

Appendix D

How Free and Open Source Software and Open Content (FOSS/OC) is Linked to Development

What makes FOSS/OC different

In recent years a wide range of organisations across the world have started to make use of 'open' ICTs in the form of free and open source software and open content. These differ from proprietary information and communications technologies and proprietary content, and do so in significant ways. The different licenses that are used to issue FOSS/OC permit the software or content to be used in various ways, but in general one or more of the following apply:

- They are developed through a process of public collaboration
- They are available for use by anyone at no or little financial cost
- Their use does not require paying licensing fees or adhering to restrictive licensing conditions. Making copies and sharing them with others is encouraged
- Access is allowed – even encouraged - to the inner workings of the technology or content (e.g., the source code or the complete electronic text) in question, which allows for modification, customisation and further improvement
- Redistribution of the modified customised or improved technology or content is both permitted and encouraged

The characteristics of FOSS/OC

These differences give rise to the following characteristics of FOSS/OC, which have technological benefits in their own right. These characteristics are:

FOSS/OC technologies and open content are generally **accessible** in multiple ways, including download using the internet from web sites, or IT companies specialising in supporting and customising free and open source software. No licensing costs are incurred. Further, *redistribution* by individual users is encouraged. In contrast, proprietary technologies and content are only available from specific vendors who

limit the use and distribution of their products by licensing and charging fees for use whilst specifically prohibiting redistribution.

Transparency means that a product or system is 'open', which means its workings are exposed to the public and can potentially be modified or improved by anyone. The alternative, which is a system whose workings are closed to the public, and modifiable by the owner only, is a proprietary product or system.

Open content - coined by analogy with open source - describes any kind of creative work (e.g., text, pictures, audio, video, etc.) that is published under an open license and format that explicitly allows the copying of the information. A number of variations on open content licenses are in common use, and the term 'open content' typically refers to the general principles of copying, re-use, and redistribution without charge, even though there may be other provisos (e.g., attribution of authorship).

Open standards are created by standards-setting organizations including consortia like the Internet Engineering Task Force (IETF), World Wide Web Consortium (W3C), and the Organization for the Advancement of Structured Information Standards (OASIS), and formal standards bodies such as the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO). For these organizations, openness allows any interested party to contribute to proposals and thereby makes it possible to base decisions on a near consensus. Users often emphasize access to documentation and free usage as key features of open standards. Care is needed by these bodies when developing open standards to ensure that they do not build upon or reference a closed proprietary standard. When this happens, the resulting standard is not open.

A standard is 'open' when:

- It cannot be controlled by any single person or entity with any vested interests
- It evolved and is managed in a transparent process open to all parties
- It is platform independent, vendor neutral and usable for multiple implementations
- Openly published
- Available royalty free
- Approved through due process by rough consensus among participants

Open standards make interoperability possible.

Interoperability describes the capability of different programs to read and write the same file formats and utilise the same protocols. Two systems can be interoperable if the owners of those systems agree to share file formats and protocols. Those that observe *open standards* will automatically be interoperable. The result is the ability to efficiently transfer and use information uniformly across organisations or societies. Interoperability does not, however, imply that systems are simply open to one another, without security, privacy or business rules that govern their interaction. Interoperability provides the potential for whatever level of information exchange between systems might be appropriate and desirable. The decisions as to whether, when and to what extent to do so remain strategic and management decisions.

Customisability means that free and open source software code and technology specifications can be altered and modified to meet the specific needs of users. Whilst specific instances of many software applications can be customised by the user by selecting from a menu of options, FOSS/OC applications can be modified and redistributed in their modified form. This flexibility especially promotes the creation of locally relevant applications and content, especially with regard to language.

The principle of **contribution** underpins the FOSS/OC development method which usually takes place through collaborative (voluntary) effort. The requirement to contribute improvements to the community of users and developers is often a part of the license conditions.

Open licensing – South African law recognises that copyright is the appropriate means of protecting rights in computer software. This is in line with its obligations under the TRIPS agreement and as a member of the World Trade Organisation. Both FOSS and proprietary software make use of copyright. In each case, users of the software are granted a licence by the copyright holder. The primary difference with FOSS licences is that they do not restrict the user's rights to modify, use, copy and distribute in the same restrictive way that proprietary software licences do. Instead the licences are used to create a software 'commons'. In some cases this is referred to as *copyleft*. This creative use of copyright by the FOSS community has

inspired similar movements in the realm of digital content. The most notable example of this *open content* licencing is the Creative Commons set of licences.

In some countries (notably the USA and Japan) rights to software *ideas* can be protected by patents. South African patent law, in line with Europe, Canada, Brazil, India and most of the rest of the world, does not recognize ideas in computer programs as patentable subject matter.

Elements of FOSS information systems

As is evident, 'free and open source software' is a broad term that encompasses a range of software types that are used by different people in different ways. It is easier to understanding how FOSS is used if these types are explained. This framework covers nine elements of information systems – five associated with software solutions plus four associated with an enabling environment.

The following five primary elements of **software solutions** pertain to free and open source software are:

- Programming Languages, and application development environments includes computer languages and associated development tools used to develop software. Free and open source programming languages and application development environments are not proprietary, privately owned or controlled. An example of a language is Python, while Zope is considered an object-oriented application development environment.
- Operating Systems are the foundation of an information system. They enable applications to interface with hardware. Operating systems are required for all hardware including mobile phones, ATMs, personal digital assistants, workstations and servers. Free and open source examples include BSD-style operating systems such as freeBSD and OpenBSD, and Linux based variants such as Ubuntu, Knoppix, Red Hat, etc.
- Databases are common to many or most applications and used as a means to store complex and relational data. Examples of most commonly used free and open source databases include mySQL and PostgreSQL.
- Applications, Components and Systems, are free and open source software programs themselves, their constituent components (both as part of a particular application and as separate sections of code), and integrated or

interoperating free and open source applications. These will commonly be built using free and open source programming languages and require an operating system as well as a database. An example is a Hospital Information System or Patient Record System.

- Generic software tools are the programs used in most workstation environments. This includes word processing, spreadsheets, presentation and more recently email and web browsing. Current examples include the OpenOffice.org office productivity software and the Mozilla suite of Firefox web browser, Thunderbird email and Sunbird calendar and scheduling software. As the information society evolves more applications will become generic. With the convergence of communications and information technology, the next major generic application is expected to be telephony.

Four primary elements of an **enabling environment** support the use of FOSS and the creation of open content:

- Community, which includes individuals and organisations participating in the use, creation, management, modification or enhancement of free and open source software, as well as the guidelines and standards for engaging in those activities, including the channels, resources and content that make the community possible and functional; that is, the open source community and what makes it work effectively. Internet access and email access are prerequisites for an OSS community.
- Copyrights, licences and Governance, which are internal and external rules by which role players manage their use of free and open source software or participation in the open source community, as well as the rules that govern their relationships with one another that pertain to free and open source software
- Information Interoperability, which includes standards and policies pertaining to interconnectivity, networking, authentication, data integration, and information access in a manner consistent with open standards.
- Content Structure, which includes standards and policies pertaining to data schema and information presentation in a manner consistent with open standards

Levels of usage of FOSS/OC

Not every user of FOSS/OC makes use of them in the same way; four levels of usage of free and open source software and open standards can be identified:

- Simple Use, which involves the use of any of the free and open source primary elements listed above, as they are downloaded and installed. For example, few users of OpenOffice make any effort to understand or change its source code
- Modify, which involves customisation or alteration of a free and open source element for the specific purposes of the user, without intention or effort to share or redistribute the element to the open source community. Many open source developers make use of FOSS languages, operating systems, databases, applications and tools to put together customised solutions for their clients on a professional basis
- Enhance, which involves modifying an element in a way that contributes to the enhancement of that element for the open source community or as part of a contribution to a registered open source development project. Enhancements to the source code of FOSS languages, operating systems, databases, applications and tools that are improvements or may be useful to others may be made by developers in the course of customising or integrating elements for a client, or may be the intent of a developer to improve a piece of software through his/her own insight and skill. Either way, other users benefit
- Create, which involves initiating, registering and supporting an open source development project for the open source community. This means starting something new – though usually by building on and incorporating existing elements. A new project could either be an effort to create a new language or tool, for example, or an effort to incorporate FOSS languages, operating systems, databases, applications and tools together to build a new specific solution through collaboration such as new management system for clinics or schools

The implications for policy implementation

While the revised policy speaks of FOSS/OC generally, each sphere of Government and each Department will need to assess precisely how each of the elements and the various levels of commitment will be managed according to their own strategies, plans and projects. In some cases, reference will be made to the Constitution and the

human rights protected therein (such as the right of access to information, the right to freedom of expression, the right to equality without discrimination with regard to language, among others), while in other cases it will be national or provincial legislation, municipal by-laws, departmental strategic plans or other documents that establish the basis of the relevant scope. Not all elements and levels of usage will be appropriate for each strategy, plan or project undertaken by a Department, but these must be assessed and justified on a case by case basis in a manner consistent with the policy. This allows for a policy that is clear and easy to understand, yet flexible and adaptable in its implementation.

The relative benefits of FOSS/OC vs. proprietary software

Various government sponsored investigations and reports have identified the following relative advantages and benefits of the wider use of FOSS/OC over and against proprietary software:

- 1) Freedoms to probe, modify, learn from and customise software to suit particular needs. From a government perspective, this has four consequent benefits:
 - Ensuring free access to public data by citizens (who are not forced to first invest in a proprietary software application in order to do so). This can only be guaranteed through the use of open content standards, which is best done through the use of compatible free and open source software
 - Guaranteeing the permanence of public data, by ensuring that the usability and maintenance of the software does not depend on the goodwill of suppliers, or the monopoly conditions imposed by them. To do this the State needs to use systems whose development can be guaranteed due to the availability of the source code
 - Security of public and state information, by virtue of the fact that source code of the applications which allow public and state information to be stored and exchanged can be inspected by citizens, the state and independent experts. This transparency gives confidence that the code is free of critical bugs or potential security flaws. Several documents liken this to the benefits in the academic and research world of peer review
 - The ability to customise FOSS/OC makes it particularly appropriate in countries – such as South Africa – with a large number of local languages and dialects, into which applications can be translated

- 2) The facilitation of interoperability between systems, allowing them to readily exchange data. FOSS/OC generally conforms to and respects existing standards, and through its use reinforces them.
- 3) Improved reliability, and less vulnerability to viruses (this is related to the security issue described under the third sub-bullet above).
- 4) The absence of a requirement to pay license fees to the originators, as is almost always the case with proprietary software – usually to foreign corporations. This reduces cost (not least by removing the need for policing), and decreases dependency on imported technology and skills.
- 5) The ability to make productive use of older – yet still functionally adequate - hardware, without the continual pressure to upgrade, with associated capital, licensing and training costs. This is also referred to as the benefit of “non-obsolence”.
- 6) The potential for a local ICT development industry to flourish, with associated societal benefits.

Developmental benefits of FOSS/OC

The benefits FOSS/OC and standards are not just the *relative* benefits of FOSS/OC when compared with their proprietary alternatives, as outlined above. The characteristics of FOSS/OC and standards mean that their use also has benefits beyond the technical and financial, including important broader social and economic benefits that are not conveyed by the use of conventional proprietary ICTs. These socio-economic benefits are an important consideration when evaluating the proper place of FOSS/OC in the developing world.

The social and economic benefits of wider use of free and open source software and open technologies are, in summary:

1. **Open source supports the local IT industry and digital self-sufficiency:**
FOSS/OC supports ICT spending with local companies, keeping that money ‘onshore’ and thereby encouraging a valued, employable skills base to flourish domestically, which in turn keeps educated and skilled workers at home and encourages other educated and skilled workers to immigrate, drawing in talent.

2. **Open source supports entrepreneurship and business formation:** FOSS/OC, by recognising participation in software development at the level of the individual and not the corporation, and by shifting the value capture within the ICT industries from proprietary software development or packaged software sales to customisation and integration of existing FOSS/OC, also furthers the success of small, medium and micro-enterprises (SMMEs), which can create opportunities for entrepreneurial success of SMMEs, and drive job creation as well as grassroots economic empowerment.
3. **Open source supports innovation, local solutions and learning:** FOSS/OC encourages hands-on, self-directed and experimental learning of 'primary source' material (i.e., source code) with peer-based support mechanisms for guidance and feedback, an empowering way of learning that is particularly important in an information society. And the result is software solutions and content that are particularly suited to local needs.
4. **Open source promotes collaboration and open standards:** FOSS/OC also provides, encourages and self-regulates a set of rigorous and broadly applicable standards and mechanisms for collaboration, quality assurance and distribution of ICT product (i.e., software), an empowering and team-oriented way of producing products, particularly well suited for the products highly valued in a knowledge economy, and proven across a range of industry sectors.
5. **Open source supports local content creation and consumption:** Existing FOSS/OC can readily be adapted for local languages, reducing barriers to access and to the mastery of skills while helping eliminate the marginalisation of those from cultures not ordinarily possessing a high level of fluency in one of the world's major languages.
6. **Open source reduces vendor dependence and lock-in:** Each of these five benefits above also help counter a psychology of dependence on developed countries and corporations to provide the innovations and solutions to problems faced domestically, even as FOSS/OC helps reduce that dependence in practical terms.
7. **Open source allows market entry for firms that would otherwise be unable to withstand corporate competition:** Supporting the collaborative and communal culture of FOSS/OC development also helps to balance the bare-knuckled culture of market competition in the ICT industries, supporting both social and economic upliftment.

8. **Open source raises the profile of South Africa in the global economy, and narrows the digital divide:** Participating in the FOSS/OC community raises the profile of the developing world, helps to demonstrate its capabilities and its desirability as a progressive, technologically literate and knowledge-savvy nation, and provides a greater degree of participation in and access to the global 'quick response' teams addressing criminal hacker and virus threats. Ultimately this participation should lead to peer based relations, thus narrowing the digital divide.
9. **Open source puts user needs first:** FOSS/OC shifts the competitive advantage among ICT companies to value creation for the customer, removing recurring revenue streams such as licensing upgrades and ancillary software purchases (e.g., for interoperability within a proprietary operating system or application suite) that benefit firms having longevity in an industry and that subsidise those existing firms to the disadvantage of SMMEs and start-ups who cannot compete on equal footing. The latter situation promotes a lock-in of economic winners in a global industry, thereby reducing market competitiveness as well as global economic transformation.
10. **Open source promotes transparency and accountable government:** The nature of open technologies can help move forward a culture of openness and transparency in government as well as society, promoting public access to government by facilitating information sharing and interoperability of ICT systems among stakeholders, and enabling government to be accountable to the people without instead being beholden to the proprietary software and standards of a private corporation.

These benefits start to be felt once the use of FOSS/OC has reached a critical mass or a tipping point within the nation. Government, as the largest user and purchaser of ICT, can play the key role in bringing South Africa to that tipping point.

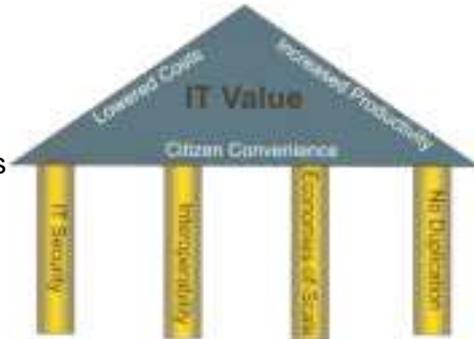
How FOSS/OC supports South African developmental goals

Because of these developmental benefits, the adoption, support and promotion of FOSS/OC helps support the government's developmental goals in ways that conventional proprietary ICTs cannot. These developmental goals, the national strategic socio-economic development objectives, are listed below, followed by a brief description of how FOSS/OC supports each:

Goal 1: Improve the efficiency and reach of government service delivery

The 'e-Government House of Value' recognises the ability of ICTs to enable the following:

- The lowering costs through workflow automation and improved communication;
- Increasing productivity by cutting the cost of administration and channelling more benefits to citizens and businesses – especially those in most need; and
- Improving the convenience of access to services by citizens and businesses



The supporting pillars of IT security, interoperability, delivering economies of scale and avoiding un-necessary duplication are better served by the preferential use of FOSS/OC.

Goal 2: Improve national competitiveness

A vibrant and innovative ICT industry is a necessary requirement for a modern, competitive knowledge based economy. The local ICT industry must be encouraged to develop the skills and competence to develop locally relevant applications and solutions – rather than just supply and support products developed by overseas corporations. Mandating the wider use of FOSS/OC will have this direct effect.

Goal 3: Support local innovation and investment

Local innovation cannot happen in an environment where ICT firms are simply resellers of proprietary software or where users cannot customize and build on existing technologies to better suit them to local conditions and needs. Support for FOSS/OC by government will have ripple effects throughout the economy that will result in more opportunities for innovative products, and investment in developing and promoting them in new market segments and expanding markets in southern Africa and beyond. Additionally, local content and local languages will stimulate local economic as well as social (e.g., cultural, artistic) activity.

Goal 4: Broaden BEE participation in the economy

Opportunities to customize, supply and support FOSS/OC are open to smaller companies, who may often in fact have advantages over larger corporates or branches of multinationals. As the level of development skills improves, black owned and managed firms will find it easier to enter markets or create new ones, thus injecting BEE equity into the ICT industry and broadening participation in the economy.

Goal 5: Build a better world

Government and other organisations need to make use of ICTs anyway; making preferential use of FOSS/OC will expand and strengthen the local economy by keeping spending at home and building skills and capacity. The ripple effects on investment and job creation into increased demand in other sectors of the economy will contribute towards building a better life for all in South Africa, and allowing African technology and firms to better compete in the region and the world. Additionally, the culture of 'open' communities and the collaborative models they engender are resonant with South African and African societal values and traditions. To encourage them to flourish internationally is to help the world better understand us.