Software and the Information Oligarchy

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Abstract:

In “Software and the Information Oligarchy,” I argue that the current state of the information economy, particularly as it regards information and computing technology (ICT), is unjust, conferring power disproportionately on the information-wealthy at great expense to the information-poor. As ICT becomes the primary method for accessing and manipulating information, it ought to be treated as a foundational layer of the information economy. I argue that by maximizing the liberties (freedom to use, freedom to distribute, freedom to modify, and so on) associated with certain computer software, an incentives-rich and stable environment can be established in ICT that will prevent a caste-like information oligarchy while also fostering development of the information economy among the information poor. I suggest that the now-mature Free and Open Source Software (FOSS) paradigm, which has already produced widely-used enterprise-class applications, can be harnessed in support of these ends.

Keywords: Information and Computer Technology, Information Economy, Free and Open Source Software (FOSS).

In 2004, the Business Software Association (BSA) and Microsoft Corporation contacted the government of Indonesia, claiming that the country owed licensing fees for Microsoft software running on 50,0000 computers. The cost of purchasing licenses to run *a single basic functional computer workstation* powered by Microsoft software is $524.98 USD, which works out to a whopping 47.73% of the per capita GDP of Indonesia.[1] But escaping such an expense by simply avoiding the use of an operating system is unfeasible. The operating system is the base-level program that bridges the computer's hardware with all of the standard programs. A computer without an operating system is a worthless piece of equipment, incapable of performing any significant computing tasks.[2] Recent research suggests that the Indonesia case is not a rarity.[3] In his article "License Fees and GDP Per Capita," Rashab Ghosh calculated the cost of license fees for Windows XP based on the per capita GDP. The results were stunning: In 47 of 176 sampled countries, the cost of running Microsoft Windows plus Microsoft Office was greater than the per capita GDP of the country.[4] In Vietnam, the software cost is equivalent to 16.33 GDP Months (GDP/capita/month). In Ethiopia, the cost is 70.96 GDP Months. Many countries lack the monetary resources to pay for licenses to run basic commercial software for their computers.

This is disheartening, perhaps, and may strike some as an injustice *prima facie*. But, considered in a broad context, this is but an indication of a much larger problem.

In this paper, I argue that the Free and Open Source Software (FOSS) model can be used to

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1 The $524.98 price tag is based on the current Amazon.com price for Windows XP Home Edition ($194.99) and Microsoft Office 2003 Standard Edition (329.99). Retail price for these is much higher. In 2004, these were the lowest end of Microsoft's operating system and office packs. According the the CIA Fact Book, the GDP of Indonesia is $270 billion (current currency exchange rate), and the population is 245,452,739. GDP/Population = $1100.01 per capita. CIA Factbook. *Indonesia*. https://www.cia.gov/cia/publications/factbook/geos/id.html (accessed 12 Nov. 2006)

2 The computer will perform basic bootstrapping ("booting up"), where software encoded in onboard chips (the Basic Input/Output System (BIOS) and firmware) is loaded and executed. But once basic initialization of major pieces of hardware is executed, the computer (when failing to find an operating system) will sit idle.

3 No public conclusion was ever reached in the Indonesian deal. At one point (July 2005), a handful of newspapers reported that Microsoft agreed to charge the Indonesian government only $1.00 USD per computer, but Microsoft denied having made any such offer. Early this year, Microsoft released a stripped-down low-cost version of its operating system for developing nations. This system has a lower price tag, but lacks features, as well.

4 Gosh, 2003.

address one of foundational points that prevents information-poor regions from developing a successful information economy. I begin by discussion the idea of the information economy. From there, I argue that the correct focal point is the software platform used on computers. By making such software accessible under licenses that encourage further development, areas that would otherwise be subject to high license fees and severe contract restrictions can instead begin with an open foundation and have the freedom to develop from this foundation as needed. I propose that the FOSS model, which has been proven to be viable, is a preferable solution to policy changes. Finally, I conclude with suggestions as to how this process can be fostered.

Information Wealth, Information Poverty

As information and computing technology (ICT) becomes pervasive, information has become a valuable commodity. And this point has not been lost on those who trade in information. Information creators and managers have sought to protect their interests through legislative means at national and international levels. International organizations such as the World Intellectual Property Organization (WIPO) and the World Trade Organization (WTO) become legislators and enforcers of such policies.

As a result, legal standards have transitioned from basic forms of intellectual protection – granting authors and inventors short-term rights over their creative work – to a behemoth system of intellectual property rights in which information is said to be as protectable a property as land or other physical possessions.[5] Intellectual property laws are no longer used merely as incentives to promote work (as was the stated purpose of copyright in the U.S. Constitution and the Statue of Ann[6]), nor even to protect the investments required for replicating information in physical media. Instead, current law is written to protect the long term financial interests of organizations who profit through the control of

5 Tavani, 2005.

6 The Statute of Ann of 1710 is the prototype for copyright law in the English-speaking world. http://www.copyrighthistory.com/anne.html.

information – however ephemeral that information may be. The initial checks and balances of the system were long ago forfeited, as legislation has shifted to favor agencies that control information at the expense of those who use the information.

The result is that in the new economy of information, the gap between the information-wealthy and the information-poor has emerged in such a way that the information-wealthy, privileged as they are with ownership, have effectively become the ruling class of the infosphere.[7] The rights to disseminate information is concentrated in a small, but affluent, sector made up not only of media corporations, but also technology companies and large research firms. Backed by international treaties (such as the Berne Convention)[8] guaranteeing copyright, patent, and trade secret protection, such organizations can restrict use of *their* information. And copyright law continues to be extended. More works are bow subject to copyright control, and copyright holders retain complete control over copyrighted information for as much as the lifetime of the author plus seventy years.[9]

In contrast, those who do not own rights to such information take on the role of information consumers who may use information only when such information is offered, and then only under the conditions under which it is offered. For example, before one can watch a sporting event on U. S. television, one is advised of his or her legal rights regarding viewing, recording, and rebroadcasting the contents of the broadcast. Beyond that, though, one is even notified that she or he may not describe the events that occur based on the contents of the broadcast.[10] Similarly, in 2000, the U.S. Patent Office issued Human Genome Sciences a patent over a sequence of human genes that seems to be resistant to AIDS. This raises the fear that "now the corporation can restrict the numbers of scientists working on

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7 The term infosphere, coined by philosopher Luciano Floridi, describes the domain of information. He explains this concept in detail in Floridi, Luciano. *Philosophy and Computing: An Introduction*. NY: Routledge, 1999.

8 WIPO, 1979.

9 Circular 92, §302. (Circular 92 is Title 17 of the U.S. copyright code, plus all amendments and pertinent legal decisions.)

10 This principle was tested in *National Basketball Association vs. Motorola, Inc.* (1997) 105 F.3d 841 (2d Cir. 1997). See also Vaidhayanathan, 2001, 17ff.

AIDS cures and drugs, unless they pay a hefty licensing fee to HGS."[11] Seeds, too, can be patented, and farmers are required to pay seed companies license fees if any patented seeds are grown in their fields.[12] All of these restrictions are placed in the name of intellectual property rights.

Certainly, some level of intellectual property protection is warranted, and even desirable. And I do not raise these examples to simply condemn them so much as to illustrate the breadth of intellectual property claims and restrictions. But what is of concern, here, is that the control over information has become centralized, and hence controlled, by a small collection of relatively affluent organizations.

The risk presented under contemporary circumstances is that the information-wealthy enforce their claims of ownership against the information poor, and they exercise their control in such a way as to prevent the information-poor from producing or owning their own information.[13] Further, the information-wealthy use legislative means to control how their information may be used. Simple examples of these problems abound. Individuals may not copy significant portions of books (where the term 'significant' is subject to judicial definition). When one finds a factual error in a text, one may not make and disseminate corrected texts. Individuals may not plant the seeds of of last year's crops (seeds are patented). Nor may they improve on such crops by grafting or other genetically modifying technologies. Individuals may not take a drug, improve it, and then make the improved version available – nor may one do the same with architectural blueprints. All of these materials are legally protected from such use.

There is a disparity between the information-wealthy and the information-poor, and because the legislative weight falls on the side of the information wealthy, such a disparity is not easily breached.

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11 Shrader-Frechette, 2006, p. 135.

12 *Ibid*. pp. 135-136. For a summary of the case, see Hirsch, 2003.

13 It may be objected that anyone can produce information simply by producing a collection of utterances, whether meaningless or not. This objection relies heavily on a strong definition of *information* (as opposed to *data*). But rather than argue the point, I would simply further qualify what is meant by information: information is valuable only when it has meaning. Meaningful information is all that I am interested in – and, in particular, I am interested in information that can be applied in service of increased human well-being (broadly construed). Falling under this rubric would be scientific and technological information as well as literary and artistic works.

Such a caste-like system with impermeable class boundaries precludes the possibility of the information-poor improving their station. For this reason, I refer to the current situation as a nascent *information oligarchy* in which the information-wealthy rule.

The term 'oligarchy' refers to the form of government in which a small minority rule over the populous. In *Politics*, Aristotle uses the term to refer to a government by the wealthy.[14] It represents for him an unbalanced (and thus unjust) form of government. As Fred Miller puts it, "Justice requires that benefits be distributed to individuals in proportion to their merit or desert. The oligarchs mistakenly think that those who are superior in wealth should also have superior political rights[....]"[15] It is this sense of the term that I wish to capture; the information oligarchy is a rule by those with a wealth of intellectual property over which they lay claim, and who leverage this wealth in order to exercise authority over those who lack information.

By promoting intellectual property law, filing legal suits – sometimes abusive ones – to protect their interests,[16] and wrapping information in additional legal contracts,[17] the information wealthy rule the infosphere. The recent push in WIPO to extend copyright protection to non-original databases, in spite of the abundance of research indicating that this will put nascent information economies at a distinct disadvantage to the information-wealthy, exemplifies the legislative endeavors of the information wealthy.[18] Likewise, the increasing reliance on implicit license agreements in digital media such as software, music discs, and even books, provides a clear indication of how contract law can be leveraged by the information-wealthy to protect their property. There is certainly an effort amongst those who *have* to strengthen their position in regards to those who *have not*. In the infosphere, what is

14 *Politics* III.8 1280a1-2.
15 Miller, 2002.
16 Lessig, 2004, pp. 95-99.
17 "End User License Agreements," "Terms of Service Agreements," and other forms of additional licenses are levied on information consumers. In many cases, information consumers need not sign such documents to become party to the license.
18 Tabuchi, 2004. See also my paper "Should Non-original Databases Be Copyrightable?"

exchanged is information. In an information oligarchy, the small group of people who control the information determine the conditions under which information is exchanged and used. While such an authority is not directly equivalent to state governments, the rule-making capacity of the information wealthy is sufficient to warrant the use of the term 'oligarchy' in a sense stronger than mere metaphor.

Before continuing on, an additional item ought to be clarified: Who are the information poor? One familiar formulation relies upon the concept of the "Digital Divide." According to this formulation, the information poor are those who do not have direct access to modern computing technology, be they individuals (such as poor African-Americans in inner-city urban areas) or nations (such as Ethiopia, Venezuela, Indonesia, and Vietnam).[19] I find this characterization is overly narrow, for only one source of information (digital computers) is considered. A broader definition should not be media-specific. The information-poor are those people who simply do not have access to or control of significant sources of information. Access may not require computing technology – books and other printed media prove ready sources of information. Likewise, linguistic and educational barriers may render one information poor even if media are readily available. Thus, information poverty, in this more general sense, need not be wedded to the concept of the digital divide. In the digital divide, there are two different problems for the information poor: First, they must become able to create new information – gain information wealth – and that is difficult, because as they create, it can become owned by the information wealthy (through such measures as requiring the turning over of copyright as condition for publishing). Further, the means of creation and distribution are controlled by the information wealthy. Second, they need to get out from under the controlling force of information wealthy, who impose restrictions on what they can and cannot do with the information they are given access to. Innovation by the information poor is stifled by restrictions and costs imposed by the

19 For one example, see Mossberger, Tolbert and Stansbury, 2003. See also Moss, (2004) who overtly categorizes into "the divide within nations" and the "global divide" (pp. 161-162).

information wealthy.

Ultimately a successful information economy will involve the balancing of interests. The rights of those who produce, distribute, and maintain information must be weighed carefully against the rights of the information consumer. But the equity demanded to allow the information poor a chance to overcome these two challenges will not spring from increased legislation and stricter enforcement of intellectual property rights, as is sought by the information wealthy. The solution is to be found elsewhere.

There is also the question of who, specifically, the information poor are. Are they individuals? Or are we talking about nations? The term could readily be applied to both.[20] But for the purpose of this paper, I am primarily concerned with large groups of peoples – nations and regions – that are, as a whole, information poor. There is a practical reason for such a choice: Information poverty at a regional level does very real harm to human wellbeing, and this damage is done on a broad scale. In contrast, smaller scale information poverty (such as in inner-city Chicago) can be mitigated to some degree by the relative information wealth surrounding them.[21]

In the following argument, then, my focus shall be on bridging disparities in information wealth at a global scale. Rather than attempting a solution that deals with the individual, the solution I will suggest is addressed to the regional and state levels. By addressing the information economy at this level, I can focus less on what might be deemed individualistic welfare policies, and more on a solution that will stimulate or even create healthy markets in these regions.

Given this focus, the question at the heart of the discussion is, "How can we reduce information poverty in regions where there is a noticeable absence of access to information resources, a noticeable absence of information wealth, and where such absences negatively effect human wellbeing?" A

20 Moss (2002) attempts to show this in the context of the digital divide.

21 Mossberger, Tolbert and Stansbury (2003) take the approach that policy-level corrections in such situations can go a long way toward mitigating those factors that diminish wellbeing.

significant way to address this question may be found in information and computer technologies.

The Foundational Role of Information and Computing Technology (ICT)

There are many facets to the issue of information wealth and control, and one could easily progress from here to discuss how AIDS medication is unavailable to the millions of AIDS patients in Africa because of the intellectual property rights of American pharmaceuticals companies. Or one might delve into the abuses of information control as a means of political or social coercion. Or one might examine how criticism, expression, and competition can be squelched when organizations exert their absolute rights to arbitrarily prohibit others' use of their information – even in context that might have, in the past, been protected as fair use.

As tantalizing as those possibilities are, though, I will refrain from moving in any of those directions. Instead, I want to focus on Information and Computing Technology (ICT). This is my focus because ICT plays a critical and foundational role in the contemporary information economy in a way that the items listed above do not. In an era of personal computers and data networks united by the Internet, information is stored, accessed, and manipulated in the digital domain. Further, no physical library can provide the wealth of information accessible on global networks. But the access points for the global network are devices (primarily in the form of desktop and laptop computers) running software designed to facilitate human interaction.[22] And the terms upon which one enters the information economy are determined by these foundational ICT layers.

(Insert Illustration 1 Here)

22 All devices that run software are considered to be computers. Hand-held devices such as Personal Digital Assistants (PDAs) are computers, as are modern cell phones. But there are many computers that are not designed for direct human interaction (servers, industrial computers, embedded systems, and so on). I am interested only in computers intended for human interaction. And for the sake of simplicity, I speak primarily of desktop and laptop computers, though almost all of what I say can be applied to PDAs, cell phones, and other computers intended for human interaction.

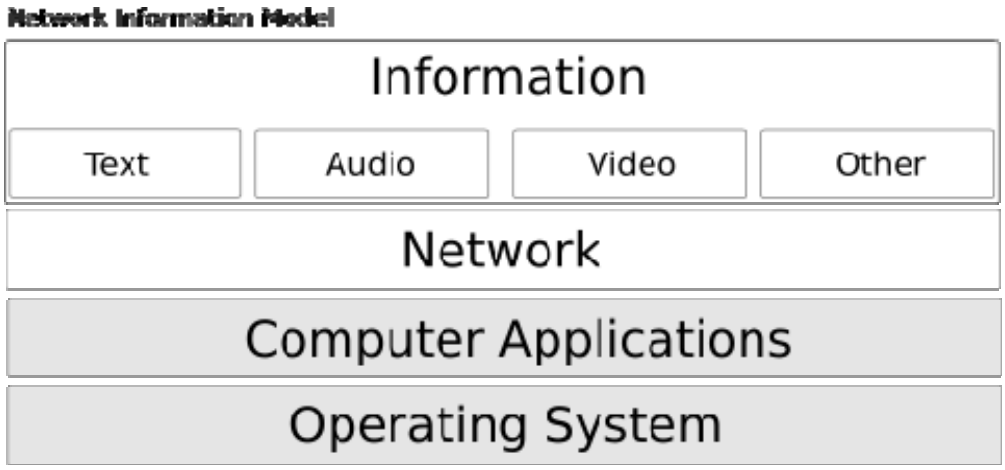

Illustration 1: The Network Information Model

The network information model with which I am working can be divided into four layers, where the lower tiers support the upper tiers. The top tier is the information tier. This describes the resources available, in the form of text, audio, video or even other categories (such as information encoded for kinetic experience). But this information is initially not in the possession of the individual, and a component of solving the problem posed by the information oligarchy is in providing access to this information.[23]

The second tier is the network. Certainly, not all computer-encoded information requires a network. A computer, in order to function, contains a great deal of information, and other media besides the network (such as CD-ROMs and DVDs) can also be used to transmit information. But with the rise of the Internet, the potential for the network as the primary information transmission layer is apparent, and it is the prominence and potential of that medium that I have sought to capture here.

The third and fourth tier are located on the physical device that the person uses to access information.[24] The term 'computer applications,' the third tier, describes the programs that run within

23 Software is, properly understood, information. This illustration, simplistic as it is, might erroneously give the false impression that it is not. To correct this perception, consider the act of downloading a new software package. The information is initially external (located on the network). After the downloading process, it is local. Only when it is executed does it perform in the role envisioned on the lower tiers of the diagram above. But at all stages, software is information.

24 For the sake of simplicity, I will not discuss network-based applications, such as thin clients running applications on X

the digital environment on a computer. This includes web browsers, word processors, image editors, messaging and telephony applications, and so on. It also includes lower-level applications, such as network management programs, which might not be visible to the user, but which run on the computer.

The fourth tier, the operating system, is the layer of software that provides a digital environment in which other programs may run. The central task of the operating system is to mediate between the central processing unit (CPU), together with other necessary physical devices (such as Random Access Memory (RAM), low-level caches, and bridges), and the computer applications that run on the computer. The operating system is foundational to the functioning of most computers.[25] And in the model with which we are working, where information is stored digitally, the operating system is foundational for accessing information.

What about computer hardware, such as CPUs, hard disks, keyboards, monitors and such? Why is it not represented above? Strictly speaking, hardware is beyond the scope of this model because it is not, itself, an informational component. It is the physical medium through which the information is conducted. Hardware stands in relation to this model as paper, glue, and cardboard stand in relation to an information model based on books.

Hardware is an important component in establishing an information, and clearly cannot be ignored. But discussion of hardware falls outside of the scope of the present discussion. It would be remiss, though, to fail to mention the efforts made in addressing the absence of hardware for the information poor (both in impoverished regions, and as isolated individuals within an otherwise information-wealthy society). The most notable endeavor is the One Laptop Per Child (OLPC) project,

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servers and browser-based web applications. These are rightly considered "computer applications," though.

25 Certain special-purpose closed systems may not distinguish between an operating system and a program. There may only be one monolithic piece of code that performs the task of both. Such computers are not generally used in the sorts of complex information models discussed herein, and are thus beyond the scope of this paper.

spearheaded by MIT's Nicholas Negroponte.[26] The goal of the project is to provide a portable computer, costing less than $100 to produce, to every child in the impoverished regions of the world. These laptops are built to be ultra-rugged. They are powered by a kinetic generator; the child's motion generates electricity which is then stored in the laptop battery. Monitors or built for indoor and outdoor viewing, and the laptop is shock-resistant. The laptops can self-organize into an ad hoc network. The pioneering engineering done for this device is likely to lead to similar low-cost devices that will function as affordable alternatives to today's pricey desktop or laptop computer.

The availability and affordability of hardware is important, and great strides have been made in addressing this. But for this discussion, centered as it is on information, hardware is beyond the scope. Software, the third and fourth tiers of the model above, is the basis of the information model considered here, and it is these two tiers that I believe provide the most promise for addressing the problem of information poverty.

Free Information: An Imperative

What does the ICT landscape look like for the individual who is (initially) an information consumer, but not a producer? Such a person is *information poor*. She begins in a state wholly dependent on receiving information from others – even at such a rudimentary level as requiring an operating system and perhaps a network address. We can ask the same question in broader terms: What does the ICT landscape look like to the information impoverished region? The illustration with which I opened this paper – the case of Indonesia and the cost of Microsoft Windows licenses – is an example: the price is extremely high. Further, the money spent does not stay local; it is lost from the region.

There are many costs in entering the information economy. Investing in an operating system (tier 4), for example, has a *minimum* start-up cost of about $200 (and, as we have seen, is generally

26 "One Laptop Per Child," http://laptop.org

higher). The price of commercial applications (in tier 3) varies, but it is not uncommon for prices to exceed $200 *per program license*.[27] In order to get the computer to the point where it can be used to produce digital information, a tremendous monetary investment must be made. Keeping GDP information in mind, the price of a single functional computer seems overwhelming.

But considerations of cost ought not strictly be limited to the pecuniary details. The license agreements one must sign for these bits of information will also have opportunity cost; use of the software almost always comes with a number of restrictions on how the information may be used.[28] What is particularly important in the context of the information economy, though, is the fact that the individual's access to information is restricted when entering the infosphere in this way. Such parties are made subject to the control of the information owners through three distinct measures: through legislated intellectual property law, through the contractual obligations of the End User License Agreement (EULA), and through the deterministic information-access rules generated by the software application itself. Each of these three deserves brief discussion.

We have already looked at a few of the considerations with intellectual property law. International treaties such as the Berne Convention impose strict guidelines on how intellectual property may be used.[29] Such conventions are imposed upon regions that are information poor through the collective pressure of coalitions such as the WTO. Such measures are then actively enforced (as was illustrated in the Indonesia case) by organizations such as the Business Software Alliance (BSA), which takes legal action against those who break such intellectual property laws.

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27 The list price for Adobe Acrobat, used to produce files in the popular PDF format, is $299. Microsoft Office Standard is $399. Macromedia Studio, used to produce graphics, web pages, and animations, has a list price of $999. And these are not isolated incidents of rarely-used software; these are popular, "standard" tools! (Price information collected from http://amazon.com on 31 January, 2007).

28 Some of these lost opportunities are made salient by the licenses. A network services provider may require that a customer not download materials deemed illegal. But other lost opportunities are less salient. An operating system license, for example, usually denies the user the rights to modify, redistribute, resell, or copy the software. It also specify what the user can say about the software, or to what lengths a user may go to to understand how the software works (a practice known as *reverse engineering*). Of course, there are other opportunity costs I have not mentioned here.

29 WIPO, 1979.

EULAs, sometimes called “click-wrap licenses,” require that one accept a license agreement before using the program. The license agreements, written in highly technical legal terms, are difficult to read and understand, and often impose stringent conditions on software use (e.g. claiming the right to use an individual's personal information or to run monitoring software on the computer to report information back to the software owner). Such licenses routinely prohibit sharing the program with another, making copies of the program (even for personal use), running the program under certain conditions, and redistributing the software. While fair use doctrine would traditionally allow such uses – one might share a book, or re-sell it when finished reading it – contracts trump fair use. If the license prohibits the behavior, the licensee – by becoming party to the license – forgos claims to fair use. Using contract law, software manufactures can impose extra-legal conditions within a contract, giving the contract author the ability to legislate.[30]

Finally, the software itself can impose restrictions on those who use it. Software is composed of deterministic rules, and such rules can be written in such a way as to limit in which ways information may work. Lawrence Lessig develops this idea broadly when he speaks of software (code) as a (pseudo-)legislative vehicle through which works are protected online. “Code is law,” he says, “In real space we recognize how laws regulate—through constitutions, statutes, and other legal codes. In cyberspace we must understand how code regulates—how the software and hardware that make cyberspace what it is regulate cyberspace as it is.”[31] The country of Venezuala, currently struggling to raise itself out of information poverty, provides a case in point.

The Venezuelan oil company PDVSA (Petróleos de Venezuela S.A.) relied upon a joint venture called INTESA (Informática, Negocios, y Tecnología, S.A.) – an operation run by the U.S. company SAIC (Science Applications International Corporation) – to handle its IT operations. INTESA

30 Accounts of this may be found in Vaidhayanathan (2001) and Lessig (2004). See especially Vaidhayanathan's discussion of pseudo-copyright, paracopyright, and metacopyright (p. 183).

31 Lessig, 2006.

implemented a computing system to manage PDVSA's information. INTESA's services were costly, and the government-owned oil company could not afford to continue them over the long term. When PDVSA decided to slowly phase out INTESA's involvement in PDVSA, INTESA went on strike and refused to provide any further services.

> The result was that PDVSA could not transfer its data processing to new systems, nor could it process its orders and bills for oil shipments. PDVSA ended up having to process such things manually, since passwords and the general computing infrastructure were unavailable [...].[32]

With the data locked up in proprietary software, PDVSA, the company that *owned* the information, could not access it. Binary data formats combined with software that intentionally obscured the way it works made it impossible for PDVSA to gain control of their information, and as a result PDVSA was forced to fall back on a far less reliable system of manually entering order and shipment information. As one pundit put it: "The moral of the story: When you have to hack your way into proprietary software to keep the mainstay of your economy running, maybe it's time to find a better way."[33] Lessig's concept of code as a form of law is instructive, here: The software created imposed an arbitrary set of conditions on the use of the software. These conditions deprived PDVSA of the ability to make use of its own information. And this, coupled with license agreements and intellectual property rights, precluded employing *technical measures* to gain access to the information. Reverse engineering is stopped, caught in a triple-bind: it violates international intellectual property law, it violates the license agreements, and it operates against the existing code. In short, the combination of legislation, contract, and code created a set of boundaries around PDVSA's information that effectively claimed outside control over it.

As I have emphasized above, the deck of the information economy is stacked against the

32 Wilpert, 2003.
33 Leonard, 2006.

information-poor. If one is forced, as it were, to enter the information economy as a member of the lowest caste under terms that will perpetually keep one indebted to (and, in fact, subject to) the information oligarchy, then one has no hope of rising from the status of information poverty. This sort of system, which does not value equality or liberty, is unjust. Again, recalling Aristotle, the error lies in the assumption by the information wealthy that their ownership of the information entitles them to encourage and institute measures to strengthen their control over information. Having made this assumption, they aggressively pursue policies that are detrimental to the information poor because these policies are unbalanced.

Is the best approach to vanquish intellectual property law. No. As Lessig, an advocate of reforming intellectual property law, states, “Intellectual property law is clearly a good. No modern society can flourish unless it accords at least some protection to creative work.”[34] But he goes on to point out the point at which the information oligarchy fails:

> But as our tradition attests, and economists confirm, just because some intellectual property is good, it does not follow that more intellectual property is better. More precisely, just because some protection is good, it does not follow that increasing that protection is better.[35]

The information oligarchy operates on that assumption that more is better. More control is more desirable; more protection is more desirable. This, I argue, stems from the misconception by the information wealthy that advancement of the cause of ownership is the correct goal, and the information wealthy are obliged to fulfill that goal.

While Lessig's goal of reforming intellectual property law is an appropriate response, such changes will occur only over the long term, and the tide is still against Lessig's proposals. A more expedient method of addressing the problem is desirable.

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34 Lessig, 2003, p. 2.
35 *Ibid*.

What about implementing government-sponsored programs and policies (at an international level) to bring about change? This solution operates in line with that suggested by Kate Mossberger, Caroline Tolbert, and Mary Stansbury in their book *Virtual Inequality: Beyond the Digital Divide.* There, they argue that the free market, left to its own devices, is not capable of overcoming an information oligarchy in America:

> Information technology skills are 'public goods,' because, like education and libraries, they are capable of providing positive externalities associated with economic growth and democratic governance. Economists justify government intervention in the market when there are externalities, or effects that ripple beyond the individuals who are directly involved in a transaction. Positive externalities mean that the market, left to its own devices, will likely *underprovide* such commodities. Because individuals fail to 'capture' all of the benefits of the knowledge and skills they acquire, they will tend to undervalue them and underinvest from the point of view of society as a whole. Public subsidy or public provision in such cases is more efficient than the market, because governments are able to act in the public interest and to realize the additional social benefits.[36]

The suggestion made in this passage is that the market will not make available the materials necessary for the information-poor to educate themselves. But as we shall see shortly, the evidence does not necessarily support this conclusion. Perhaps a solution in the arena of the information economy may in fact be possible without recourse to government-initiated policy. That, in fact, is the thesis for which I argue.

What sort of solution can be considered a just solution? And can social justice be implemented without the sort of policy changes suggested in the quote above by Mossberger. Tolbert and Stansbury? In this paper, I take the view of social justice that jurist Cass Sunstein defends in his book *Free Markets*

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36 Mossenberg, Tolbert , and Stansbury, 2003, p. 5.

and Social Justice. There, Sunstein argues that the free market and social justice are not antithetical. In fact, the opposite seems, in many cases, to be true: "A system aspiring to social justice aspires to liberty, and a system of free markets seems to promise liberty, because it allows people to trade goods and services as they wish."[37] Where possible, we ought to take advantage of a free market when addressing social justice issues. However, sometimes the interests in service of one conflicts in the interests of the other. In such cases, we ought to prefer social justice over free markets. "Achievement of social justice is a higher value than the protection of free markets; markets are mere instruments to be evaluated by their effects."[38]

The solution I offer is one that makes use of the free market in order to promote more market activity – but activity of a sort that promotes social justice in developing nations. This solution involves voluntarily freeing certain information of the constraints usually imposed on intellectual property. Certain information – here, the software source code to foundational software applications – should be made universally available in a form that prohibits any one group from asserting control over this software. Sunstein's emphasis on liberty is important, here: it is a value we want to protect and promote. And the solution I propose is liberty-sensitive, following a dictum like Mill's, where liberty is limited only in the name of the protection from threats to objective well being (such as food insecurity, injury, and so on).[39]

Surprisingly, a viable solution does not necessarily require policy-level changes at an international level (which would require nearly global cooperation of the information oligarchy – an unlikely possibility). Rather, existing international intellectual property law can be harnessed in such a way as to provide protecting the freeness of designated software, but without taking away form the

37 Sunstein, 1997, p. 3.
38 *Ibid.* p. 9.
39 It is undeniable that there are subjective components to well being, and these subjective components as well have been debated in the context of Mill's harm principles (c.f. Joel Feinberg's *Limited Offense Principle*). But given the scope of this paper, I will forgo discussion of that debate. There is a broad, cross-disciplinary discussion of the concepts of happiness, well-being, welfare and flourishing. See Gasper, 2004.

information-wealthy. No software company, for instance, needs to be coerced into making its software available under such terms. Instead, interested parties may voluntarily create this liberty-centered software. Does this sound too reliant on altruism? In fact it is not.[40] Such a paradigm has already been implemented, and to a surprisingly successful degree, in the form of Free and Open Source Software (FOSS). It is the FOSS model that I will promote as a viable solution.

What is Free and Open Source Software? For a piece of software to be considered FOSS, it must grant the user at least the following four freedoms (as specified in the "Free Software Definition"):

1) The freedom to run the program, for any purpose.
2) The freedom to study how the program works, and adapt it to your needs.
3) The freedom to redistribute copies so you can help your neighbor.[41]
4) The freedom to improve the program, and release your improvements to the public, so that the whole community benefits.[42]

To fulfill the second and forth freedoms above, one must be given access to the software source code. Source code is an intermediate language that a computer program can read and write, and that a computer can interpret as a series of instructions specifying the behavior of the program from start to finish. The source code can be compiled into a form that is machine-readable and executable, but which a programmer cannot edit. This format, called the *binary* or *executable* format, is how most non-FOSS applications are distributed.

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40 There is a growing literature devoted to discussion of why, exactly, people do contribute to FOSS projects. For collections of papers on the topic, see Ghosh, 2004 and Feller, et al., 2005.

41 I believe this is not to be read non-restrictively, as "The freedom to distribute the software in such cases as it helps your neighbor," but as "The freedom to distribute the software, which allows you to help your neighbor."

42 Originally these freedoms were numbered from 0, 1, 2, and 3 (according to programming conventions). Another codification of the same principles is present in the ten-point Open Source Definition. Stallman, Richard, et al. "The Free Software definition." Free Software Foundation. http://www.gnu.org/philosophy/free-sw.html (23 Oct 2006). Perens, Bruce, et al. "The Open Source Definition: Version 1.9." The Open Source Initiative. http://www.opensource.org/docs/definition.php (9 Nov. 2006).

One who has access to only the binary format of a program is limited in what she or he may do with the software. Modification is difficult, requiring the intensive, error-prone technique called reverse engineering – a strategy usually prohibited by law (such as the Digital Millennium Copyright Act), and by EULAs and other contracts. The Venezuelan case of PDVSA is an illustration of how binary-only proprietary software can prevent certain uses of the software.

In contrast, one who has unbridled access to the source code can figure out how a program works, modify the software, or even take pieces of that software and use them to create or modify other software programs. Customizing how an application works – even by simply translating the text from a foreign language to a local one – can turn an application with otherwise limited appeal and make it accessible and useful to a much broader audience.

Software applications are constructed to solve particular problems, and often such problems are bound to particular assumptions – sometimes societal, cultural, or regional. Under the proprietary model, the creator of the software sets the assumptions, and the software operates according to those assumptions. Under the FOSS model, anyone is allowed to modify the software and redistribute changes. FOSS applications that provide some of the desired features, but need adjustment for a particular environment, can be modified by anyone with the requisite skills. A piece of software can be re-engineered to fit a different environment than the one originally intended, and this is done without requiring the intervention of the original authors of the software.

The point on language should not be lost, either. In proprietary (non-FOSS) applications, the work of translating an application to a specific language is done by the owner of the application. If translation is not economically worthwhile for the information owner, then it is not done. Those who wish to use the software, but whose native tongue is not supported, have no recourse. They must either learn the foreign language or forgo using the software. On the other hand, translation of a FOSS application may be done by anyone with the requisite skills. And to facilitate this, large FOSS

communities have developed tools and methodologies to expedite translations of FOSS applications.[43]

By ensuring basic liberty-sensitive rights to the software and its source code, the inequalities at the foundational ICT layers (tiers 3 and 4 in the model presented in the previous section) can, to a large extent, be eliminated. Through the FOSS model, many of the constraints, in terms of lost opportunity and limited access to (and use of) information, can be avoided. As individuals take part in the information economy, they will not be immediately and irrevocably subject, in virtue of their participation through ICT, to the controlling interest of the information elite as a precondition for their taking part in the information economy. How does this work to overcome an unjust system? I suggest three different ways.

First, FOSS makes free what needs to be free, while still allowing for private or capitalist interests where such endeavors are supportable. In other words, there is nothing in my proposal which will prevent economic growth through capitalist measures – one can still, for example, sell software and ICT services. But it does ensure that a certain foundational level of the ICT infrastructure comes with a guarantee of freedom. FOSS software will always be free to use, modify, and redistribute.

Second, FOSS plays a pedagogical role. Source code can become the basis for learning how to produce software, and FOSS guarantees access to the source code of the software. Thus, a FOSS application is a learning environment for technology. And not only can the code be read, but it can be used as a model. The venerable tradition of learning by imitation, a tradition which is suppressed in an information oligarchy, once again becomes available. In addition to the code itself, many FOSS applications have manuals also licensed under non-restrictive licenses. These resources serve a pedagogical role, while also being liberty-sensitive.[44]

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43 For example, see the Rosetta project, maintained by Ubuntu. See https://translations.launchpad.net/ for more information.

44 For example, see the Creative Commons project (http://creativecommons.org/) and the GNU Free Documentation License (http://www.gnu.org/licenses/fdl.html)

Third, FOSS is customizable by *whoever wants to customize* it. What that means is that FOSS applications can be fitted to context, and in a way that is free of external reliance. Countries and cultural groups can tailor the software to reflect their standards, goals, and values. Individuals can tailor the software to meet their own needs. Entrepreneurs can take the base software, add features, and build sustainable business models on their services or customizations.[45] Because of this customizability, FOSS software not only fulfills a need, but can serve as a platform for further innovation – and this platform does not leave one indebted to an external organization.[46]

The net result is that FOSS, when instituted at the foundational layer, can provide a certain basic level equality. But beyond just the equality, it provides an opportunity in the form of tools that one can work with to become a productive member of the information economy. Thus, not only can FOSS eliminate the caste-like nature of information poverty, but it can encourage the growth of healthy information societies by encouraging localization, personalization, and entrepreneurship.

As information-poor communities and regions work in a FOSS environment, benefits will accrue locally. As healthy local economies grow, quality of life can be improved. A stronger economy, evidence suggests, is better able to provide for the basic needs of its people, and when basic needs are met, the quality of life is higher.[47] This, I suggest, is the link between implementing the FOSS model and supporting human flourishing through the reduction of information poverty.

Practical FOSS

Such a proposal, by its very nature, will require participation of the information wealthy. The code must be there, and must be robust and reliable before it will be of use to the information-poor. But

45 Krishnamurthy, Sandeep. "An Analysis of Open Source Business Models." In Joseph Feller, Brian Fitzgerald, Scott A. Hissam, and Karim R. Lakhani, eds., *Perspectives on Free and Open Source Software*. Cambridge, MA: MIT Press, 2005. pp. 279-296.

46 Some non-FOSS software companies allow others to build on their code, but only under costly conditions. Royalties, extended licensing fees, intellectual property rights, and the like, for example, may be required as recompense for permissions to use their code.

47 Trout, 2007, chapter 1.

who will produce the code? The majority of contributions to existing FOSS software comes from the information-wealthy regions of North America and Western Europe (though participation by other regions is on the rise).[48] And this trend must continue for some time if the goal is to reduce information poverty through promoting FOSS. (Of course, there are other benefits – more local benefits – to be had from supporting FOSS here.)

To conclude the paper, I propose three measures that we (particularly academic and private institutions) can implement to promote the solution I have outlined above.

First, I propose organization-wide (and publicly endorsed) adoption of FOSS tools. This is not to suggest a policy wherein only FOSS software is allowed, but one where appropriate, enterprise-class FOSS solutions be implemented. This first measure bolsters claims of the legitimacy of FOSS. But, more importantly, it provides implicit incentive for further development of these tools. There is already broad precedent for this. The Apache web server still commands over 60% of the web servers on the Internet.[49] The Firefox web browser is quickly becoming the most popular alternative to Microsoft's Internet Explorer, and it has already surpassed the later in performance and features. OpenOffice.org, a FOSS office productivity tool (including a word processor, spreadsheet program, database, and presentation software) is now replacing Microsoft Office on state government computers in Massachusetts.[50]

Second, institutions ought to actively contribute to continued development of FOSS software. Contributions come in many forms, from writing code to providing monetary incentives or sponsorship of FOSS projects. The primary motivation here is the improvement of the FOSS codebase (both in quality and in quantity). But again, there is an advantage to be gained by such participation. Organizations can increase their visibility in certain areas by participating actively in FOSS projects.

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48 Lerner and Tirole, 2005, pp. 55-56.
49 Netcraft, 2007.
50 LaMonica, 2005.

Potential customers (or students, or faculty) will be attracted to organizations that have a higher visibility in the areas in which the potential subject is interested. Viewed in this light, contributing to FOSS can serve as a form of advertising.

Third, and this applies specifically to academic institutions, support of research and development of different aspects of FOSS should be granted. The scope of this last proposal is beyond that of the previous; it is not limited just to supporting FOSS projects, but operates at a higher level. It is the promotion of a research program that takes as its object the principles, concepts, and methods that comprise the core of FOSS. A better understanding of FOSS as well as the environments in which it is employed can improve our ability to effectively use and improve the FOSS model. And this is not just an endeavor for computer scientists. Social and natural sciences, and even the humanities can contribute to this research program. At this time, much of the literature has revolved around the economic questions of FOSS. But this is only a narrow aspect of what can be studied and learned from the FOSS phenomenon. How do self-organizing, seemingly anarchic endeavors succeed in producing high-quality, highly cohesive products? What are the motivations – and not just the economic motivations – that drive FOSS developers? Can FOSS principles be applied to other domains? And if so, which ones? Even the statements I made above could be further refined by empirical examination: How beneficial is it to participate in FOSS projects? How much business can be gained by so doing? Do faculty contributions to FOSS projects raise the estimation of a school's computer science department? These questions are unanswered, and largely unaddressed.

In each of the recommendations I have made, I have attempted to not only provide normative guidance on how FOSS may be promoted, but I have also suggested that doing so is beneficial to the institution. I see this additional facet to be an important part of my argument: If FOSS is supposed to be capable of opening new markets and stimulating economic activity, and if it is supposed to encourage an information economy, then there ought to be clear benefits to using this model – even in our

information-wealthy state. Such, I believe, is the case.

Conclusion

I began with a sketch of the dangers of an information oligarchy, particularly as it pertains to ICT, which I see as a foundational layer of the information economy. I argued that an information oligarchy left unchecked leads to widespread injustice and inequality. But the negative effects can be stymied without radical changes to the economic or policy landscape. I propose that this be done by introducing Free and Open Source Software in foundational positions, making it available to those who might otherwise find themselves forced into a caste of information-poor. But making this plan feasible will require the effort by those who are already amongst the information-wealthy. To that end, I have outlined three specific ways that we can encourage further development and proliferation of FOSS software.

The major difficulty in writing such a paper is the shortage of empirical data on the topic. While economic literature on the subject of FOSS is rich and diverse (and, indeed, there is a wealth of computer science texts on the subject as well), little work in other areas has been done. Clear policy investigations and empirical analysis of the impacts of FOSS on information poor regions would greatly increase the strength of the argument made herein. In particular, the link I have suggested between information wealth and objective well-being, while strongly supported by anecdotal evidence, appears not to have been tested in a more structured way. Studies done on subjective well-being and technology do not directly apply to the thesis at hand, either.[51]

In some ways, the literature on the "digital divide" has introduced confusion into the debate, as the problem of an emerging information economy has been conflated with the unequal distribution of

51 Jackson, et al. (2004) conclude in their study on subjective well-being along the digital divide suggests that there is no correlation between subjective well-being and Internet access. The suggested reason? Those information-poor who do get computers don't have peers with whom to communicate. It is to be suggested, then, that for such resources to improve subjective well-being, access must be made pervasive.

computer technology. The result of this is that the significance of the role of intellectual property rights and legislation has been obscured or ignored, overshadowed by the much more salient question of who owns computers. I believe that by re-framing the problem in terms of an information economy, details that are not salient in the other model, but are causally involved, receive due attention.

To a large extent, the possibility of empirical studies of FOSS has been limited by the fact that few information poor regions have a history of employing FOSS. But this situation is changing. China now has a government-sponsored version of the FOSS operating system Linux (a version so popular that Hewlett-Packard officially supports it).[52] Venezuela is in the second year of its two-year transition to Linux.[53] Vietnam is in a similar position, where government computers now primarily run FOSS software, and commercial computer vendors pre-install FOSS software, rather than proprietary alternatives.[54] And these are not the only countries making such a move, either. The One Laptop Per Child project, if it comes to fruition, might also serve as an invaluable resource for collecting such data. As data becomes available, the largely suppositional argument made here can be replaced by one grounded in evidence.

Finally, the main focus of this paper has been on the ICT information model – and only on the lowest tiers, at that. There are many other topics in this simple model that deserve attention. How can networks be extended to the information poor? How can artistic works such as music and literature be produced in a way that makes it both accessible to those who cannot afford it (in geographically isolated areas) while not undercutting the incentives for producing? And there are behemoth questions about the availability of other sorts of intellectual property – drug patents, seed patents, and so on – that will take significant thought to resolve (if it is even possible to resolve such problems). Might FOSS serve as an inspiration for solving such difficulties? These are questions that fell outside of the scope of

52 Red Flag Software, http://www.redflag-linux.com/eindex.html.
53 Sojo, 2004.
54 Khiem, 2004; “Vietnam government opts for open source”, 2003.

this paper, but which are nonetheless worthy topics of investigation.

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