati, St Louis, Atlanta and New Orleans. These observations were matched with the patent records to identify the inventions that were patented. The information has further been linked with the manuscript population censuses, yielding insights into the backgrounds of individual inventors, such as occupations, age, wealth and geographical mobility.

Observers of the US patent system in the nineteenth century noted that almost everything that could be patented was patented, and the data on the propensity to patent support these claims. At the same time, it is also true that a considerable and diverse amount of creativity at invention was indeed occurring outside the formal patent system, and we can speculate why such items were not patented. First, some might argue that such inventors actively rejected the patent option and instead decided to appropriate returns through other means such as trade secrecy. However, secrecy seems somewhat implausible as a general explanation, for it is unlikely that secrecy would be promoted by participating in a public exhibition. Secondly, inventors may have compared the costs of getting and enforcing a patent to the benefits of patent protection and decided that the net present value of patenting was negative. If so, this suggests that many of these unpatented inventions may have been of minimal economic value. Thirdly, a straightforward explanation is that many exhibits were simply not eligible to be considered for a patent, either because the degree of novelty or improvement was minimal or because the innovation fell outside the subject-matter that could be patented. It is not feasible to determine the amount of novel inventive capital vested in unpatented exhibits, but we can categorise the patentability of each item in terms of subject-matter. Application of this minimal filter of subject-matter suggests that close to half, or a total of 47 per cent of the sample, was patentable. A closer assessment of the unpatentable items reveals that a large fraction comprised final or consumer goods, a finding that supports the conventional view that patents may be a better measure of inputs than of output. Patentability statistics thus indicate that much of the creativity that we observe in exhibitions was quite different from the creativity that resulted in patents or in enhanced capacity for economic growth.

The stated objective of industrial fairs was to advance the standing of innovative workers and artisans. Nevertheless, participants in the fairs were drawn from more prominent occupations than the general population of patentees.¹⁹

Indeed, exhibitors were less likely to be artisans and ordinary labourers than were patentees, and the representation of artisans at the exhibitions also declined over time. However, occupational class does not directly translate into economic or social status or influence. For this, we turn to the records on wealth-holding in the federal population censuses, which allows us to more directly assess the economic status of exhibitors relative to patentees in general. The data reveal that the participants in the exhibitions were substantially wealthier than the general population. For instance, in 1860 the sample from the industrial fairs owned average personal property that was almost twice as extensive as that of patentees in general, and more than double their average real estate holdings.

Patents are granted because they satisfy specific rules and standards that are outlined in the laws. A key question is what determines whether an exhibit receives a prize or not. Statistical analysis indicates that almost all of the variation in the silver or gold awards also remains unexplained, implying that these grants were based on fairly random rationales. The one variable that does in part influence outcomes is financial status: exhibitors with greater personal wealth were more likely to win gold and silver medals. However, the mechanism through which wealthier exhibitors gained an edge over their competition is unclear. This finding was not due to their superior entries, but may have been associated with greater expenditures on their presentation at the fairs, or their name recognition, or perhaps to less obvious connections with the

¹⁹ B. Zorina Khan, "Promoting the Useful Arts: An Empirical Estimation of Technological Innovation Outside the Patent System, 1790–1880", working paper, 2013.

award juries. In general, the results support the notion that the majority of medals reflected factors other than inventiveness, productivity or technological innovation.

The judges for these technology classes stated their objective was to reward novelty and inventive ingenuity. In practice, they bestowed medals for an array of other reasons besides inventiveness, including overcoming adversity (such as age or physical handicaps), cheapness of the item, neatness and aesthetic factors. In addition, a mercantilist orientation was evident when awards were given to the producers of American goods that rivalled innovations originally created in foreign countries. The decentralisation of judging committees, the lack of transparency and private nature of their decision making process, and the absence of appeal from their rulings, all encouraged idiosyncratic and inconsistent decisions. It is therefore not surprising that observers continually criticised the arbitrary way in which the awards were given out, at domestic and international fairs alike. A lack of systematic methods of allocating awards was likely to reduce the incentives for inventors who realised that prizes in many instances were uncorrelated with inventive merit.

Prizes tended to be awarded to readily observable final goods that enhanced taste and consumption possibilities, rather than leading to the promotion of inventive activity. This raises the possibility that prize exhibits did not reflect the sort of technological creativity that could expand productive frontiers through spillovers. Part of my research has been directed towards a comparative assessment of the effects of different technological institutions, and how they might influence spillovers from inventive activity. The usual justification for offering patent protection proposes a bargain or a social contract by means of which inventors obtain a temporary monopoly in their discoveries, in return for disclosing their ideas in sufficient detail that the invention can be recreated by someone who is skilled in the arts. By contrast, alternative methods of appropriation include the use of lead time, private methods of exclusion, and trade secrecy. Although these mechanisms might benefit the owners of new technologies, at the same time they could impose a social cost if the information is not available to others despite its low incremental cost. Thus, it is not clear whether unpatented ideas would tend to generate knowledge spillovers, or to inhibit them.

Technological spillovers and patents and prizes

Patents and prize-winning innovations differed in many regards, including in terms of geography and location. If prizes were less systematic and had a lower likelihood of being associated with location and geography, then such awards would fail the necessary precondition for the prevalence of geographical and technological spillovers. Spatial autocorrelation analysis of patents and prizes revealed that patents were significantly influenced by the inventive activity in adjacent counties.²⁰ This is consistent with the bargain or contract view of patents, which proposes that the limited grant of a monopoly right to inventors benefits society, because in exchange the public gains information about the discovery that increases social welfare. The patent grant requires a specification that is sufficiently detailed to enable a person who is skilled in the arts to recreate the patented invention. From the earliest years of the patent system, policy makers engaged in discussions about how to ensure that information was available to the broader public. Patent legislation included measures to publish information about patents that were granted in annual reports that were widely disseminated, and expired patents were published in newspapers. The US Patent Office maintained local depositories and offices throughout the country. Thus, even if the patentee had acquired a monopoly for (at that time) 14–17 years, access to the information about the discovery likely facilitated inventions that worked around the initial patent, or led to ideas for follow-on inventions.

²⁰ B. Zorina Khan, "Of Time and Space: A Spatial Analysis of Knowledge Spillovers among Patented and Unpatented Innovations", working paper, 2013. Spatial autocorrelation exists when the values of a variable comprise a function of its location and spatial characteristics that are defined in terms of a specific measure of distance. If so, the usual method of merely adding fixed effects for regions or states leads to unobserved heterogeneity that will likely lead to biased results.

By way of contrast, the patterns of prizes were inconsistent with the presence of technological spillovers. Thus, trade secrecy or even open access to ideas did not generate as much diffusion of information as in the case of inventions that were protected by patent grants. Exhibits sponsored by the Franklin Institute or the Cincinnati Mechanics' Association might have been open to the public, and some inventors might have been able to copy from the displays, but there was likely a selection effect that influenced the owners of inventions that were readily duplicable to avoid displaying them at fairs. Moreover, even if inventors had access to knowledge about innovations from attending the fairs, if they did not physically attend the events, there were few or no mechanisms that might have led to the spread of information. This was of course a function of the decentralised nature of the prize system in the United States, but even in European countries that offered centralised institutions such as the Royal Society of Arts, access to unpatented inventions and knowledge about them was quite limited.

Patents and prizes, then and now

The popularity of such prizes faltered towards the end of the nineteenth century, and the Royal Society of Arts itself acknowledged that the system of inducement prizes was flawed. Exhibitions undoubtedly facilitated efforts to advertise and commercialise innovations. Many manufacturers accumulated medals at numerous fairs and highlighted their awards in magazines, journals and other advertisements. Medals may have proven useful in competitive markets as a means of product differentiation, and as a way of signalling higher quality or brand-name capital. Some observers go further and contend that prize systems performed as effective incentives to stimulate new inventions. However, whether the prizes that such private institutions proposed were indeed effective in encouraging creativity and inventive activity is difficult to determine. Many of the displayed items were entered into competition at multiple exhibitions, both domestic and international, so the effect of any one event is debatable. More important, procedures through which the prizes were determined were idiosyncratic and difficult to predict. The random nature of judging is a theme that recurs in numerous contexts both within and beyond the expositions. As stated before, competitors who were financially better off had an advantage in gaining the attention of the judges, regardless of the technological merits of their contributions. Decentralised judging encouraged a lack of uniformity in standards and also led to the award of premiums that did not necessarily reflect the same degree of inventive capital across technology classes. The lack of systematic allocation implies that, if potential inventors responded rationally to net expected benefits, then prize systems were arguably less than successful in achieving the Constitution's mandate to "promote the Progress of Science and useful Arts".

Today this history is forgotten, and once again there is a resurgence of interest in innovation prizes, in both the United States and other developed countries. Many of those who support the use of prize-granting institutions refer to casual anecdotes from the historical record to justify their positions. Such advocates of prizes are also promoting their adoption in developing societies, based on the belief that they will generate innovations and entrepreneurship. For instance, the Innovation Prize for Africa offers entrepreneurs cash prizes for such ideas as the use of fly larvae to produce animal feed.²¹ In Israel, a "brain prize" will be awarded to anyone who "can demonstrate an extraordinary breakthrough in brain technology with

²¹ See "Innovation Prize for Africa (IPA)", available at <http://witug.org/tag/innovation-prize-for-africa/> [Accessed October 1, 2013]. Other suggestions for prizes in African agriculture are discussed in William A. Masters and Benoit Delbecq, "Accelerating Innovation with Prize Rewards: History and Typology of Technology Prizes and a New Contest Design for Innovation in African Agriculture" (2008) International Food Policy Research Institute, Discussion Paper No. 835.

global implications”.²² Numerous proposals have been made to reward other medical innovations in vaccines, therapeutics and medicines that are crucial for achieving development objectives.²³

At the same time, the analysis of the historical record suggests a number of difficulties were associated with administered prize systems, such as the potential for bias or corruption, unpredictable methods of allocation and outcomes, as well as other deficiencies attendant on a nonmarket-orientation. Even if a prize system were successful in generating new inventions, it would be unlikely to be effective in managing the unpredictable and often lengthy processes required to transform an idea into a commercially viable product. These issues are all the more likely to be problematic in developing countries, where complementary institutions and governance mechanisms are typically flawed. Such observations do not imply that inducement or reward prizes are never effective generating technological innovations, for they can prove to be useful in certain specific circumstances. For instance, prizes may be necessary to substitute for private initiatives in the event of market failure, such as in the area of tropical vaccines. They may further serve to elicit the attainment of unique and well-specified targets, as long as the difficulties of decision-making and governance issues are explicitly recognised and addressed. The point is that policies are unlikely to be effective unless all the costs and benefits of alternative options are fully taken into account.

Conclusion

In summary, this project examined the impact of alternative technological institutions through a systematic comparison of the patterns in patenting and those of innovation prizes during the “long nineteenth century”. The overall conclusions that can be drawn from the empirical analysis are that intellectual property institutions were successful in the United States largely because they ensured open access to creative individuals, and because they were associated with decentralised decision-making, extensive markets for technology, and strong enforcement of such rights. However, as observers noted in the nineteenth century, industrial prizes in large part faltered because of their lack of market-orientation. Even the democratic nature of economic institutions in the United States could not overcome these deficiencies in administered prize systems. Given the potential for corruption and the absence of efficient institutions in many of today’s developing countries, the introduction of industrial prizes seems all the more likely to be problematic. In any event, significantly more research needs to be completed before we can conclude that such awards should be re-introduced in the twenty-first century as a means of promoting entrepreneurship and technological progress.

²² Israel Brain Technologies, “B.R.A.I.N Prize”, available at <http://israelbrain.org/b-r-a-i-n-prize/> [Accessed October 1, 2013].

²³ Paul Wilson and Amrita Palriwala, “Prizes for Global Health Technologies”, Results for Development Institute, Washington DC, 2011; Robert Hecht, Paul Wilson, and Amrita Palriwala, “Improving Health R&D Financing for Developing Countries: A Menu of Innovative Policy Options” (2009) 28 Health Aff. 974.