Intellectual Property Rights, Innovation and Software Technologies

The Economics of Monopoly Rights and Knowledge Disclosure

Elad Harison

New Horizons in **Intellectual Property**

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NEW HORIZONS IN INTELLECTUAL PROPERTY

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About the Author

Elad Harison obtained his BSc and his Masters degree in Engineering from the Faculty of Industrial Engineering and Management at the Technion–Israel Research Institute. In 2005, he received his Ph.D. from the University of Maastricht.

Before joining the PhD programme at the Maastricht Economic Research Institute on Innovation and Technology (UNU–MERIT) in The Netherlands, he was working as a logistic engineer and as an information systems analyst at the Israeli Navy Computing Center, where he specialized in Enterprise Resource Planning systems. His research was awarded a National Doctoral Fellowship by the Netherlands Organization for Scientific Research (NWO). The final stages of his research were supported by the Dutch Ministry of Economic Affairs.

Dr Harison completed two research projects on Intellectual Property Rights in a Knowledge–Based Economy for the Dutch Advisory Council for Science and Technology Policy (AWT) with Robin Cowan. He participated in the European Commission's Expert Group on Intellectual Property Rights Aspects of Internet Collaborations. In 2004 he visited the Copenhagen Business School as a Marie Curie doctoral fellow. Currently, he participates in the EC's study on the Effects of Patenting Computer–Implemented Inventions. He is also a member of the EC's Network–of–Excellence on European Policy for Property (EPIP). His work was presented on numerous occassions to conferences and to policy makers.

Since January 2005, Dr Harison has been working as an Assistant Professor in Business and Information and Communications Technologies at the Department of Business and Economics, University of Groningen.

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Contents

1

Introduction

1.1 Background

The inclusion of algorithms, business inventions and mathematical formulae in the scope of patentable subject matter resulted in exponential growth in the number of software patents after the approval of the USPTO *Guidelines* in 1996. These phenomena have raised significant doubts about whether patents are granted to software inventions on grounds of sufficient novelty and contribution to the state–of–the–art of technology.

Contradicting opinions on the success of patents and copyrights to foster innovation in software technologies persist. Legal and economic scholars indicate that the present legislative regime that provides inventors with long–term, expansive rights over technology has distorted the balance between incentives to innovate and monopoly rights. Further, if a significant number of software patents are granted to minor improvements, as some scholar suggest (for example Merges, 1999), assignees are provided with wide exclusive rights over technologies in return for disclosure of relatively insignificant advances. Cosequently, in the short term low–quality patents may restrict the entry of competitors to neighbouring market niches with superior technologies.

In complex technologies, such as software which integrates a broad variety of computational elements to achieve a required functionality, patents can potentially block development of products that use one or more of the essential components (Merges and Nelson, 1990). Further, software products encompass high degrees of interoperability between the final product and other programs and between the

elements that construct it. Algorithms, mathematical formulae and sub–routines are the building blocks of computer programs that accomplish particular tasks that are essential for their operation. Therefore, when invention is recognized as patentable and receives exclusive rights, patent–holders can prevent competitors from entering the market with products that use similar or improved features. Consequently, when a particular element cannot be used in computer programs without infringing legal rights and cannot be substituted, the functionality of the program might be crippled, or even not be attained at all.

In some cases software patents fail to provide a sufficient degree of knowledge disclosure in return for monopoly rights. Then, the ability of second comers to review and to learn from prior inventions and to build new inventions upon them is fairly restricted. Similarly, if patent claims (that is the potential uses of the patented invention) are general and obscure, the scope of protection is wide and covers new applications that were not envisioned by the inventors when the patent application was filed. Those domains will be excluded from other inventors in advanced phases of the technology. Moreover, if patents lack sufficient novelty and disclosure, they become "obvious" to practitioners and, hence, their quality encompasses lower levels of innovative added value and contribution to the public's welfare. Syrowik (1996) suggests that the examination of software patents by the USPTO suffers from those problems and as a result the balance between private and public interests has changed. The balance can be restored by application of a different legal scheme that limits the scope of claims of software patents to particular applications and data structures (Schumm, 1996; Witek, 1996).

Our empirical analysis indicates that the structure of ownership of software patents is highly concentrated, as every year large numbers of patents are granted to a small group of assignees, all of which are multi–national firms that operate in the electronics and ICT sectors. However, since the establishment of the *Guidelines* by the USPTO, the structure of ownership has become more fragmented as larger numbers of small patent–portfolio holders (mostly SMEs and individuals) apply for and are granted patents over their software inventions.

Granting broad exclusive rights (as defined by the patent claims) for long periods to inventions whose contribution to innovation is marginal is likely to hamper entry of new developers and firms to the market. In the long run, this scenario can lead to stagnation of the technological trajectories in the software industry. Nevertheless, those predictions could have barely been fulfilled had the

market followed a different trail in reaction to software patenting.

Our findings reveal that since the 1960s the US legislation of software IPRs has lingered by more than a decade after the development of new information technologies. As a result, legislative changes suffered from two major sources of inefficiencies: First, policy adaptations were presented long after technical changes had occurred, hence applying older legislative frameworks to new technologies. Second, by the time that IPR policies were modified due to those technical developments, newer technical paradigms were introduced to the market, hence creating another source of inefficiencies. Consequently, the quality and the innovative value of software patents gradually deteriorated during the 1980s and early 1990s. However, since the enactment of the *Guidelines* in 1996, the quality of software patents is increasing and recent patents are more often cited as *prior art* than before.

The Open Source movement challenges the traditional IPR regimes by providing software developers with alternative incentive mechanisms that are based on reputation rather than on exclusive rights. Open Source development is based on disclosure of the source code and on removal of ownership rights to enable further development of applications. Open Source projects attract growing numbers of programmers and many firms adopt it as their favourite mode of development, even though their creative outputs are disclosed at a zero price tag. The book presents the dynamics of Open Source communities and elaborates whether policy-makers should integrate the Open Source mode of development as a substitute or as a complementary approach to IPRs.

1.2 Outline of the Book

Chapter 2, *The Economic Rationale of IPRs*, reviews the economic objectives of IPRs and their impact on the market in terms of fostering technical change. The chapter presents various legal–economic theories through which the structure of the legal regime and the public and private benefits that it provides can be analyzed.

Chapter 3, *The Role and Performance of IPRs as Knowledge–Propelling Regimes*, proposes a conceptual framework for analyzing the role and functionality of IPRs. The frame of analysis is based on insights from the evolutionary economics literature discussing the effects of technical knowledge and disclosure on innovation and technological development.

Chapter 4, *Revealing Obscure Sources: The Paradoxical Evolution of Software Appropriation Regimes*, discusses how software IPRs evolved *vis-à-vis* the development of information technologies. We elaborate the role of patents and copyrights in protecting software and assess whether software IPRs have formed an over- or under-protective regime. We also discuss the success of the Open Source movement to establish an alternative regime that is based on removal of IP claims from the source code, as well as the dynamics of online communities of developers.

Chapter 5, *Benefiting from Intellectual Property and Free Disclosure*, aims at revealing the economic rationale underlying Open Source development and how this mode can strategically be used by firms to enhance their profits. By constructing an analytical model of the market, we identify the optimal share of source code that should be disclosed and developed as Open Source to maximize profits and how this share is affected by the pricing decisions of the firm.

Chapter 6, *Designed for Innovation: The Structure of IPR Regimes and the Evolution of Information Technologies*, constructs a dynamic model of the software market that explores the links between different structures of the patent regime and the market dynamics and technical change. The chapter provides insights on the relations between patent duration and the novelty criterion and the degree of competition and the performance of technologies.

Chapter 7, *Owning Technology: The Structure of Intellectual Property Ownership in Software Technologies*, studies the structure of ownership of US software patents and how it was affected by major changes in IPR policy. Further, the chapter evaluates to what extent the quality and the innovative value of software patents have been influenced by legislative changes and reveals the links between software patenting and the emergence of Open Source projects.

Chapter 8, *Proposed Framework for Analyzing IPRs in the Knowledge-Based Economy*, discusses the economic nature of software and computational processes. We compare between the schemes of IPRs that were established for protecting computer programs and those that protect their physical equivalents (that is, computational machines). Then, we propose a new conceptual framework for legal and economic analyses of software products and technologies.

Finally, Chapter 9 provides conclusions and policy implications.

2

The Economic Rationale of Intellectual Property Rights

2.1 Introduction

IPRs are long-living institutions that were enacted centuries before the emergence of digital technologies. Copyrights were initially constituted in the 15th century by the city council of Venice to provide incentives for authors and to prevent free rendering of their works. The roots of the patent system also evolved during the same period when rulers in England and Venice granted inventors with letters of monopoly rights over the production of their inventions.[1]

The *raison d'etre* of IPRs and the objectives to be attained by establishment of those regimes have virtually not changed since then. Patents provide economic incentives to inventors (individuals or firms) by granting them monopoly rights for limited periods over improvements of present techniques or breakthroughs in technology.[2] The procedure of patenting new inventions involves submission of patent application to the patent office, evaluation by a professional referee ("patent examiner") and approval of a patent grant if the invention is found novel and exceeds a *minimal inventive step* in technological terms.[3] In return for property rights

[1] Machlup and Penrose (1950) and David (1993) provide detailed reviews of the evolution of IPR regimes. Granstrand (1999; pp 28–31) presents historical chronology of their development.

[2] Patent protection is granted for 20 years from filing an application in the US and in the EU. Copyrights are obtained for the author's lifetime plus 70–90 years *post mortem autoris*.

[3] There are no legal standards for *inventive step* or *non-obviousness* of inventions.

over patented technologies, inventors are required to disclose to the public domain the technical know–how for which they are awarded protection. The knowledge is organized by the patent office according to pre–defined categories (and search criteria) and it is completely accessible to the public. Although the rationale behind patents and copyrights is similar, literary and artistic works differ from technical inventions, as they are automatically included in the scope of copyright protection when published and they do not require any examination process to be considered as intellectual property.[4]

IPR regimes aim at protecting diverse genres of knowledge, products and works and consist of different legal means, among which patents and copyrights are paramount from both judicial and economic standpoints.[5] For long periods IPRs were considered as efficient regimes for fostering innovation and technical progress, embracing economic incentives for innovative individuals and firms. Nonetheless, IPRs, and patents in particular, faced continuous attempts to curtail the privileges which inventors were granted by Law.

The solicitations of the anti–patent movement finally won a victory when the patent system in the Netherlands was abolished in the late 19th century. After cancelling the patent regime no noticeable changes in innovative and technological output were experienced by the Dutch economy. Whether any foreseen benefits associated with complete abolition of patent protection eventually happened remains unclear (Lerner, 2000). However, it was the only achievement ever won by patent opposition movements, and it was short–lived, as the Netherlands had to revise its policy less than 40 years after the changes took place in order to comply with the Paris Convention whose terms were adopted by many other nations at the same period.

Although complete removal of IP protection did not prove useful for the society, petitions against wide and long–lived patents are continuously heard up to the present. Their nature, however, has turned from general opposition rejecting all forms of patents to controversy over specific technologies, mainly those that have

Both definitions are open for wide interpretations by patent examiners and by Court. However, those terms represent qualitative measures for significant improvements beyond the state–of–the–art of technology for which inventions are recognized patentable.

[4]Registration of original works in the Copyright Office is optional but not obligatory to obtain copyright protection over them. Yet, the procedure is inexpensive and can prove helpful in legal disputes.

[5]Trademarks and industrial designs are other mechanisms of IPRs, but they play a less significant role in affecting the evolution of technologies.