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**From Exclusive IPR Innovation Regimes to  
Commons Based Innovation Regimes**

*Issues and Perspectives*

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# From Exclusive IPR Innovation Regimes to “Commons- Based” Innovation Regimes

## Issues and Perspectives (\*)

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### Abstract and organization of the paper

The aim of this paper is to draw attention to the emergence of a new innovation regime characterized as “commons-based”, and to the benefits that can be drawn from its expansion.

To do so the paper is divided into three parts:

1. In the first part of the paper, we review how and why the basic rules of the “Open Science” institutions were installed in the course of the 20<sup>th</sup> century. We show how the frontiers between “secret”, “open disclosure” and temporary monopolies granted through patents were re-defined within the open science system. We show how the open science system gave rise to an “innovation regime” that was conducive to the requirement of growth for firms, from the end of WW2 to the mid 1970s
2. The second part (focusing on the US case) reviews from the 1970s onward the ways in which this innovation regime was progressively eroded by a series of “displacement of frontiers” provoked by a series of IPR laws and court rulings that have altered the characteristics of the classical open science system. If the large firms of the new emerging sectors (especially in Biotech and Information technologies) have benefited from these changes in the IP regime, we argue that in many cases, the new regime has posed important threats and obstacles to the creativity of a large variety of communities of innovators
3. In the third part we focus on the initiatives of some communities of innovators in reaction to the limits and shortcomings instituted by the new enhanced IP Regime. We examine how, under the name of “Commons”, a series of new entities were established. Based on the sharing of information and cooperation between the actors at the origins of different types of information and knowledge commons, these new entities have given rise to what we can characterize as a commons-based innovation regime<sup>1</sup>

A short conclusions emphasizes the new role of the state that results for these changes

Key words : IPR systems, open science, Knowledge Commons, innovation

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<sup>1</sup> The notion of “commons-based innovation regime” is coined in reference to what Yochai Benkler, has characterised on his side, as “commons-based peer production” systems (Benkler, Y., 2002).

## Introduction

Even if this thesis has triggered a series of debates and controversies, it is now accepted that our economies can be characterized as « knowledge<sup>2</sup> based” where intellectual property rights (IPR) systems play a crucial role. If IPR systems, envisaged here as specific institutional arrangements around R&D and innovation activities, deserve attention, it is because at the same time : i) they mark the frontier between what are patentable vs. non-patentable matters, thus defining the frontier between the world of “open” vs. restricted access to knowledge; ii) they embed a series of incentives to innovate thus contributing to fix key characteristics of the “innovation regimes” under which the economic actors behave; iii) finally, because - as it has been stressed - IPR systems have experienced dramatic changes in the last 30 or 40 years, deeply impacting the classical routes and channels followed by R&D and innovation policies (Coriat and Orsi 2002, Jaffe and Lerner 2004). The importance of the changes that have affected IPR regimes is such that they could be characterized as contributing to the implementation of “a new enclosure movement” (Boyle, 2003), an enclosure that this time encloses, not land, but ideas and knowledge.

In this paper, after briefly reviewing how IPR systems have evolved, we draw attention to new institutional arrangements, known as “commons” (or to be more precise “*knowledge commons*”) that can be analyzed as institutional innovations allowing to overcome the limits introduced, through IPR systems, with the recent extension of exclusive rights on knowledge and basic research.

In order to better understand the importance of such knowledge commons, the paper is organized as follows.

1. The first section is dedicated to the presentation of the so called “open science” principles and to the traditional role played by the type of IPR systems that prevailed after the Second World War, up until the mid-1970s. We show how the open science system has given rise, during that period, to an “innovation regime” that was very conducive to the requirement of the growth of the firms

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<sup>2</sup> For a detailed analysis of different types of « knowledge commons » see Hess and Ostrom (2007). On this issue one can also refer to Madison M. J., Frischmann B. M., Standburg K. J. (2008). In Coriat (2012) and (2015), we have tried to define the similarities and differences between “natural resource based commons” and “knowledge commons”

2. The second sections shows how, beginning in the 1980s, this innovation regime was eroded by a series of “displacements of frontiers” provoked by a new series of IPR laws and court rulings which finally, have altered the characteristics of the classical open science system. If some of the large firms of the new emerging sectors (especially in Biotech and Information Technologies) have benefited from these changes of the IP regime, we argue that in many cases the new regime has resulted in important threats and obstacles to the creativity of a large variety of communities of innovators

3. In the third part we focus on the initiatives taken by different communities of innovators in reaction to the limits and shortcomings posed by the new enhanced IPR Regime. We examine how, under the name of “commons”, a series of new entities were established. Based on the sharing of information and cooperation between the actors at the origins of the commons, these new entities (often defined as “knowledge commons”) have given rise to new innovation regimes whose key feature is that they are grounded not *on competition and exclusive IP rights*, but on *cooperation and the shared benefits of the products of cooperation*.

## **1. IPRs in the age of corporate capitalism : “the open science” principles and the classical economic foundations of patent regimes**

During the period following the Second World War, which is also the “thirty glorious” era of so-called “fordist” accumulation regime, a well-defined type of IPR regime which proved to be very favourable to innovation prevailed both in the USA and in Europe. This IPR regime known and codified under the name of “open science” is based on well-defined principles. According to this vision, the open science systems is composed of two complementary worlds :

i) the world of “open science” as such, characterized by the following traits :

- basic research<sup>3</sup> mainly performed in universities and public labs is largely publicly funded; the result of this type of research, published in academic journals is made freely available to the community of innovators;
  - the quality of the publications is guaranteed by a system of “peer reviewing”: the specialists of the concerned fields by authorizing the publication of given results provide at the same time a sort of “guarantee” on the scientific quality of the paper accepted for publication;
  - the system is driven at the same time by cooperation (the scientists can benefit freely from the works and discoveries of their colleagues) and competition : the race to be the “first to publish” on a given issue (a position recognized by the date of publication in academic journals according to the so called “rule of priority”), has proved to be a powerful incentive inside the community of scientists.
- ii) the world of the “kingdoms of technology” ;
- the other complementary world is constituted by the so called “kingdoms of technology”; in this world the discoveries are patented; thus, against a commitment to disclose the content of the discovery and make it free to be copied some years later, the patent owner is granted a right to exploit the benefit of its discovery under a temporary monopoly;
  - this world, in opposition to the previous one, is a world where the actors (mainly : firms) seek to exploit rents based on the temporary monopolies granted to them; profit seeking is here the incentive driving the activity of the firms

This type of institutionalization of science (Merton, 1973 Dasbugta 1999), was not born in a day. It is the result of a long history of trials and errors but also of conflicts and compromises between the different actors involved in the process of production of knowledge<sup>4</sup>. But it is not an overstatement to say that the foundations of this regime were posed on the occasion of a series of reflections and debates that followed the publication of the Bush report (Bush, 1945), and the discussion it raised

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<sup>3</sup> The content and meaning of the notion of « basic research » which are key to the understanding of the organization of the open science system are defined below. On this topic see the seminal Nelson (1959) paper

<sup>4</sup> See our Coriat and Weinstein (2012) paper where a historical perspective is given on the establishment of the system.

on the crucial role of basic science and fundamental research in the process of economic growth (Nelson, 1959). In this sense, It took a long time to have these principle fixed. They are the result of both theoretical efforts and of historical contingences.

To really understand the issues at stake, it is necessary to refer to Arrow's contributions on the role of basic science. Since his seminal article (Arrow, 1962), it has been recognised that an economy composed of private, decentralised agents in competition is constantly under the threat of under-investment in research. This is due to the indivisible nature of good "information", including the products of research. Because the investment to produce new products is at the same time costly and risky, most firms would prefer to let their rivals invest first and stay in a position of "free rider" to benefit from the innovation without having invested for it. In these conditions, granting inventors with patents, (in other words a "temporary monopoly" to exploit their inventions), is intended to provide a sufficient incentive for private firms to invest in research activities<sup>5</sup>. Fundamentally, therefore, the purpose of patents is to compensate for so-called "market failures", while at the same time curbing monopolies and restrictive or discriminatory practices<sup>6</sup>, which would deprive the public of the benefits of inventions. Hence, an "optimal" patent system must find the right balance between two opposing requirements: - the incentive for innovation on the one hand, and its diffusion at a reasonable cost on the other.

According to this view (that, until recently, used be to the dominant one in economic theory and public policies), all patenting systems should be governed by considerations of social welfare. While guaranteeing the incentive to innovate, such systems must limit the social cost of the protection granted to innovators by restricting the rights conferred on patentees<sup>7</sup>.

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<sup>5</sup> Let's recall that a patent is classically defined as the exclusive but temporary right to enjoy the proceeds of an invention – including the right to prevent from competitors from using it.

<sup>6</sup> What competition law formalizes as "abuses of a dominant position".

<sup>7</sup> Note that all patenting systems demand something in return. The inventor must reveal the contents of his invention, so that society can benefit from the new knowledge and other players can develop it further or invent around it. In accordance with this principle, patenting systems have always required a written description of the invention as a condition for the granting of the patent.

Another key principle at the heart of IPR regimes concerns the definition of “patentable objects”, that is to say define the “frontier” which separates information and knowledge which can be patented from that which cannot. On a purely theoretical level, the search for this frontier has stimulated, particularly in the United States, certain observations of crucial importance concerning the status of basic research. Following on from the work of Nelson (1959), Arrow, setting out a principle that would be subsequently a key reference in the field, stressed the need to distinguish basic research from other research activities. He argued that because it occupies a very “upstream” position in the R&D process, the specific purpose of basic research is to provide *common knowledge bases*, in other words *multiple-use inputs* for other research activities. The results of basic research are characterised by the fact that they can only be used for future advances in research or for the development of new products. Consequently, as any private appropriation of the results of basic research would work against the fruitful development of innovation, by impeding their use, Arrow contended that all researchers should have free access to these results, in the interests of public welfare.

In this approach, long recognised as the authority in the matter, a patent is seen as *a constituent element of a frontier between “upstream” and “downstream” research activities*. Only patents on downstream research products are considered capable of playing a positive role in the encouragement of innovation. On the contrary the results of “upstream research” mainly obtained in universities and other academic institutions largely through public funding, should be freely and publicly disclosed and made available to the community of researchers.

It has to be noticed that both systems possess their own incentives to create and innovate. The point is obvious as regards the patent system. The (temporary) monopoly granted to the patent owner is a solid ground to extract financial rents. In the business world, the search for seeking monopoly rents is obviously a powerful motive to innovate. But even if it is less obvious, incentives are operating also on the other side of the system. Here “the rule of priority”, *i.e.* the recognition for an author to be the first to publish on a given issue, is indeed a powerful incentive and reward. It provides to the beneficiaries reputation among the peers thus maintaining vivid emulation in the community or researchers. More than that, it should be mentioned

that “reputation” apart from the honours it will bring, can also be at the origins of financial benefits (in terms of accelerated professional careers, rewards and prizes granted by different knowledge societies).

Finally, considered as a whole, the open science system with its two sides (the world of free access to scientific results, and the world of “secrets” and patents) has given rise to a specific innovation regime that proved to be very conducive to innovation activities<sup>8</sup>.

The system was all the more efficient that it spreads along with the extension of what was characterized as “managerial capitalism”. The rise of the large “M” firm described by Chandler (1990, 1992), is a constitutive part of the “open science system”, since, most applied research (destined to be patented) was carried on inside the specialized laboratories of the large “M form” firms. As Schumpeter (1911/1934) noted on his side, the installation of *specialized research labs* inside large firms is typical of the last stage of capitalism he describes in his famous book. Thus the articulation of “publicly funded ” research in large universities and public research institutions *mainly dedicated to basic research on one side, with applied research mainly carried on in the private labs in large corporations* and destined to be patented on the other side, were the basis of the specific innovation regime that imposed itself after WWII until the mid 1970s.

To conclude on this point, it should be noted that the principles of “open science” (characterized by free access to basic knowledge and patents granted to the sole inventions whose utility is clearly established), proved to be very conducive to the creation and diffusion of innovation during the period that started after WWII and lasted until the mid 1970s. This period was one of the most spectacular in the history of capitalism in terms of growth and other economic performances, a period marked also by a continuous flow of innovations. In the domain of pharmaceuticals for instance, this period is known as the “golden age” of the industry. It is during that period and under the regime of open science, that the larger number of new

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<sup>8</sup> For an exhaustive presentation of the word of « open science », one can refer to Dasgupta and David, 1994) and to Merton’s seminal works

molecules and drugs were conceived and marketed. (Orsenigo, Dosi, Mazzucato, 2005)

## **2. The 1980's : “displacement of frontiers”, alteration of the open science principles, extension and strengthening of exclusive IP rights**

Beginning with the late 1970s and 1980s however, some dramatic changes took place. The changes were so rapid and deep, than in less than 25 years a largely modified IPR was regime was established (Coriat and Orsi, 2002). The new regime first appeared in the USA, and so it is on the changes that took place in this country that we must focus on. As we will show, the new regime was installed by the means of a number of institutional changes whose origin is at the same time “political” (new laws emanating from the Congress of the USA) and jurisprudential. A number of key courts rulings, regarding IPR disputes were delivered. In a country marked by the tradition of the *Common Law*, these rulings of course played a major role for the enforcement of the new regime.

### *Legal changes*

A series of changes of a legal nature were first introduced to open up the area of patents (and more generally IPR) to new players. In practice, these were the universities and research laboratories, authorised by the new legislation to file patents on the products of their research, even—and this is the noteworthy point—when the research in question is publicly funded. This step was taken in 1980 with the passage of the Bayh-Dole Act, which introduced a series of complementary arrangements. On the one hand, it authorised the filing of patents on the results of publicly funded research<sup>9</sup>. On the other, it opened the possibility of transferring these patents to private firms in the form of *exclusive licenses* or creating joint ventures with such firms in order to take advantage of the knowledge thus transferred. This created the opportunity for such joint ventures firms either to trade these licenses or to make

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<sup>9</sup> It has to be noticed that the practice of patenting results from publicly funded research did exist before the Bayh-Dole, but only in well defined and restrictive conditions. The passing of the Act opened the way to the generalization of such a practice.

use of them to create marketable products. A massive increase in the number of patents registered by university labs followed (Jaffe, 2000)<sup>10</sup>.

The transformation introduced by the Bayh-Dole Act was decisive. In fact, until this law was passed, the prevailing doctrine in the area of patents had a considerably different orientation which, consistent with the economics of research as analysed by Arrow and Nelson<sup>11</sup>, attempted to compensate for the market shortcomings resulting from the 'public interest' nature of scientific information. The Bayh-Dole Act broke with this practice and the doctrine underlying it. With the introduction of the possibility of attributing the results of publicly-funded research in the form of *exclusive licenses to private firms*, the very foundations of the incentive to innovate through public grants lost both its meaning and its bases in the theory of well-being.

The effects of the Bayh-Dole Act were all the more profound that they took place in a context of general and dramatic changes of doctrine regarding patents and IP protection, largely fuelled by a series of key new court rulings that have largely modified the prevailing jurisprudence.

### ***New Court Rulings: software programs and living entities as patentable matters***

The changes introduced by the new court rulings covered numerous issues, but the essential change consisted in enlarging the scope of patentability to cover objects which had not previously been included or were explicitly excluded from it<sup>12</sup>.

Two main areas are concerned here: computer software and living organisms. In the first, this development was reflected by the authorisation to patent *algorithms*

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<sup>10</sup> An indicator of the involvement of universities in patenting activity during the 1990s and the early 2000s is given by their spectacular increasing licensing revenue. According to a survey on this issue : “ Beginning in 1991, university licensing revenue chiefly from patents increased nearly three times, passing from \$200 millions to \$550 millions in less than a decade” (Merill et al, 2004). However closer examination reveals that the large majority of this revenue is concentrated in few biological inventions and is captured by a small number of institutions. “The top 10 universities patent holders accounted for 66 % licensing revenue in 2000” (id).

<sup>12</sup> For a detailed presentation of the modifications, see (Jaffe, 2000; Jaffe and Lerner 2004) and (Coriat and Orsi, 2002).

*corresponding to the simultaneous use of mathematical equations.* In other words, elements of 'generic' knowledge currently used by the community of software programmers and designers were now patentable. The 1990s were thus to see the patentability of the famous "business models" for sales methods or financial services.

As a consequence of these changes the granting of software and Internet patents surged. « ... [from 1992 to 1997] ... the USPTO granted 750 internet patents » But it is mostly after 1998 that the granting of such patents soared. More than 4000 patents were granted in 1999, and nearly 57000 in the year 2000, mainly to software developers and to ICT companies. Between 1995 and 2000 the rate of increase of internet was estimated at 1 515 % » (I. Liotard, 2004). It has to be noticed too, that during the same period many Internet companies were promoted on the basis of the financial markets' evaluations of their intangible assets, which took the form of patents and other IPR on computer methods.

But the change was most radical and heavy with implications in the *life-sciences* field. Here, the breach was first opened by the well-known Chakrabarty ruling allowing General Electric to patent a micro-organism and this decision was the first in a long series which ultimately led to the patentability of genes and partial gene sequences. In the United States today, more than fifty thousand patents on gene sequences or partial gene sequences have been granted or filed, thus *opening up the way to a veritable commodification of scientific knowledge* (Orsi 2002; Orsi and Moatti 2001). In numerous cases, moreover, the patents granted cover not inventions of recognised utility but a wide range of future applications. By granting patents on basic knowledge itself (the input of future inventions), American courts have protected not only the inventions described and disclosed but also all the potential and virtual ones which might be derived from the use of patented knowledge.<sup>13</sup>

The changes in the IP regime on living organisms offer an exemplary demonstration of the process leading to the erosion of the distinction between 'discoveries' and

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<sup>13</sup> In this respect, American jurisprudence broke with prior doctrine, for the precise description of the invention concerned in order to demonstrate its practical utility had been an essential criterion of patentability. In 1997, however a court decision (*Regents of the Univ of Cal v Eli Lilly and Co*) has stated that simply describing a method for isolating a gene or other component of a sequence of DNA is not sufficient to show possession and the complete sequence or other identifying features must be disclosed to have a patent granted. It is however too soon to evaluate the practical effects of such a tentative to put limits to the granting on genes on so called research tools (more on this issue in Merrill et al 2004)

'inventions'. In the past, this border clearly separated two worlds: that of the production of knowledge (constituted as the world of "open science") and that of the commercial exploitation of these discoveries (the world of innovation) where industrial firms confront each other, as previously stated in section 1 of this paper.

To sum up, it can be argued that this period has witnessed something like a "displacement of borders" inaugurating an era of privatisation of the scientific commons (Orsi 2002). This unprecedented situation is denounced by many important and influential sectors of the scientific community but also by private-sector innovators<sup>14</sup>.

At a more theoretical level, we must observe that, in line with the "revolution" achieved by the theory of property rights in other domains of economic theory (and mainly regarding the theory of the firm), these changes on the IPR doctrines and practices marked the primacy of the idea that the granting of *exclusive rights*, (i.e. "right to transfer" and or alienate) should be enforced as a way to promote efficient market for knowledge<sup>15</sup>. (More on this point in Coriat and Weinstein 2012)

The new regime did produce some positive effects for a certain class of firms. Basically the beneficiaries of the system were the large firms of the IT sector on the one hand, and the new biotech firms that make profits by selling property rights on the other hand. Elsewhere we have argued that these changes have opened a space to what can be named a new type of "science-based firms" (Coriat et al 2003)

As a result of these changes it can be argued that the classical "Innovation regime" based on open science principles has been largely eroded. The displacement of frontiers that happened in the world of patents has made available to business activities a series of domains that were previously governed by the rule of open science and free access to inventions and discoveries.

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<sup>14</sup> This point is developed below.

<sup>15</sup> This view is strongly defended by proprietary rights theorists. For a systematic plea in favor of implementing *exclusive* property rights as a mean to strengthen market efficiency see A. Alchian (1978 and 1993)

### **3. The rise of “Knowledge Commons” as alternatives to the ongoing process of privatization of knowledge**

The limits and shortcomings of the regime that emerged from the ruins of the classical Open Science System are numerous and have regularly been denounced. One of the most careful and exhaustive critical assessments of the new IPR regime was achieved in 2004 by the powerful National Research Council of the American National Academies. The conclusions published by Merrill and al (2004) confirm on numerous points the anxieties expressed by the scientific community, and the authors foster a series of reforms aiming at setting the granting of patents on more solid grounds. These conclusions come to strengthen those already made by a series of many influential academics who plead for a return towards more balanced forms of protection, leaving more space to the principles of open science (Heller and Eisenberg, 1998; Rai, 2000; Rai and Eisenberg, 2003; Nelson, 2004)<sup>16</sup>.

Indeed the process of privatization of knowledge (presented in section 2) strengthened the idea that the scientific community was likely to face a “tragedy of the anticommons”, a notion coined to mirror the earlier opposed thesis formulated by Hardin (1968). The assumption behind the vision proposed by Heller and Eisenberg (1990), is that the abuse of exclusive rights established by IPR over discoveries or inventions have finally raised a series of new obstacles to the production and circulation of knowledge, thus damaging the process of innovation itself. Since, in many cases there were obstacles posed to free access to “upward” knowledge (to paraphrase Arrow’s words), inventors were in danger to be confronted with a situation where the bits and pieces of knowledge they need to gather to pursue their own research activities, are protected with patents, creating more or less artificial barriers, hammering their capacity to innovate<sup>17</sup>.

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<sup>16</sup> Even more critical arguments against the system, asking for the suppression of IPR were also launched on the public scene. See the plea by Boldrin and Levine (2008) “against intellectual monopoly”.

<sup>17</sup> A detailed presentation of these changes and the threats they pose for the scientific commons can be found in Coriat and Orsi (2002). On this point, see also Nelson (2004).

It is in such circumstances that different types of initiatives were launched and soon spread out among the community of scientists. The goal shared by the actors at the origin of these initiatives was to find a way *to re-open a space for free and open access to basic scientific resources*, and to re-establish more cooperation in a world where competition had spectacularly increased. An important point here is that, whilst pursuing their basic goals (re-install the conditions of open science) the actors were encouraged to promote a series of institutional and judicial innovations that finally gave rise to new modes of production of innovation. It is this family of new entities designed to restore free and open access and cooperation that, during the 1980 were designated under the name of “knowledge commons”. In this sense it can be argued that just as the history of natural-resource commons is linked to that of the “enclosure movement” (Hardin 1968 and for a critique of this view Ostrom,1990), the history of knowledge commons is inseparable from the “second enclosure movement” (Boyle, 2003) that took place in the last decades of the 20th century. To be sure, it is first and foremost in order to overcome the limits posed by the new regime of the 1980s that new modes of producing innovation came into existence.

The route towards the establishing of these new modes is not unique: initiatives were taken at different levels and in different domains<sup>18</sup>. But there is no doubt that what has been done under the aegis of the F/LOSS (Free/Libre and Open Source Software) movement was the first successful tentative at very large scale, to introduce new modes of production of innovation. As such F/LOSS can be considered as the locus of the most archetypical “Knowledge Commons”.

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<sup>18</sup> To overcome the limits posed by the extension and the strengthening of copyright laws, a movement based on “Creative commons” was also launched in the early 2000’s. The organization created for that purpose has conceived several copyright-licenses known as Creative Commons licenses free of charge to the public. These licenses are designed to allow creators to communicate which rights they reserve, and which rights they waive for the benefit of recipients or other creators. Creative Commons has been described as being at the forefront of the copyleft movement, which seeks to support the building of a richer public domain by providing an alternative to the automatic “all rights reserved” copyright, dubbed “some rights reserved. In 2008, there were an estimated 130 million works licensed under Creative Commons. As of October 2011, Flickr alone hosts over 200 million Creative Commons licensed photos. (information gathered on wikipedia website)

In the same way a movement to establish “open publishing” principles against the “cartels” that was formed by the publishers of the professional academic journals, began to spread

The F/LOSS movement was not successful only in its specialized domains (i.e. producing a series of software through new practices based on free and open access to the source codes). It was also successful *in the design of major judicial and institutional innovations that surpassed the sole world of software and opened a space for other types and categories of innovations*. These are the reasons why we have chosen to focus here on some of the achievements of the FLOSS movement. The FLOSS movement can be regarded as an “archetype” of the new commons-based innovation regime.

Without drawing a complete picture of the history of the FLOSS movement, one must recall that in the beginning, the first « free » software were the result of initiatives taken by professional developers to bypass and counteract the privatization and the enclosure of software that began to take place in the late 1970s<sup>19</sup>. Initially, in the 1960s and early 1970s, clients had to pay for the hardware, *the software being provided for free*, as « public goods ». And software were produced in a cooperative way by developers sharing and associating their skills. As stated by B. Gates in his famous « Letter to the Hobbyists » : in the early days of the industry « Hardware must to be paid, software is something to share”<sup>20</sup>. It is only after many years of battle, after the extension of copyrights and patents to mathematical algorithm that software were sold as « commodities » and marketed as such.

It is in reaction to these changes in the world of software than certain professional communities of developers involved in the maintenance of large systems decided to produce their own tools, renewing with the tradition of openness and cooperation that prevailed at the origin of the business. .

To do so, in the course of their activity, they had to design their own tools and institution to protect their inventions *and to guarantee their maintenance in the public domain*. Thus, through the FLOSS foundation, emerged a series of legal innovations. Among them a key institutional innovation was the GPL-GNU license that guarantees the cumulativeness of progresses through free access to information and innovation.

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<sup>19</sup> For the history and an analysis of that period see Stallman (2002) Mangolte (2015)

<sup>20</sup> B Gates “Letter to the Hobbyists (Feb 3, 1976)

If the world of free software can be analyzed as a world of “commons” it is because, like natural resource based commons<sup>21</sup> it is constituted of specific entities based not on exclusive property rights granted to one owner or proprietor but on the distribution and allocation of different attributes of property rights allocated to different stakeholders. To put it in another way, in the world of FLOSS (just as in the world of natural resource based commons : fisheries and so on ...) *property rights takes the form of a « bundle of rights »*<sup>22</sup> . In the case of software one can distinguish three types of basic rights : i) rights to use the soft ; ii) rights to duplicate and transfer it to third parties ; iii) rights to have access to the source code, to modify it and to create new versions of the same basic soft.

Whether the developers using the latter right are obliged (or not) to reintroduce in open access the result of their works is a question of design of the licenses attached to the soft. In the same way, whether the developer (who has created a new version of an existing soft available in free access) is authorized (or not) to seek a commercial benefit from his work, and under which forms and conditions this benefit can (or cannot) be taken, is also a question of design of the license attached to the use of the soft. In fact, with the launch of these innovative licenses, began a process of institutionalization of new modes of producing innovation through shared access and the constitution of « communities of innovators » (Von Hippel). Thus there exist a series of different licenses providing different possibilities.

One of the licenses designed at that time, introducing the notion of « copyleft license » played a key role in the history of knowledge commons and can be regarded as a « constitutive rule » in this field. According to the rule attached to the copyleft principle : the developers interested in a given soft have a right to access the database and source code, they can work on the information withdrawn to develop new applications, propose solutions to existing errors or bugs, install new and more efficient routines ... but, doing so implies that they accept the constraint to share their

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<sup>21</sup> On this issue and for a comparison of natural resource based and knowledge commons see our paper : Coriat (2011) available at <http://www.mshparisnord.fr/ANR-PROPICE/documents.html>

<sup>22</sup> The notion of « bundle of rights » is discussed in details in Schlager E. and Ostrom E. (1992). See also Orsi (2015) in Coriat (ed) (2015)

innovations on the public domain (i.e. the domain of open and shared access).

Even if the design of such licenses is of crucial importance to fix the way users will access the products of developers, and the conditions for further development of existing products, the point will not be discussed here. It suffices for us to highlight the fact that the legal regime attached to these softs is at the origin of a completely different regime than the one organizing the world of private and exclusive property rights that resulted from the spread of copyright and patents on software.

If we concentrate on the mode of production of innovation that is at the basis of the new commons based innovation regime, some remarks can be made. One here must observe that by defining the type of « rules » embedded in the different licenses, the communities of innovators gathered in the F/LOSS movement were able to initiate a powerful process whose originality lies in key principles:

i) It is first of crucial importance to note that the different types of licenses opening access to shared databases of information *do not imply any « absence of property »*. On the contrary the new license designed under the aegis of FLOSS contribute to delineate spaces of « common » and shared property. Like natural-resource commons, *knowledge commons are not based on an absence of property rights, but on another form of use and distribution of the different types of rights attached to Intellectual Property Rights*. Here, like in the case of natural resource based commons, much depend on the type of “bundle of rights” deployed among stakeholders. (more on this in Coriat ed, (2015)

ii) **Incentives**. The new commons-based innovation regime relies on incentives of a different nature than the ones attached to the classical exclusive IP rights. Here the incentives to join the community are based on the fact that joining the community allows the newcomer to benefit from the creativity of the other participants and stakeholders at the condition that the newcomer in the community accepts that the others can also benefit from his/her own creativity.

iii) As regards the internal « dynamics » that takes place inside the community of developers, it has been argued that one specificity of the process of creation is that it

is based on “horizontal” interactions between developers, rather than on a vertical and hierarchical division of labor. Raymond (1999) after having analyzed the form of cooperation adopted in the Linux project found a de-centralized “bazaar” model, which he set off against the traditional corporate approach of hierarchical, small-circle development which he dubbed the cathedral style ». (F. Lehman, 2004)

iv) This « horizontal » and decentralized way of conducting the developments tasks, opens up original ways of resolving the « conflicts » that can arise in the course of the development process. In the FLOSS world « ... there is always the option of a split, or fork. The terms of FLOSS licenses make forks possible; both halves will be able to continue their work with only a loss in numbers and skills, but without having to rewrite any code (... ). Temporary forks are also a way out of major conflicts, giving both parties the chance to implement their ideas, and allowing for the project to be reunited under a more successful course of action (F. Lehman, id)

Finally a remarkable achievement of the FLOSS movement lies in the fact that through private contracts the constitution of a public domain guaranteed as such can be achieved. If the knowledge put in common is covered by a copyleft license then: as stated by Stallman himself, «*anyone can add but no one can withdraw information and appropriate for private use*». It has to be noted however that the variety and flexibility of available licenses makes it possible also for developers and innovators to use an open-source database, to protect their inventions. In the first case we are in the world of “free” software and innovations, in the second case we are in the world of “open source” developers. We are dealing here with institutional constructs guaranteeing free access and free use of the innovations generated by the commons, but only to those who accept the rules of the game.

## **To conclude**

Two series of remarks deserve attention

1. Even if we have concentrated our analysis on one “category” of innovators (the FLOSS community) there exists a wide variety of such commons based innovators. In the same way as it has been argued, there are a number and a large variety of types of “licenses” guaranteeing different levels of access and rights to withdraw

and/or develop the information gathered in given commons. Hence, more work is needed to better understand what is at stake. In this paper, we merely aimed to draw attention on an emerging process and provide some initial elements of analysis for practices capable of renewing the core of innovation activities.

2. A second remark concerns the role that the state can play to favor the spread of the new innovation regime. To face the new challenges we would argue that in addition to its classical function (fund public research and universities, define strategic R-D priorities, design the right IPR laws and patent systems...), the state has to play new roles, assuming the objective of being *an enabler and facilitator of the new innovation regime*. Identifying the right stake holders, guaranteeing the sharing and distribution of the different rights among stakeholders in a given knowledge commons (and/or community of innovators), contributing to the definition of the rules of the game, contributing to the definition of the appropriate « governance structure » and governance mechanisms of different types of knowledge commons ... are new tasks for a State that will have to act not “on behalf” the citizens, as it previously did, but as a *partner*. The new commons-base innovation regime clearly implies for the State to behave differently: less on “*behalf of*” the citizens (and the communities of innovators) but “*together with*” the citizens.

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