A Review of Owning the Future, by Seth Shulman
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Barry C. Smith

This is an interesting and provocative book. Shulman's basic theme is that as the world enters the post-industrial, information age, knowledge becomes an increasingly valuable economic asset. Unfortunately the government regulation controlling ownership and protection of knowledge assets are largely based on regulations of tangible assets. Due to the way in which knowledge assets produce value, as opposed to tangible assets, these regulations are in some cases ineffective and in some cases counter-productive. In particular, the patent process which encourages innovation of tangible products may stifle innovation when applied to knowledge-based assets. If this is indeed true, we may be headed towards an environment in which innovation and development in software becomes encumbered with conflicting ownership issues. A more troubling and profound aspect of this issue is the pace at which knowledge previously in the public domain is being parceled up and claimed as, or sold into, private ownership. Plants, animals, gene sequences are all moving into private ownership. According to Shulman, we are moving into an age when just a few very large corporations and universities will control the basic information required to conduct medical research. Anyone wanting to do research will require the owner's permission. Clearly there are many legal and ethical issues to resolve in these areas. On any one issue, Shulman may seem something of an alarmist but taken together, the direction we are headed in areas as diverse as software and drug development paints a rather disturbing picture of our future. The bleakest outcome is a slowing of innovation and development that leads to economic collapse and the beginning of a new Dark Age.

I must say that I don't agree with every point Shulman makes but overall his story is very compelling. In the three years since the book was published the pace in this ominous direction has not slackened. In the following paragraphs we'll highlight his major points.

As knowledge has become more valuable in the Information Age, individuals, corporations and universities have sought to stake a claim of ownership on specific knowledge assets and to protect that ownership. A primary means of staking these claims is through the patent process. The US patent process, developed in the late 1700's, was intended to reward innovation by providing the inventor with a limited-term monopoly on their invention. This "right to exclude" monopoly suppresses direct competition during the term of the patent. The scope of exclusion for a patent of a particular physical invention is pretty clear and limited. When knowledge or concepts are patented the scope is more difficult to determine. Shulman argues that the scope of many concept patents is much too broad. Rather than patenting "actionable knowledge" patents are often granted for very broad concepts. Shulman quotes a software executive as saying, "The difference is between a patent on a particular improved mousetrap and a monopoly on the idea of trapping mice." As Shulman points out it is often difficult to tell the difference between

patent claims that are reasonable and those that we far too broad. As patents are filed in rapidly developing and expanding fields, the US Patent Office generally does not have the expertise to tell the difference. The Patent Office makes mistakes, some are later overturned but all have the tendency to reduce innovation.

What is knowledge worth? A lot. According to Shulman the Brookings Institute estimated that in 1982 knowledge assets accounted for 38% of US manufacturers' total value. By 1992, knowledge assets contributed 62% of total value. Over 25% of US exports rely of intellectual property rights. As a result the US and other developed countries have pushed hard for strong ownership of intellectual property. This creates natural tension in international trade negotiations. Developing countries tend to ignore intellectual property restrictions in order to jump-start their economies. This principle has been at work for a long time; the US ignored British industrial patents early in its history. Shulman suggests that we are headed inevitably towards a global patent system to resolve this issue.

How are knowledge assets different from physical assets? Physical items are depleted with use. Knowledge assets are not. Once a knowledge asset is created, there is almost no cost is disseminating it. As Shulman points out, knowledge assets lose their value if they are not used. I think this mostly true but Shulman misses, or ignores, a point on knowledge assets. While they are not depleted with use, the value of knowledge assets is depleted with dissemination. For example, every time someone downloads music from the Internet, the potential market for this intellectual property is reduced. The value to the owner of that property is also reduced. The value is not reduced ever time the music is played but when the music is downloaded there is an opportunity lost to the owner.

Shulman suggests that there are three ways to think about intellectual property in a knowledge economy. First, productivity – does the current system encourage innovation? How do we deal with the trade-off between providing an incentive for innovation through protection versus driving additional innovation through dissemination? Second, equity – are inventors fairly rewarded for their contribution? In particular how do we deal with the fact that no knowledge stands alone, everything we do is built on prior education and understanding. Third, democracy – how do we protect shared public resources? Once they are privatized it is difficult to get them back into the public domain.

Shulman provides several examples to make our current situation and direction more clear.

Beginning in 1954 the US Patent Office has awarded patents on medical procedures. Since then, many patents have been awarded to physicians for new or modified medical procedures. Armed with a patent, individual doctors can require royalties from other doctors. Doctors infringing on a patented procedure could be sued. This not only increases the cost of treatment, it reduces the tradition of freely sharing advances across the medical profession. Even worse, "If the Heimlich maneuver had been patented, would one hesitate to save" a choking person, "for fear of infringement?" By the 1990's

the potential problems of patenting medical procedures were apparent. Rather than eliminating medical procedure patents for fear of weakening the US's intellectual property position internationally, legislation was passed that allowed medical procedure patents but doctors could not sue one another for infringement. Strangely this legislation does not apply to patents previously issued so there are many land-mines for medical practitioners to wander through.

In another strange example, in the first successful use of gene therapy, a small team of medical researchers developed a treatment procedure to cure a genetic condition that 30 people in the world suffered from. Based on this work, several members of this team filed a patent on every kind of human gene therapy in which cells are manipulated outside the body. This is incredibly broad. The team sold the patent to a large Swiss drug company. What makes the situation more complex is that the research was funded by the National Institute of Health and carried out by many more researchers than were on the patent. In this case the inventors, (at least some of them), are rewarded for their work, but the reward comes at the cost of taking valuable knowledge assets that were publicly funded and moving them into private hands. Due to the enormous potential impact of this situation, the FTC ruled that the patent owner would be required to provide "low royalty license" to any entity that requests it. Since then, the patent office has reconsidered and put the original patent in limbo. One of the results of all this is a chilling of communications within the medical field. Researchers are less likely to communicate results, less likely to share all the details of the work when they do communicate.

In another case, the availability of a specific cancer treatment was delayed because the first company to successfully manufacture the drug was unable market it due to patent infringement, while the owner of the patent was slower to get the drug to market. Again, public welfare is jeopardized by intellectual property issues.

There are horror stories associated with software as well. In 1989 the software company Compton's filed for a patent covering all multimedia software. By the early 1990's multimedia was a very big business. Compton's announced that they had secured the patent at Comdex, the annual industry trade-show. They announced that any manufacturers of multimedia CD-ROMs would have to pay Compton's a royalty of 1% to 3% of their revenues (a very steep tax) or face infringement lawsuits with the possibility of paying treble damages. No software is built from scratch. All development is based on prior work. If such broad patent protection in the software industry became common, any conceivable development could be blocked by the owners of the intellectual property on which it is based. The rate at which patents are being issued for software in the US makes this a serious concern. As a result by the mid 1990s the software industry was diverting resources from R&D to legal costs. In 1994 the head of the US Patent Office realized that they had made a mistake on the Compton's case. They re-examined the patent and eventually rejected every claim.

The problem with software patents seems to be one of lack of resources and skills in the US Patent office in a rapidly changing, technical field. According to Richard Stallman,

"The Supreme Court has ruled that no one can patent an algorithm or other law of nature, but skilled patent lawyers have been tricking the Patent Office into regularly doing precisely this in the software field." Apparently a colleague of Stallman's had received a patent on Kirchoff's Law, first published in 1845. As Stallman point out, "If the Patent Office couldn't understand electricity after a century, how can we expect it to understand software in another decade or two?" Clearly a lot of damage can be done with overly broad patents while the UP Patent Office gets up to speed. The publisher of *Patnews* predicted that by 2000 there would be 40,000 questionable patents in the software industry.

Shulman points out three negative outcomes from this system. First, software becomes more expensive as companies pay each other royalties. Second, the industry will tend to consolidate as this system favors large companies that can support the legal burden. Third, the pace of innovation will slow as new development depends on understanding the impact of overlapping intellectual property rights more than on technology. Again quoting Stallman, "Two kinds of patents hurt programmers: valid patents and invalid patents. Even a valid patent can and will obstruct software development."

Patents are designed to reward the inventor of a product or idea. It is scary when a patent falls into the wrong hands. In 1985 the US Patent Office awarded a patent that essentially covers all forms of commerce over the Internet. The patent was sold in 1989 for $200,000. By 1999 the new owners estimated its worth at $20 billion. In 1996 the owners (three guys) sent letters to 75,000 companies demanding royalties for any form of e-commerce. This seems to be a new form of government sanctioned extortion.

Shulman describes the same kind of confusion and land-rush happening in the bio-tech area. There are two problems. First, the US Patent Office has issued overly-broad patents in agriculture. One company that developed a small genetic change to a soybean was awarded a patent on all genetically modified soybeans, "created by theirs or any other method that might be developed." Clearly this has a chilling effect. No one will feel safe doing research in this field without getting permission from the patent owner who can set an arbitrary price for permission. The second issue is one of valuing the incremental change by the inventor versus the value of the raw material with which they started. According to Jack Kloppenburg an agricultural sociologist at the University of Wisconsin, "Now a seed is, in essence, a packet of genetic information, an envelope containing a DNA message." By awarding it a very broad patent, the US Government has given Asgrow Seed, the company that made the small change in the Soybean DNA, ownership not only of its change but of all the genetic information in the soybean. Soybeans have been evolving for a long time and can be argued to be part of a natural legacy owned by no one and everyone. The US patent system has taken this natural legacy and put it into private hands. This decision sounds like a mistake but it is an example of a consistent direction in the US patent process. Shulman argues that public welfare will be significantly degraded as we continue to remove important assets from the public domain. Things are so confusing now that the USDA has contested this patent.

Why are we headed down a path that seems so illogical? Our legal and regulatory processes tend to lag behind current events. Fortunately in the past, they have been able to stay close and catch-up with their intended functions. But we seem to have turned a corner very quickly in moving from industrial to information-based economy. And the lag is creating an environment full of individual opportunity and public peril. I'll quote Shulman: "As business analyst Peter Drucker succinctly states, 'The knowledge-based economy does not behave the way the existing theory assumes an economy to behave.' Quite simply, the ownership of knowledge seems to operate differently from the ownership of tangible goods, a fact that has been obscured because the Second Wave packaged technological innovation into a parade of new consumer goods, from televisions to toasters. But today the emphasis is shifting from toasters to tollbooths: players are learning to cash in on new concepts by requiring payments from anyone who want to do business in a given area."

One problem is that we have a system that rewards people that stake-out conceptual turf with no intention of producing a product or service with it. Once staked-out, the owner waits for an individual, corporation or industry to wander into this turf. If this area contains a necessary component of a profitable process, then the owner is in position to extort royalty payments from the people actually developing value from the protected area. So rather than rewarding the production of value, our system rewards speculative claims. If these claims are very broad they can have a significant impact on an industry. The most egregious example is Jerome Lemelson. He owns a large number of US patents, second only to Thomas Edison. Unlike Edison, Lemelson has never produced a product. He has made a fortune, by working slightly ahead of industry and staking-out conceptual turf. Lemlson is clearly a smart guy and has had many good ideas, but he has magnified the value of these ideas by manipulating the patent process. The most interesting technique is the "submarine patent." Quoting Shulman: "In this scenario a broad vague patent application is filed very early in the development of a new technology. Over a lengthy approval process, the claim is honed and fleshed out. Years later, when the patent is finally granted, the early seminal claim 'surfaces' – bolstered by the backing of a government-sanctioned monopoly – to wreak havoc on an industry that has already brought to market the items cover in the patent claim."

Shulman suggests that, while regulation and government interference should be avoided when possible, the new economy requires some intervention because some economic principles have changed. In particular, economies have historically self-corrected through a negative-feedback process. For example if demand for a particular product is very high, it becomes scarce, prices go up and demand is reduced. In the new economy we see positive-feedback. In particular the value and demand for a product may increase as adoption and production increase, this is driven by the "network effect". Classic examples are VHS vs. Beta and the adoption of Windows operating system. Shulman argues that in an economy that exhibits the network effect, some additional regulation is required to protect the public interest. This is the basis for the government's anti-trust claims against Microsoft.

Clearly, the US Patent Office is making some questionable calls. Big business is encouraging these calls and taking advantage of them. The Patent Office is only partially to blame. They need better guidance from Congress and The Supreme Court in order to better serve the public good. for as Shulman often points out, once property, intellectual or physical leaves the public domain it is very difficult to get it back. In the absence of an appropriate regulatory framework we may well be headed into a new Dark Age.