Open Source and Sustainability: the Role of University

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SSUC-2018 - Florence - Dec 11, 2018

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What has OS to do with sustainability?

- Agenda 2030: Sustainable Development Goals:

Goal 9

"Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"

- promote inclusive and sustainable industrialization
  $\rightarrow$ favour diffusion of technologies!

a striking contrast

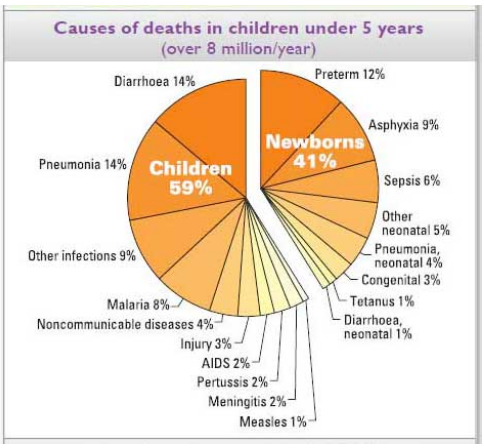
There is indeed, today, an unsustainable contrast between

- the high level of technology available to humanity as a whole
- ... and the large fraction of people having no access to it

For example:

more than 10 million children under the age of five die each year from preventable causes

[Pearce, 2012]



[Pearce, 2012]; [PMNCH, 2011]:

Intellectual Property Rights (IPR)

It is a fact that one of the obstacles to the diffusion of technology are Intellectual Property Rights (IPR)

- **copyright** limits people's *access* to knowledge
- **patents** restrict the *use* of novel technologies

> This waste of human life could be prevented by known (to humanity as a whole) technologies, many of which are simply not available to those that need it. Availability is restricted by both the cost of access (such as pay-to-view articles on renewable electricity generation under copyright by the IEEE)[2] and by companies wielding patent law to maximize profit at the cost of human lives (e.g. restricting the sale of antiretroviral drugs to treat HIV in Africa)

[Pearce, 2012]

IPR and development

- Opinions about how effective IPR are in promoting and disseminating innovation differ
- The traditional view is that IPR are required in order to secure a reward to research investment
- In recent years there has been a growing number of studies suggesting that a different paradigm may be more effective:


Global Policy Volume 1 . Issue 3 . October 2010 237

Intellectual Property, Dissemination of Innovation and Sustainable Development

Research Article

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IDDRI – Sciences Po and Columbia University
Joseph E. Stiglitz
Columbia University and Brooks World Poverty Institute, Manchester University

Abstract
We live in a knowledge economy. The production and dissemination of knowledge will be central to solving the problems of climate change and environmental sustainability, reducing global poverty and addressing other global problems. This article asks: do intellectual property rights – with their increasingly global reach – further or hinder the production and dissemination of knowledge? Experience with genetically modified organisms shows that a model markedly different from the current one is more likely to bring wider social benefits, both in the short and the long run. Indeed, the current system may impede both innovation and dissemination. There are reforms in the intellectual property regime, and more broadly in the way we finance, organize and incentivize innovation, that would increase the pace of innovation and its utilization. The spread of the current dysfunctional system owes much to the evolution of intellectual property rights in the US – and the influence of particular special interests there.

called opposition) should reduce the number of 'bad' patents.
- The patent system is only one part of a society's innovation system, through which the production of knowledge is financed, incentivized and organized. Too much attention has been focused on IPR (intellectual property rights), and too little on alternatives, e.g. open source systems, publicly financed innovation and prizes.
- Providing more scope for compulsory licenses – making it easier for countries to issue them – would reduce some of the inefficiencies associated with the current patent system.

One does not need to be an expert to understand that the development path on which we are globally drifting is unsustainable. We now understand that the growth path in the United States based on the real estate bubble was not

Boldrin et al. [2009], Henry and Stiglitz [2010]

"Open Source" Software challenges IPR

- The so-called "Open Source Software" (but this term is misleading –more on this shortly) has shown that innovation can effectively develop and spread in the absence of IPR
- The success of OSS has made authors suggest that the "Open Source" scheme be exported to other areas, such as hard technologies, or content publishing and education

Two points

- what are the defining properties of the "Open Source" model?
  - to what extent can they be exported from software to other areas?
- what can Universities do to promote the diffusion of such a model?

"Open Source" vs. "Free"

- When we speak of "Open Source" software, we actually refer to more than just the ability to read the source code.

Free Software Foundation (FSF) definition

A program is Free Software if the program's users have the four essential freedoms:

- The freedom to run the program as you wish [...]
- The freedom to study how the program works, and change it [...]
- The freedom to redistribute copies [...]
- The freedom to distribute copies of your modified versions [...]

[FSF, 2017]

features of FLOSS

- quality
  - contrary to the popular belief, there are many FLOSS products of comparable quality to their commercial counterparts, or even better; and many companies cite "quality" as the first reason they choose FLOSS
- reliability
  - the revision and test process is very efficient because every user/developer contributes
- flexibility
  - FLOSS can be modified by anyone and can be adapted to any environment, with your changes immediately available to the world
- innovation and learning incentive
  - new ideas are best fostered in a in a free and knowledge-sharing environment
- collaborative scheme
  - the way that people work with FLOSS is "radically decentralized, collaborative, and nonproprietary; based on sharing resources and outputs among widely distributed, loosely connected individuals who cooperate with each other"
- independence from vendor
  - you are not forced to continue using the same software, perhaps because of all you data are in their (opaque) proprietary format
- low cost
  - FLOSS can be distributed at lower prices than commercial products, as a consequence of reduced costs of both production and marketing
- service
  - FLOSS can be serviced by anyone - good opportunity for the emergence of local capabilities!

Open Source Hardware

- In Open Source Hardware, what is shared is only the immaterial part (the design): blueprints, methods, ...
- One definition of OSH:

Open Design Definition

- documentation of a design is available for *free*,
- anyone is *free* to use or modify the design by changing the design documentation,
- anyone is *free* to distribute the original or modified designs (for fee or for free), and
- modifications to the design must be returned to the community (if redistributed).

[Open Design Foundation, 2000]

OSH examples

- OS hardware can take the form of simple (very useful!) objects ...

The CCAT Wash n' Flush

A toilet modification that allows users to save water by utilizing the wastewater from handwashing to flush the toilet.

Business model

WIRED SUBSCRIBE

CLIVE THOMPSON BUSINESS 10.20.08 12:00 PM

BUILD IT. SHARE IT. PROFIT. CAN OPEN SOURCE HARDWARE WORK?

[Thompson, 2008]

- OSH can be profitable

Open Access

> *"Removing access barriers to ... literature will accelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich, make this literature as useful as it can be, and lay the foundation for uniting humanity in a common intellectual conversation and quest for knowledge."*

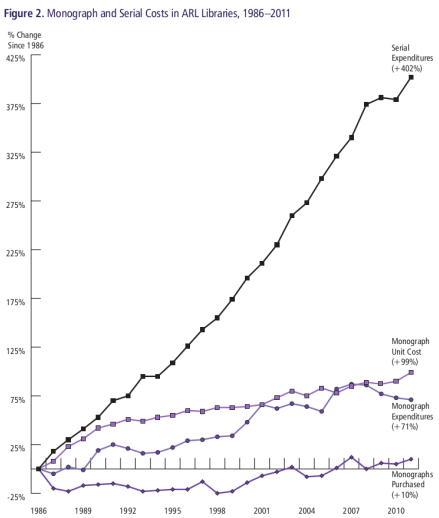
[The Budapest Open Access Initiative, 2002]

Scientific literature

Problem:

- general public has virtually no access to up-to-date technical and scientific literature covered by copyright

- costs of journals and books have not declined since the advent of the Internet



[Kyrillidou, 2012]

OA publications

- possible solution: Open Access publications

- rationale: authors pay the costs of publication, content is freely accessible

OA licenses

- Open Access material is free and open source, like FLOSS

Free Cultural Work definition [Möller, 2008]

by freedom we mean:

- the freedom to use the work and enjoy the benefits of using it
- the freedom to study the work and to apply knowledge acquired from it
- the freedom to make and redistribute copies, in whole or in part, of the information or expression
- the freedom to make changes and improvements, and to distribute derivative works

(compare FSF definition of "free software"!)

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[FSF, 2017]

Open Access licenses

- there are many licenses granting access to published material
  - moral right to be recognized as the author is always preserved
- Creative Commons licenses are perhaps the most popular non-copyright licenses

creative commons

Creative Commons

- many types of CC licenses, imposing different conditions

Open Education

> *"Education is sharing knowledge, insights and information with others, upon which new knowledge, skills, ideas and understanding can be built ... [in Open Education] Open is key; open allows not just access, but the ability to modify and use materials"*

[Open Education Consortium, 2018]

- The Open Education movement advocates the diffusion of Open Source principles to the educational world
- This can be done at different levels, e.g.:
  - supporting the use of non-proprietary tools in the classroom and the laboratory
  - developing collaborative and sharing methods of learning
  - implementing OA educational resources

Use of non-proprietary tools

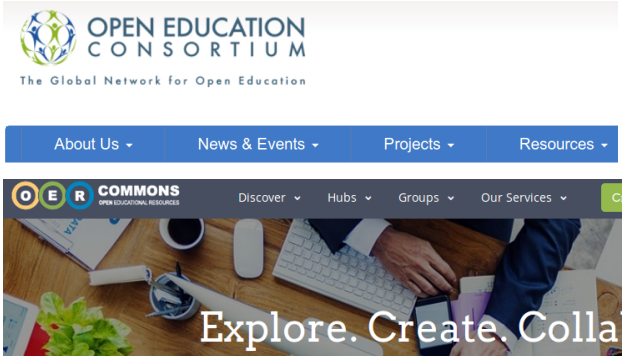
- use of patented/copyrighted educational tools is widespread in the educational world
  - not really justified when there are OS alternatives
  - students should acquire universal skills, not become familiar with one commercial product
- using OS software/hardware, schools and universities can
  - increase school neutrality
  - contribute to OS tools development, for others to use
  - reduce costs

Collaborative and sharing environment

- OS software or hardware can be freely studied and modified
  - this makes them ideal subjects of teaching projects, aimed at e.g.
    - developing new functionality of some s/w or device
    - adding new content to shared resources (e.g. Wikipedia)
- OS projects can be carried out involving people from different universities/regions/countries
- students peer-review the work of one another
- teachers and students can share their experiences (without infringing patents etc.)

Open Education resources

- teaching material can be made open-access and shared on the Internet (possibly following a wiki-like scheme)
- many OER repositories, e.g.:



- Open Education Consortium
- Open Education Europa
- the OER Commons
- ...

- more efficient use of resources
  - teachers can translate/adapt other teachers' courseware
  - reduced costs for students
  - expanding the subjects with a library of supplementary materials
- promote less-favored populations' access to knowledge.

A possible road-map

A possible road-map for universities:

- apply Open Education methods and tools (see above)
- support the Open Source philosophy
- switch to Open Access publication
- substitute proprietary software applications with FLOSS

Open Education

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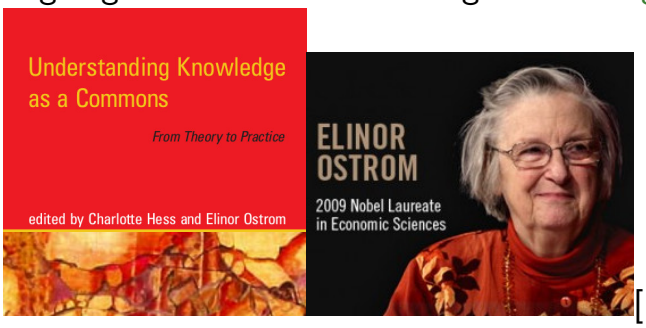
Support OS philosophy

- we know that the public discourse accompanying FLOSS can influence the diffusion of this technology
- higher education institutions can transmit a positive or negative attitude towards FLOSS
- they have the same role with respect to the *OS model* as a new scheme of production
  - ongoing academic debate on e.g. "knowledge as a commons"



[Hess and Ostrom, 2007]

  - promote seminars, dedicated courses, open discussion groups, ...

Open Access publication

- Many universities are already committed to making as much as possible of what they produce available worldwide under an open access license
- Some have been successful in negotiating with publishers more reasonable deals on Article Processing Charges and subscription prices

> *Robert Darnton, the past director of Harvard Library, says "We faculty do the research, write the papers, referee papers by other researchers, serve on editorial boards, all of it for free ... and then we buy back the results of our labour at outrageous prices."*

[Sample, 2012]

Substitute proprietary applications with FLOSS

- a very simple step!
- easier to do in teaching/research, where there is usually a more positive attitude towards FLOSS
- can be done in every branch of universities' activity: accounting, logistics, ...
- be aware of potential drawbacks:
  - migration may be a difficult/long process
  - workers may need some form of instruction
  - popular products (like Ubuntu Linux or LibreOffice) are more complete and well-established, while smaller projects maybe require some customization effort
  - ...

Conclusion

"Give a man a fish and you feed him for a day
- Teach a man how to fish and you feed him for a lifetime."

"- Let every man learn freely how to fish, and you feed humanity forever."

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