How to maximise the positive impact of Open Source on technological independence, competitiveness, and innovation

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OpenForum Europe (OFE) is a not-for-profit, Brussels-based independent think tank which explains the merits of openness in computing to policy makers and communities across Europe.

Founded in 2002 to accelerate and broaden the use of Open Source Software (OSS) among businesses, consumers and governments.
In this presentation

● What is the economic impact of Open Source Software and Hardware in the EU?
● What impact did OS public policies have around the world?
● Latest developments in OS policy and research
● Recommendations
When I talk about open source...
Open Source is no longer a niche in policy
Some history of measuring the impact of open source
Von Hippel and Von Krogh (2003)

**Title:** Open source software and the “private-collective” innovation model: Issues for organization science.

**Author(s):** Von Hippel, E., Von Krogh, G.

**Year:** 2003
Challenges of open innovation: the paradox of firm investment in open-source software

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Challenges of open innovation: the paradox of firm investment in open-source software

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Some Simple Economics of Open Source
by J Lerner · 2002 · Cited by 3899 — paper makes a preliminary analysis of open source software. We highlight the extent to ... SOME SIM
“To an economist, the behavior of individual programmers and commercial companies engaged in open source projects is initially startling.”
Challenges of open innovation: the paradox of firm investment in open-source software

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2006 - EC
National level?

- Germany (Bitkom, 2019, 2021, 2023)
- France (CNLL, 2019 and Nagle, 2019)
- UK (OpenUK, State of Open Report, 2022)
The impact of Open Source Software and Hardware on technological independence, competitiveness and innovation in the EU economy

FINAL STUDY REPORT
Economic Impact

Short summary of economic results produced by Knut Blind/Fraunhofer ISI

All numbers are for EU 28 in 2018
Data sources

- Open Source Software
  - 1.3 billion commits at GitHub
  - 32 million users at GitHub with 1.5 million organisational affiliations and 2.5 million country codes
  - Almost 700,000 organizations

- Economic Data
  - OECD
  - Eurostat
  - European Patent Office
  - Crunchbase, Amadeus, Worldbank, ILO, ...
Investment in OSS on MS level

- 8.2% of the 3 millions employees in computer programming contribute on GitHub in the EU
- 30 million commits to GitHub: effort of more than 16,000 FTEs
- €1 billion personnel cost investment in 2018
- Small companies most active, i.e. > 75% have < 100 employees; the smaller the company, the more commits
€65 - €95 billion

OSS contribution to EU economy in 2018

(lower bound)
OSS makes up between 0.5% and 0.7% of the EU’s GDP.

- This means OSS contributes a similar value to the GDP as both air and water transport combined, according to Eurostat.
- Significant contribution of OSS to foundation of start-ups, i.e. an increase of 10% would generate around additional 1,000 ICT start-ups per year.
10% increase in number of contributors:

€ 95 billion Increase in EU GDP (lower bound)
1:4

Cost : benefit ratio

(lower bound)
What about OSH?

- Difficult to estimate the impact: few studies and data points
- Some work done on OSH in research and scientific applications:
  
  “Distributed digital manufacturing of free and open-source scientific hardware (FOSH) used for scientific experiments has been shown to in general reduce the costs of scientific hardware by 90–99%.” (J. Pearce)

- Majority of OSH companies are both designing and manufacturing hardware products
Open-Source Lab: How to Build Your Own Hardware and Reduce Research Costs
details the development of the free and open-source hardware revolution. The
combination of open-source 3D printing and microcontrollers running on free software
enables scientists, engineers, and lab personnel in every discipline to develop powerful
research tools at unprecedented low costs. After reading Open-Source Lab, you will be
able to: Lower equipment costs by making your own hardware Build open-source
hardware for scientific research Actively participate in a community in which scientific
results are more easily replicated and cited Numerous examples of technologies and the
open-source user and developer communities that support them Instructions on how to
take advantage of digital design sharing Explanations of Arduinos and RepRaps for
scientific use A detailed guide to open-source hardware licenses and basic principles of
intellectual property
And what about policy?
Introducing: the Digital Services Act and the Digital Markets Act

Artificial Intelligence for Europe

{SWD(2018) 137 final}
In order not to hamper innovation or research, free and open-source software developed or supplied outside the course of a commercial activity should not be covered by this Regulation. This is in particular the case for software, including its source code and modified versions, that is openly shared and freely accessible, usable, modifiable and redistributable. In the context of software, a commercial activity might be characterized not only by charging a price for a product, but also by charging a price for technical support services, by providing a software platform through which the manufacturer monetises other services, or by the use of personal data for reasons other than exclusively for improving the security, compatibility or interoperability of the software.
Cyber Resilience Act

Feedback to the Commission regarding Cyber resilience act – new cybersecurity rules for digital products and ancillary services

The CRA and Open Source Software

23 January 2023
Cyber Resilience Act

- The exemption is "to avoid hampering research and innovation" → could make for a very narrow interpretation
- Collaborative software development might be difficult - assuming responsibilities and liabilities for the development performed by collaborators over whom they may not have authority to impose or verify adherence to the CRA
- What about using OS code from outside of the EU?
Cyber Resilience Act

- Fix #1: remove the general ban on publishing non-compliant software and instead have CRA compliance as an optional seal of quality. Instead of making the CRA mandatory for publishing software, it would be mandatory for claiming that a particular version is "CRA compliant (CE)" - public administrations have to use CRA compliant software.
- Fix #2: third-party provides an audit for particular solutions.
- ...
Public Policy
OSs in policy

- OSS push in early 2000s
  - Internal lobbying achieved high-level political support
  - Intertwined with political concerns around independence and culture
    “Software as a commons”
  - Institutionalisation significant part of effort, but never centralised

- Early 2010s saw end high-level political support
  - Without central function, institutions quickly lost mandate
  - Why did the Software Livre movement lose its power of persuasion on the government?

- Today we see a new push for open source in public policy
Policy and open source

- Compare expansiveness of public policy actions relating to Open Source (not normative!)
- Understand why governments engage with Open Source
- Understand what works and what doesn’t
The framework

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Criteria</th>
</tr>
</thead>
</table>
| **Public policies aimed at the public sector** | ● The level of prescriptiveness of a policy, throughout the jurisdiction.  
● The degree to which public procurement policies take OSS/OSH into account.  
● How effectively the policy is being executed.  
● The degree of competence with regard to OSS and OSH within the public authority. |
| **Public policies aimed at the private sector** | ● To what degree the jurisdiction supports private actors in adopting and developing OSS and OSH.  
● To what degree the jurisdiction makes guidance available for private actors.  
● Whether the jurisdiction's administration takes on a role (and if so, what role) with regard to OSS and OSH communities.  
● To what degree OSS and OSH is being taken into account in neighbouring policy fields. |
## Existence of OS policies in selected countries

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Max Mark</th>
<th>Bulgaria</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Poland</th>
<th>Spain</th>
<th>United Kingdom</th>
<th>United States</th>
<th>Brazil</th>
<th>China</th>
<th>India</th>
<th>Japan</th>
<th>South Korea</th>
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<tbody>
<tr>
<td><strong>Dimension: Public sector</strong></td>
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<tr>
<td>Policy existence</td>
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<td>5</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>15</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>5</td>
<td>10</td>
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</tr>
<tr>
<td>Public procurement</td>
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<td>15</td>
<td>10</td>
<td>0</td>
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<td>5</td>
<td>5</td>
<td>10</td>
<td>0</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Policy implementation</td>
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<td>3</td>
<td>8</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>5</td>
<td>5</td>
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<td>OS competence</td>
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<td>19</td>
<td>0</td>
<td>12</td>
<td>1</td>
<td>12</td>
<td>12</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

| **Dimension: Private sector**    |          |          |        |         |       |        |       |                |              |        |       |       |       |         |
| Supporting private sector        | 20       | 0        | 0      | 2       | 0     | 1      | 0     | 0              | 2            | 0      | 2     | 2     | 2     | 2      |
| Guidance                         | 5        | 0        | 2      | 0       | 0     | 0      | 0     | 0              | 2            | 0      | 2     | 2     | 2     | 2      |
| Community                        | 10       | 1        | 10     | 1       | 4     | 0      | 6     | 3              | 0            | 1      | 4     | 4     | 0     | 6      |
| OS present in neighbouring policies| 10       | 0        | 3      | 2       | 2     | 0      | 1     | 2              | 0            | 1      | 5     | 1     | 0     | 0      |

**Total of achievable mark**

<table>
<thead>
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</tbody>
</table>

*Source: The impact of OSS/OSH in the EU, 2021*
Italy

- Italy’s OSS policy story revolves around the CAD ("Codice Administrazione Digital")
  - From 2012 on, developed into the “perfect” OSS procurement law
  - Comparative assessment, favouring OSS
  - Except nothing really happened

- Why?
  - Unclear responsibilities
  - Lacking awareness
  - No guidance

- Improvement as of late
South Korea

- South Korea’s government doesn’t procure OSS specifically
- South Korea wants its industry to be sovereign
  - Ministry: “Open Source software [...] the basis of all activities”
  - Coordinates with CJK (China-Japan-Korea) countries on OSS
- Institutionalisation and industrial policy
  - Korea Copyright Commission, License compliance - $3 mil annual
  - Open Source Software Competence Plaza - $12 mil annual
  - KOSSLab, an Open Source incubator
  - National IT Promotion Agency - $360 mil annual
Conclusions

- Writing a good law is not everything
- Implementation and follow up is difficult
  - Awareness / ease of implementation / education
- It is difficult to force the disinterested to do something
  - External spark, intrinsic motivation
- Political support - changing priorities and governments
Issues and approaches

- Level of prescriptiveness secondary as explanatory factor
- Culture seems most important factor - Open (Source/Innovation/Data/Government) culture
  - The bigger the organisation/scope, the more challenging
  - Only successful examples on regional level
- Institutionalisation common approach, but mixed results
  - Political support necessary if open culture has not set in
Globally: Open Source policy mapping

<table>
<thead>
<tr>
<th>Region</th>
<th>Approved</th>
<th>Proposed</th>
<th>Failed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>126</td>
<td>27</td>
<td>10</td>
<td>163</td>
</tr>
<tr>
<td>Asia</td>
<td>59</td>
<td>20</td>
<td>2</td>
<td>81</td>
</tr>
<tr>
<td>Latin America</td>
<td>31</td>
<td>15</td>
<td>11</td>
<td>57</td>
</tr>
<tr>
<td>North America</td>
<td>16</td>
<td>11</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Africa</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Middle East</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>

Figure 2: Regional Distribution of OSS Policies by Year

Source: Center for Strategic and International Studies, “Government Open Source Policies”, January 2023
and each entry contains information related to a specific event that has occurred within a system or network.

(j) the term “Software Bill of Materials” or “SBOM” means a formal record containing the details and supply chain relationships of various components used in building software. Software developers and vendors often create products by assembling existing open source and commercial software components. The SBOM enumerates these components in a product. It is analogous to a list of ingredients on food packaging. An SBOM is useful to those who develop or manufacture software, those who select or purchase software, and those who operate software. Developers often use available open source and third-party software components to create a product; an SBOM allows the builder to make sure those components are up to date and to respond quickly to new vulnerabilities.

Source: White House, Executive Order on Improving the Nation’s Cybersecurity, May 2021
Figure 5: Type of Actions

Source: Center for Strategic and International Studies, “Government Open Source Policies”, January 2023
**Why OSS?**

Figure 8: Stated Objective

- **Cost**: 43%
- **Sovereignty**: 18%
- **Support for Industry**: 20%
- **Modernization**: 5%
- **Transparency**: 6%
- **Security**: 8%

Source: CSIS.

Source: Center for Strategic and International Studies, “Government Open Source Policies”, January 2023
European Commission’s OS Strategy 2020-2023

- Set up an Open Source Programme Office in the Commission;
- Set and promote the inner source default;
- Enhance the software repository;
- Revise software distribution practices;
- Enable and create innovation with open source labs;
- Develop skills and recruiting expertise;
- Increase outreach to communities;
- Integrate open source in internal IT governance;
- Ensure OSS security;
- Encourage and promote inner source;
Interoperable Europe Act

This bundles valuable resources in support of public sector entities all over the EU and paves the way to better reuse of existing solutions (ideally open source) for public benefit. In doing so, it helps remove administrative burdens, including legal, organisational, semantic and technical obstacles. As a result, it will reduce cost and time for companies and citizens, businesses and for the public sector itself.
Interoperable Europe Act

- A structured EU cooperation of public administrations, supported by public and private actors, regions and cities.
- The sharing and reuse of solutions, often open source, powered by an ‘Interoperable Europe Portal’ – a one-stop-shop for solutions and community cooperation.
- Innovation and support measures, including regulatory sandboxes for policy experimentation, GovTech projects to develop and scale up solutions for reuse, and training support.
Interoperable Europe Act

- Savings from €5.5 and €6.3 million for citizens and between €5.7 and €19.2 billion for businesses dealing with public administrations
Summary

- Open source is ‘pretty good’ and it is more recognised by governments
- Economic value of open source can be derived by a variety of actors, and this impact is large
- Implementation and culture are the big challenges for OS
Why do companies want to use open source?

- Speed of development
- Freedom to adapt to own/customers’ needs
- Crowd-sourced product development
- Bottom-up sales
- Generating trust among the developer community
- Attractive to employees
- Variety of models: maintenance, hosting, consulting, freemium, support services...
Why do governments want to use open source?

- Transparency and trust
- Interoperability
- Technological independence/digital sovereignty and control over own assets
- Modernisation and speed of development at scale
- <economic impact>
Why Open Source matters in digital policy?

Large economic impact of Open Source Software and potential impact of emerging Open Source Hardware

Public policy should be used to scale and incentivise production of OSS for EU economy

Comprehensive and coordinated policy approach is needed based on institutional capacity across public sector
How to maximise that impact?
Public sector

Research and Development

Industry

+ overarching ideas
Public sector and policy
Digital sovereignty

“In the digital decade, Open Source will be a key element to achieve Europe’s resilience and digital sovereignty”

- Thierry Breton, European Commissioner for the Internal Market
How to foster open source through policy?

- When you talk about digital sovereignty, talk about open source
- Don’t forget about open source when legislating
- Gather data on usage and creation of open source
- Fund, research and collaborate on OS security
Building institutional capacity

- Economic value of Open Source > European institutional capacity
- Use OSPOs as a vehicle to increase institutional capacity in the public sector → laws are not all it takes
  - OSPOs: EC, Paris, France, Germany, Czechia, WHO,...
Center for Digital Sovereignty (ZenDis, Germany)

The center is intended to act as a link between public administration and players in the open source ecosystem, determine market trends, absorb ideas, suggestions and requirements from public administration and communicate these in open source communities/market. By initiating and supporting collaborative projects, tailor-made open source software solutions for public administration are to be created and offered on a central marketplace. The solutions funded by the Center for Digital Sovereignty of Public Administration (working title) should be based on open standards, open interfaces and a modular architecture, as well as compatibility with existing IT of the public administration in order to achieve the greatest possible interoperability and flexibility in the future.
Building institutional capacity

- Not only OSPOs, but networks of OSPOs (in public administrations, in research institutes...)
- Promote open source in future revisions of the European public procurement directive → government agencies have to favor OSS over proprietary software
- Provide guidance on how to procure open source
Open R&D enabling European growth and innovation
How to foster Open Source in research?

- R&D funding related to OSS and OSH projects through existing programmes, such as Horizon Europe; for SMEs
- Research awards and incentives for OSS and OSH communities, students, and professors.
- Incentivise sharing code of publicly funded research
How to foster Open Source in research?

- Promote and include open source in educational programs: not only ICT, but also business schools, media studies, law...
- Support the creation and maintenance of European platforms and networks
A digitised and internationally competitive industry
How to support open source for the European industry?

- Contributions from both individuals and corporations should be treated as charitable donations for tax purpose
- Clarify liability regime for OS developers
- Fund security audits of critical OSS projects requiring specific security-improving changes with public resources
How to support open source for the European industry?

- Finance high-risk, R&D intensive OSS based startups
- Embrace OSH early and research how to take advantage
- Additional funding in support of OSSH projects, if they provide supplemental "green" benefits
How to support open source for the European industry?

- Promote partnerships between small open source players, trusted intermediaries and larger companies
- Consider OS in competition, platform and SME policies
Virtuous Open Source Funding Cycle

Ecosystem
Further supports both R&D and private sector, increasing the ecosystem as a whole

R&D Funding
Increased Public Open Source R&D funding leads to increase of available code basis

SMEs and Start-ups
Increases number of SMEs and Start-ups, further increases available code basis
Open Source Program Office

- Supports and accelerates the consumption, creation, and application of open technologies within an organisation
- Emerging as a networking interface with other OSPOs, foundations, OS communities and the users of OS solutions
- Gathers knowledge and expertise on OS within an entity: on licensing, legal compliance, internal contribution policies, needs, resources, measuring the use of OS
- Provides training and guidance, can influence internal culture (“share early”)
Open Source Program Office

- Very popular in the private sector, less so among universities and public administrations
- Universities: Johns Hopkins, Rochester Institute of Technology, Trinity College Dublin, University of California, Carnegie Mellon, CERN...
Open Source Innovation in Universities

On March 24th, OSPO++ is organizing an in-person event in partnership with Trinity College Dublin to discuss emerging trends relating to open source in Open Science, Innovation and Knowledge Transfer.

OSS Licensing in Universities

In this OSPO++ Community Call, Cindy Chepanoske will share learning about OSS licenses from CMU’s Center for Technology Transfer and Enterprise Creation.

Open Event
Watch Recording
Representation
Thank you.

Paula Grzegorzewska