

THE INDIAN JOURNAL OF LAW AND TECHNOLOGY

Volume 1, 2005

**TECHNOLOGY, LAW, FREEDOM AND
DEVELOPMENT***Yochai Benkler****ABSTRACT**

Technology interacts with social, economic and legal frameworks to set the basic 'affordances' and constraints of human action over time. While biotechnology and nanotechnology may portend significant upheavals in the future, the most significant present transformation revolves around computers and the emergence of the networked information economy. These new technological and economic conditions are creating new forms of production and new forms of social behaviour that are fundamentally altering the way we know the world, how we learn about how the world is and how we can make it become. It is important that we study this transformation and understand it in political as well as economic terms. How we manage the transition - in particular how we construct the basic institutions governing it, such as intellectual property and communications law - will go to the very structure of freedom and the possibility of human development in the coming decades.

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I am honoured to have been asked to write a few words upon the inauguration of the Indian Journal of Law and Technology. We stand at a moment of transformation in the conditions of economic production and human freedom - a moment wrought by a cluster of technological shifts and, in large measure, managed through law. Law already is, and will continue to be, a major domain in which the conditions of tomorrow are negotiated, but it cannot be thought of without understanding the technological, economic and social context in which it operates and the historical moment at which it intersects with these other disciplines. A systematic dedication to understanding how technology is affecting life and how law interacts with technology is a precondition to understanding the stakes and implications of the institutional battles we observe today.

I. OF LAW, TECHNOLOGY AND BEHAVIOUR

We can think of law as one of a series of systems within which human action occurs. Coarsely, we can say that technology, law, economic conditions and practices, social relations and cultural conceptions are different systems or contexts within which human beings act, alone and with others. Each of these systems, and the interaction among them in any given society and time, has certain characteristics that, borrowing from the language of engineering we could call 'affordances and constraints'. By 'affordances' we refer to actions and behaviours that a context or system makes feasible or easy. By 'constraints' we refer to practices and behaviours that are made difficult by acting through this context. To render this abstract statement concrete, think of an automobile. It affords us the ability to travel at much greater speeds and carry much heavier loads than animal transport could, but is generally constrained to be used along a relatively narrow range of paths such as roads, highways and dirt paths, but not through terrains such as forests or over sands. It is the combination of these affordances and constraints that support some of the social patterns, particularly suburbanisation, that typify a heavily automobile-based society like the United States. A standard rule of law, say, "everyone should drive on the right side of the road", also provides affordances and constraints. It not

only constrains behaviour - "thou shalt not drive on the left" - it also enables those who live under it to plan effectively how to drive with some degree of safety - to wit, on the right. By using the terminology of 'affordances' and 'constraints', however, I mean to recognise that none of these contexts is usually deterministically related to outcome or actual behaviour. We can, and sometimes do, when we need to, drive on the left or off-road. The point is that on a large societal scale, contexts that have certain affordances and constraints will tend to support patterns of behaviour that the context makes easier to pursue, and to suppress patterns of behaviour that the context makes harder. This is not technological or legal determinism. It is merely an observation about the tendencies of various configurations of constraints and affordances to support or undermine certain actual behavioural practices at a societal level. These behavioural practices can then become the basis for normative assessment and, in turn, for a discussion about the design of law, of technology, or of economic and social systems of action that have contributed to the emergence of practices that our normative analysis tells us are desirable or undesirable.

The different contextual systems - law, economic structure and organisational strategy, social relations and norms, and technology - do not always cohere in their affordances and constraints. There are periods of dislocation where one or the other of these systems will change sufficiently so as to bring the practices it makes easier into conflict with those supported by the other systems. The dislocation brought about by industrialisation, a combination of technical and economic organisational changes, for village-centred social life is the staple example from the Industrial Revolution. Perhaps less obvious are the changes in law and socio-cultural practice required to move from a system of feudal relations in the country and artisanship and guilds in cities to a system of free labour, that is, towards a more fluid market in labour that industrialisation required. Over time, however, as the practices collide through more or less violent upheaval, the various systems fit together more closely, through changes in some and suppression of others. The result over time is a system of punctuated equilibria or path dependencies. Periods of relative stability and coherence among the different systems of context are punctuated by moments of change and transformation, during which dislocation occurs and conflict ensues to determine the characteristics of the next equilibrium.

From the vantage point of 2005, it seems as though we are going through at least one such period of transformation. The instigating event was, in this case, technological - the development of the chip and with it the launching of the personal computer, combined with the development of the Internet and the launching of a global communications network. It is likely that the discovery of DNA at more or less the same time and the subsequent emergence of biotechnology will bring about as profound a transformation. However, except in the very important area of agriculture, its contours are not yet clear, and we have not quite reached a point where biotechnological transformation exerts pressure on our existing social, economic, and political institutions. Further yet into the future is the likely effect of nanotechnology, which is at present beyond the point of science fiction, but it is too early to offer a good sense of how profound a change it will in fact bring. Monitoring and predicting the effects of those fields will necessarily play an important role in the study of law and technology. But much more immediate is the transformation caused by personal computing and global connectivity. It is already upon us, and its disruptive effects are very real and already the subject of much legal and political debate.

II. THE RISE OF THE NETWORKED INFORMATION ECONOMY

We have for several decades been talking about the rise of the information society or information economy. Emphasising the continuity of the present transformation with the rising importance of information in the past five decades is of course partly valid, but it tends to obscure more than it reveals. While it is obviously true that the relative weight of information production and symbolic manipulation have grown in the developed economies and the more developed sectors and regions of developing economies, much of information production throughout this period was organised in an industrial model and around the needs of industrial production. Beginning with the high-throughput electric presses of the second quarter of the nineteenth century, the capital cost of producing media increased vastly, later followed by high-cost radio transmitters, televisions, satellites, and mainframe computers. Throughout this period, participating in the production of information required a capacity to raise vast amounts of capital and the 'business models' for production of information, knowledge and culture tended to be either market-based or government-funded. The critical role traditionally played by social

processes - family, friends, neighbours, teachers - in producing the information environment within which most human beings grew up was eroded significantly, especially in more technologically developed and dependent societies.

The networked personal computer inverts the capital structure of information production and exchange that has been the stable fact of these sectors for over one hundred and fifty years. While the exact number is difficult to pin down, somewhere between six hundred million and one billion people around the globe now own the basic physical capital necessary to produce information, knowledge and culture, and to participate in the global economy centred on them. That means that almost one billion people on the planet now have the freedom to decide to produce information or culture simply because they want to - they already have access to the physical requirements and the human intuition, wisdom and creativity necessary to do so. They do not need a business plan to write software to serve a need they have. If they know how to do it, they can write it and find others who will work with them to improve it. This is the fundamental fact proven by the dramatic success of free and open-source software development. Over a million programmers participate in tens of thousands of projects, the best known of which are responsible for most of the basic functions of Internet communications, some having been adopted in the face of strong, but ultimately unsuccessful, competition from proprietary firms. Thirty thousand individuals can come together to construct a free online encyclopaedia such as Wikipedia¹, which may not displace the Encyclopædia Britannica quite yet, but is a very good substitute for most other online encyclopaedias. Examples are by now legion, and we have reasonably good economic models to explain why commons-based information production in general, and peer production in particular, occurs, and why both types of production are sustainable under the conditions that typify a networked information environment.

The critical transformational fact is that all these people can now come together with machines they already own or have ready access to. There is no need to buy a steam engine, a production line or a broadcast station as a

¹ See *Wikipedia: About*, at <http://en.wikipedia.org/wiki/Wikipedia:About> (last visited Oct. 12, 2005) (describing the collaborative nature of the Wikipedia project).

precondition to being able to cooperate productively. The same motivations that bring us to spend time with friends and to talk about politics with our neighbours and family now bring us to participate in various effective practices of information production. But, unlike in the industrial economy, in the networked information economy, these outputs of basic human connectedness become actual, effective substitutes for market-based or government-funded information goods. In the global information economy, what that means is that basic human social relations come to occupy a vastly more important role as an economic phenomenon. Moreover, civil society can come to play a substantially more important role than it could when larger amounts of money were required to act in the public sphere and in providing basic needs.

The rise in the potential and actual importance of non-market behaviour has significant and positive implications for both freedom and development. By non-market behaviour I mean to encompass both organised action in the traditional non-profit and non-governmental sectors and, more radically and importantly, effective individual action alone, in loose association with others and in larger-scale peer-production processes such as free and open-source software development. Together these newly emerging behaviours are beginning to offer new avenues for constructing the public sphere, for opening up new domains of individual autonomy, and, perhaps most immediately relevant to the challenges and opportunities faced by India today, for development.

III. THE CONSTRUCTION OF THE PUBLIC SPHERE

Mass media has been a part of all modern democracies. The early Dutch and American republics, France in the few brief years between the French Revolution and the Terror and, more ambiguously, the early British parliamentary democracy, had a press that was small-scale, artisanal, and largely independent of market forces or government subsidy. Beginning in the second quarter of the nineteenth century and gathering force over the following one hundred and fifty years, the public sphere was constructed on a mass media model - a very small number of professional speakers at the core controlled what millions of people read, listened to and saw. The critical change was brought about by the vastly higher cost of new technologies for printing papers for mass circulation and the great increase in the number and geographic dispersion of people who were part of the relevant political community, changes

that were themselves brought about by steam transportation, both rail and shipping, and the increased production capacity that required large markets. The increasing size and geographic dispersion of the relevant political communities meant in turn that the papers necessary for these ever-growing relevant political communities had larger distributions. The cost of meeting these new requirements squeezed out the artisan press and ushered in industrial production of the public sphere. When radio was introduced, there was a brief period when it was technically and legally possible for it to go a different way - small-scale, local and inexpensive. But in a series of policy moves during the 1920s, all major countries adopted policies that fell into one of three models: nationalisation, which typified Continental Europe and its colonies, the BBC hybrid model, with or without monopoly, which typified Great Britain and its colonies and former colonies, and the American system of advertiser-supported media, highly concentrated and co-dependent on government regulation. From that point on there were no more inflection points until the rise of the Internet.

The past few years have seen a radical inversion of the capital structure of the production of the public sphere. Since the early 1990s we have read many proclamations about how 'cyberspace' allows everyone to be a pamphleteer. To some extent, this has been an exaggeration. The power of the mass media continues to loom large even in societies where Internet penetration is very high. And yet, without embracing the millenarian view that democracy will be completely revitalised by the Internet, the past decade and, in particular, five years of research into actual authoring and linking practices on the Internet suggest that we are in fact seeing a quite basic change in the relative ease with which almost anyone who has access to an Internet connection can find a way of injecting their observations and concerns into the public sphere. We are beginning to see peer production of the type we have seen in software development being applied to the core functions of the media in democratic societies - from the watchdog function of the press to sustained commentary and a platform for discussion. For example, a combination of activists, academics and students were able to investigate, analyse, and publicise criticisms of voting machines introduced by one of the major manufacturers in the United States, causing many of the machines to be decertified in California.² Patterns of linking and archiving materials and

² See John Schwartz, *File Sharing Pits Copyright Against Free Speech*, N.Y. TIMES, Nov. 3, 2003, at C1; Melanie Warner, *Machine Politics in the Digital Age*, N.Y. TIMES, Nov. 9, 2003, at C1.

inviting readers to read the underlying documents for themselves and linking across ideological divides point to an emerging culture where groups that share intense interests cluster around a few hundred websites of varying but significant visibility, and these create a new public sphere. In this public sphere, intense interest to a dedicated group of users, rather than mild interest to large masses of audiences, becomes important to public debate. Money cannot dominate the discourse, as it does to a large extent in the commercial mass mediated environment, nor can the government control the agenda as completely where the mass media are state-owned. Independently, networked communications have become a new platform for social mobilisation, as the use of SMS in the Philippines during the demonstrations that led to the ouster of President Estrada has come to symbolise.³ While the Internet has not, as some claimed it would in the mid-1990s, brought forth a completely new and utopian democracy, the emergence of a larger role for non-market, decentralised information production and exchange has provided some well-defined improvements over the reasonably well-known democratic failings of mass media. As the relevant market and, because of the ever-expanding role of the international trade regime as a source of substantive law, the relevant political community become global, the capacity of the networked information economy to increase the importance of intense engagement and moderate the dominance of money becomes particularly important.

IV. COMMONS-BASED PRODUCTION AND DEVELOPMENT

The relationship of the networked information economy to development is more instrumental than intrinsic. If one were to take, at the most simple level, the components of the Human Development Index as a starting point, it becomes obvious that the way we produce and manage information, knowledge and culture is germane to development. The basic requirements of living a long and healthy life, as measured by healthy life expectancy, that is informed and acculturated, as measured by literacy, and that is materially satisfying, as measured by GDP per capita and growth, are all closely linked to the use and application of information. First and foremost, information-embedded goods and tools are basic to all three aspects of development. Better

³ Kevin Anderson, *Breaking Down the Great Firewall*, at <http://news.bbc.co.uk/2/hi/asia-pacific/4496163.stm> (last visited Oct. 25, 2005).

food crops and medicines, which depend on research and innovation, better information about health and nutrition practices and better information on the outcomes of different practices are central to living long and healthy lives. Better access to teaching materials, training opportunities for teachers academic centres of learning and connectivity to access materials and databases are central to education and allowing the population of teachers and learners, both children and adults, to learn over the course of their lives. Finally, it has been a central observation of the economics of growth since the 1950s that innovation and the application of information and knowledge are central to growth and represent a substantially greater component of wealth than efficiency.

A critical point to be noted is that commons-based production has always played an important role in information production in all countries, developed and developing. No one would manufacture automobiles in the non-profit sector, yet universities have consistently played a critical role in our research system. Different industries have different mixes of the roles of non-market and market producers and, even among market producers, there are those that rely on a knowledge commons to become more efficient and those that rely on proprietary rights in information goods as their core business strategy.

All information- and innovation-based industries have a range of actors that follow distinct organisational strategies. Government-funded and government-conducted research always provides an important source, as do universities.⁴ Among market actors, there are some who rely on asserting exclusive intellectual property rights, such as software publishers, mainstream pharmaceuticals and major seed vendors. But in these sectors there are also organisations that do not depend on asserting exclusive rights, but instead rely on different kinds of strategies to appropriate the benefits of their innovation. In repeated empirical studies of industrial research and development, almost all industries except for pharmaceuticals and medical equipment report first mover advantages, sales relationships, marketing advantages, and learning curve effects on cost as more important mechanisms

⁴ See also Yochai Benkler, *Commons-Based Strategies and the Problems of Patents*, 305 SCIENCE 1110 (2004) (proposing two complementary avenues - 'publicly-minded licensing' and 'peer production' - open to scientists and universities to alleviate the costs of overly protective patent systems).

for appropriating the benefits of their research and development than patents. In the case of software, for example, the software services industry, which relies on customer-specific services and not on copyright or patents in the software, accounts for two-thirds of revenues in the United States from software development. Only one-third comes from software publishing, which is dependent on copyright. Significantly (although much less dramatically), the generic drug industry is an important player in pharmaceuticals and plays a critical role in introducing manufacturing and distribution efficiencies into the market for medicines once patents have expired. In addition to these organisational forms, individuals have often played important roles in information production, ranging from the proverbial inventor in the garage to the hundreds of thousands of free and open-source software developers. Moreover, the non-profit sector more generally, apart from universities whose main mission is the creation of information and knowledge, also plays an important role - from amateur choirs to philanthropically funded professional operas, from political parties to religious organisations.

As I have already mentioned, access to a stock of knowledge is critical to every single aspect of development. The advantage of the emerging practices of commons-based production is that they treat the stock of knowledge that exists at any given moment as a common good, free for anyone, regardless of access to financial capital, to use for both consumption and, perhaps more importantly, as a production input or tool. Take, for example, software services. In order to offer software services for any given software, one must be able to learn the software and legitimately work with it. If the software is proprietary, doing so requires a licence. If the software is free or open-source, anyone skilled can approach a project and begin to work and compete on their abilities alone, as opposed to their ability to acquire a licence. In a globally networked market, the ability of talented software developers to compete for systems design and customisation using free or open-source software from every corner of the world is much greater than when it can only be done with the permission of the incumbent owners of the software platform they wish to implement or service. Similarly, new scientific research can only be conducted with access to the current stock of scientific knowledge. Current journal prices have risen at alarming rates, squeezing the budgets of even the best-funded universities in the United States and Europe. In the past few years, a movement among scientists has begun to push for an open publication model, where the outputs

of scientific research, much of it government funded and conducted by scientists who are not profit-maximisers and who are not paid a penny for publishing their discoveries, will be made freely available on the Internet. This movement has seen the development of non-profit efforts such as the Public Library of Science⁵ and some businesses, such as BioMed Central⁶, which aim to facilitate it. In two recent decisions, both the US⁷ and UK⁸ primary government research funding agencies have begun to require that research results be made freely available within a certain period (no more than a year) after initial publication. Again, the emphasis on commons-based publication lowers the barriers of access to the existing stock of knowledge so as to allow talented people around the globe to compete on a more equal footing in creating knowledge that is useful for their own societies and for the global community as a whole.

In medicines and agriculture the efforts to apply commons-based approaches are still in their infancy. Perhaps the best example currently underway is the Australia-based project called Biological Innovation for an Open Society (BIOS)⁹ that has been seeded by a number of enabling

⁵ See Public Library of Science, *Open Access*, at <http://www.plos.org/about/openaccess.html> (last visited Oct. 28, 2005) (describing the 'open access' policy of the Public Library of Science and its various 'open access' efforts).

⁶ See BioMed Central, *BioMed Central Open Access Charter*, at <http://www.biomedcentral.com/info/about/charter> (last visited Oct. 28, 2005) (setting out the 'open access' policy on which BioMed Central operates).

⁷ See National Institute of Health, *Policy on Enhancing Public Access to Archived Publications Resulting from NIH-Funded Research*, Feb. 3, 2005, available at <http://grants.nih.gov/grants/guide/notice-files/NOT-OD-05-022.html> (last visited Nov. 5, 2005) (requiring National Institute of Health-funded investigators to submit an electronic version of the author's final manuscript upon acceptance for publication, resulting from research supported, in whole or in part, with direct costs from National Institute of Health, effective from May 2, 2005).

⁸ See Research Councils UK, *RCUK Position Statement on Access to Research Outputs*, Jun. 28, 2005, available at <http://www.rcuk.ac.uk/access/statement.pdf> (last visited Nov. 5, 2005) (proposing a requirement for all grants awarded from October 1, 2005 that, subject to copyright and licensing arrangements, a copy of any resultant published journal articles or conference proceedings should be deposited in an appropriate e-print repository wherever such a repository is available to the award-holder).

⁹ Biological Innovation for an Open Society, *The CAMBIA BIOS Initiative*, at <http://www.bios.net/daisy/init/1061/1081.html> (last visited Oct. 30, 2005) (explaining the CAMBIA BIOS initiative as a synergistic approach involving 'intellectual property analysis', 'innovation policy reform' and 'cooperative technology development activities' as a means of fostering democratic innovation in applications of biological technologies to sustainable development).

technologies in agricultural research. Its goal is to create a self-binding commons and collaboration platform for research tools and enabling technologies in biological innovation that would allow anyone anywhere to then develop their own technologies oriented towards food security and health. We also have seen in the more computation-based early stages of medical research the development of the open bioinformatics movement, where similar commons-based approaches have been adopted.

What ties all these disparate efforts together is a simple idea. Information, knowledge and culture are critical to human flourishing and development. The shift to a networked information economy, in which much more of the total information production sector is carried on through commons-based strategies, moderates the disadvantages of developing economies as they start to participate in the global information economy. In this, the shift will not radically change the equation of poverty, but it can make well-defined and meaningful improvements: for the more advanced of the emerging economies by levelling the playing field in terms of access to the existing stock of global knowledge; and, for the poorer countries, by offering new avenues to produce and deliver much cheaper information-embedded goods - from textbooks to agronomic innovation, from health information to, more ambitiously, early access to generic drugs.

V. THE BATTLE OVER THE INSTITUTIONAL ECOLOGY

The benefits of commons-based production, however, are being achieved at the expense of some of the incumbents of the industrial information economy of the twentieth century. Hollywood, the recording industry and the pharmaceutical industry have no interest in the development of the non-market sector or the emergence of their passive consumers into a new role of productive users. We are seeing today, within developed economies, internally and through international trade (both multilateral and bilateral), and the international intellectual property system, a systematic effort by governments lobbied by these industries to support ever-stronger intellectual property rights. These exclusive rights are valuable to the incumbents because they increase their rents from their production activities, but they are neither efficient nor just. They are not efficient because, for over forty years now, mainstream economics has shown that excessive protection of intellectual property increases the cost of production more than it increases appropriability of

outputs, and is therefore likely to hamper innovation more than help it. They are unjust because they squelch the development of free individual and group creativity that is not aimed at the market, while at the same time causing a loss of the opportunities for development that commons-based innovation makes possible. This battle, fought in national legislatures, the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Council, the World Trade Organisation (WTO) and the World Intellectual Property Organisation (WIPO), is a battle over the future of innovation, information production, cultural creation and knowledge. At stake is whether we will be able to develop a system of information production that is more free and equal than we had in the twentieth century.

It is important to understand that this is not a battle between those who support markets and those who oppose them. IBM, the largest patent holder in the IT industry in the United States, makes more than twice as much from Linux-related services as it does from all its patent licensing and IP royalties combined. There are flourishing markets in providing the tools and platforms for the newly enabled productive users of the commons-based system. There are flourishing markets in servicing its outputs. There are flourishing markets in devices and implementations of the outputs of the commons-based production system. The battle is between those few but powerful companies that have large rents from the old twentieth-century system and the still diffuse but slowly coalescing political force of users, non-governmental organisations and, slowly but surely, those market actors that have learned to adjust their business models to serve and benefit from the newly emerging forms of production in the commons of the networked information economy.

VI. CONCLUSION

The rise of the networked information economy and its contributions to both freedom and development seem to be an important and immediate conclusion of a systematic study of law and technological change in our age. We are in the midst, however, of a series of deep transformations in how we produce information, knowledge and culture and how these elements of human knowledge will be applied to improve the human condition. The next few decades will offer more opportunities to do the right thing, as well as to go wrong. Incumbents will generally try to optimise law to protect their rents and business models. But in order to diagnose the likely benefits or costs of

new practices, and, as a consequence, of the laws that will be proposed and opposed along the fault lines of these transformations, one must have a good analytical basis from which to evaluate both the old and the new and the stakes of the transition from one to the other. This is why the study of law and technology will be central to the understanding of human flourishing, welfare and freedom for many years to come.