



Archived at the Flinders Academic Commons:

<http://dspace.flinders.edu.au/dspace/>

'This is the peer reviewed version of the following article:

Vivienne, Sonja, Potter, Martin and Thomas, Pradip (2014). Free and Open Source Software (FOSS) as a tool for digital citizenship: preliminary surveys in India and Australia. In: Diana Bossio, Refereed Proceedings of the Australian and New Zealand Communication Association conference: The digital and the social: communication for inclusion and exchange. Australian and New Zealand Communication Association Annual Conference, Melbourne, Vic, Australia, (1-21). 9-11 July 2014.

Copyright (2014) The Authors.

**Free and Open Source Software (FOSS) as a tool for Digital Citizenship:  
Preliminary Surveys in India and Australia**

refereed submission with primary keyword: *New Media*

supplementary keywords: *Global Media and Development; Citizenship; Pedagogy*

**Abstract**

This article explores the links between Digital Citizenship and e-literacy initiatives that use Free and Open Source Software (henceforth referred to as FOSS). We present early hypotheses arising from initial surveys undertaken in development of a larger research project that compares FOSS-enabled Digital Citizenship in India and Australia.

## **Introduction**

FOSS is a model of software development and distribution founded on principles of free exchange of information and open collaboration. This shared model allows for development and adaptation of software in collaboration with a global community and creates a co-operative ecosystem where users become contributors and improvements are shared. Benkler (2006), echoing many other theorists, identifies FOSS as the most important and visible aspect of the development of a new digital economy based on commons-based peer production of information, knowledge, and culture.

FOSS represents what is, arguably, a utopian vision of social enterprise in that it is entirely dependent on meaningful and ongoing community collaboration, from its very conception, to the diverse, iterative use/re-use of its implementations. For this reason, FOSS is portrayed by many as the embodiment of the technological idealism of early Internet researchers and developers (including Stallman, 1998; Torvalds, 2000; Benkler, 2006). However, with increased enclosure around many (FOSS and non-FOSS) based social media platforms, and increased engagement by governments with Open Source concepts and practices, a review of FOSS, both as tool for social change and a model of production, is necessary. To this end, we review key concepts of FOSS, Digital Citizenship and e-literacy, and briefly survey some examples. These are categorised in a matrix that canvasses structure, objectives and longevity. We speculate as to why it appears that FOSS in India has born benefits to traditionally marginalised sectors of society, while in Australia it is relatively unknown to ordinary people and appears to be most utilised by the “geek elite”.

The primary focus of the proposed large scale study is to explore whether or not e-literacy is making a difference to Digital Citizenship in India and Australia and assess whether implementation strategies can be applied across contexts. For the purposes of this study e-literacy is defined as the ability to effectively and critically navigate, evaluate and create information using a range of digital technologies (Jenkins, 2009).

Our enquiry has been shaped around these questions:

*What digital literacies facilitate everyday peoples experiences of citizenship? How do FOSS technologies/applications make a difference? Do they support flows of information between community and policy-makers/educators or is the experience of Digital Citizenship more amorphous?*

The larger research project is still in its early stages, with more in depth ethnographic work and interviews across four case studies in India and Australia required.

However, our initial surveys of web based archives and a review of recent scholarship have allowed us to speculate what strategies for deployment of FOSS based civic engagement might most successfully be mapped from India onto the Australian context. These tentative hypotheses are supported by preliminary interviews with FOSS stakeholders in government and in government supported agencies (for example the innovative digital hub at 'The Edge' in the State Library of Queensland). This article attempts to define the parameters of Digital Citizenship and e-literacy initiatives across a finite range of contexts, and analyse the relationship of these concepts to the libertarian rhetorics of FOSS.

### **Free and Open Source Software (FOSS)**

FOSS has underpinned some of the most substantial digital innovations of the past 25 years – notably on the Internet. Tim Berners-Lee's original World Wide Web

implementation was FOSS. HTML, the language that drives millions of web pages, is FOSS. FOSS was used to build Google (and Google Chrome), Amazon, Twitter, Wikipedia, Facebook and Mozilla platforms such as Firefox and Thunderbird. FOSS also drives content management systems like Drupal and Joomla, server and operating systems such as Linux, GNU and Apache as well as computer-based software such as LibreOffice, Audacity, Blender and Gimp.

Benkler (2006) argues that, as engagement with FOSS initiatives and process expanded, encompassing more participants and producing more of the basic tools of Internet connectivity, there was an attempt to render the process apolitical. This was driven in part by Eric Raymond in his book *The Cathedral and the Bazaar* (Raymond, 2001) who was concerned that use of the word “free” might be too ambiguous and consequently “spook corporate types”. Stallman has attempted to clarify this with his oft-quoted epithet “Free as in Free Speech, not free beer” (Stallman and Gay, 2002; Williams, 2002). The depoliticisation of FOSS created a schism between the free software movement (of which Richard Stallman can be characterised as unofficial prophet) and “open source”, which has become a generalised term for peer development/production/access to code/data, best described by Raymond (2001). Benkler argues that depoliticisation enabled FOSS to emerge from the fringes of the software world as a practical alternative to proprietary, enclosed models. Critics of FOSS point to difficulties in measuring cost-efficiency; perceived problems with technical support; and low levels of population-wide e-literacy, that in turn makes FOSS difficult to trial and implement (Martin, 2013; Waugh Partners, 2008).

### **Government Use of FOSS**

Perceived advantages of FOSS in the public sector include its capacity to:

- support e-literacy across education, governance and business sectors;
- reduce dependency on foreign vendors of proprietary software;
- enhance agile adaptation and innovation, including embedded software on consumer devices;
- expand IT access for local and remote communities (facilitating multi-lingual platforms);
- build and support global and regional co-operation

(Gurusamy and Campbell, 2012; Lundy, 2011; Moyle, 2008; Waugh Partners, 2008).

Advocates also argue that FOSS saves money in e-governance. E-governance is defined as the application of information and communication technology (ICT) for a) delivering government services; b) exchange of information and communication transactions and c) integration of various stand-alone systems and services between government and citizens; government and business; and government to government; back-office processes and interactions within the entire government framework.

While governments across the globe are embracing FOSS for e-governance, implementing digital-by-default public service delivery, this does not necessarily engage users as empowered citizens. The terrain between theoretically “open” principles of civic engagement and the pragmatic realities of e-literacy and a multi-level digital divide is poorly mapped.

An initial survey illustrates the connections between FOSS implementation at the back end and citizen-centric rhetoric. The US government has strongly advocated for FOSS use since 2003 (Bollinger, 2003). The current UK government has made open source central to its Big Society Agenda (Digital Service Manual, 2013) and has

mandated FOSS for all new software developments. The EU's Digital Agenda strongly advocates for FOSS approaches across the Union and across all sectors. Malaysia has a Public Sector Open Source initiative driven from the Malaysian Prime Minister's office. The Brazilian Software Livre Government initiative promotes FOSS as a means to improve economic and social conditions. Additional examples from more than 40 other countries can be found at <http://proposicion.org.ar/doc/encrucijada.html>.

To the extent that quality, reliability, and ease of customization are consistently better with certain free and open source software products, they are particularly attractive to developing nations. In this context, primary arguments include cost, transparency, and freedom from reliance on a single foreign source (for example, Microsoft), and the additional potential for local software programmers to learn programs and acquire skills, and therefore easily enter the global market with services and applications for free software. The question of cost, despite the confusion that often arises from the word "free," is not prevalent.

Perhaps most significantly in terms of sheer scale and diversity of use, Indian national and state governments have been early adopters of both the concepts and practices of FOSS. In 2001, the Government of Kerala declared official support for FOSS in its State IT Policy. The policy was formulated after a free software conference in India, Freedom First! held in July 2001 in Trivandrum, Kerala. The Free Software Foundation of India was inaugurated at this time. Unlike some of the previously mentioned international examples, government directed implementation of FOSS in India seeks to harness theoretical potential with practical facilitation of social change. This support has resulted in significant cross-government, civil society and industry FOSS-based initiatives such as IT@Schools, ITforChange, SPACE and Centre for Internet and Society. Overcoming numerous social, economic and

linguistic obstacles, FOSS enabled e-literacy in India is evident across both private and public sectors spanning education, community development, and small and large business.

While India has been a global leader in ICT development and deployment, Australia lags well behind other developed nations, ranking 12<sup>th</sup> on an index of e-intensity that measures “the relative maturity of Internet economies” (Boston Consulting Group, 2013). According to the World Economic Forum’s Global Information Technology index, which scores the readiness of governments and firms to absorb IT, Australia was ranked 9<sup>th</sup> in 2004, but 18<sup>th</sup> in 2012. According to the International Telecommunications Union’s ICT Development index, Australia was ranked 15<sup>th</sup> in 2007, but only 21<sup>st</sup> in 2012. Akamai’s most recent State of the Internet report (Akamai, 2013) found Australia had fallen to 40<sup>th</sup> place in a league table of actual average download speeds across nations. OECD figures show that in June 2007 Australia ranked 12<sup>th</sup> for fixed broadband penetration, with a take-up rate 121 per cent of the OECD average. By December 2012, Australia’s ranking for fixed broadband penetration had tumbled to 18<sup>th</sup> and take-up was 96 per cent of the OECD average due to a combination of factors. This includes poor regional and remote coverage and incremental speed increases in Australia. Whilst broadband penetration stagnated in Australia other nations leapfrogged forwards with rapid speed increases and government led national rollout of broadband technology. Arguably, the effects of this are apparent in a significant decline of Australians using the Internet to engage with government between 2009 and 2011 (Australian Government Information Management Office, 2011).

Despite these indicators, increasing adoption of broadband and ubiquitous Internet use has led to a cultural shift in which Australian people increasingly expect



transparency, demand openness and aspire to meaningful engagement with governance (Waugh, 2011).

### **Digital Citizenship**

Digital Citizenship is emerging as a key theme for governments and communities worldwide, as they struggle with rapid expansion of technical freedoms, changing expectations of engagement, and distributed power across divergent publics (Waugh, 2011). Digital Citizenship can be understood as both the ability to participate in society online, and as the norms of appropriate and responsible behaviour with regard to technology use (Mossberger et. al. 2007). Ribble (2011) regards the defining characteristics of Digital Citizenship as:

- access to technology;
- capacity to engage in electronic trade and commerce;
- ability to share information with digital tools and on digital platforms;
- capacity to learn and innovate;
- awareness and respect for digital etiquette, laws, rights and responsibilities;
- capacity to maintain health and wellbeing in a digital world;
- and ability to maintain personal safety and digital security.

Although encouraging digital creativity, experimentation and collaboration among a global population is critical to developing attitudes that lead to participation in open source projects (ATIP, 2010) the connection between e-literacy and Digital Citizenship in Australia is tenuous to say the least. The terrain between theoretically “open” principles of civic engagement and the pragmatic realities of e-literacy and a multi-level digital divide is under-analysed.

In contrast, India offers many examples of innovative and multi-tiered IT initiatives, spanning all aspects of open (data, standards and software), engaging meaningfully with the utopian concepts around “free”, and ranging across development, education, governance and business sectors, offering evidence that the implementation of FOSS platforms and principles can lead to both social empowerment and economic growth.

### **The intersection of Digital Citizenship and FOSS enabled e-literacy**

Themes of dialogue, mutual respect, universal literacy and negotiated rights and responsibilities resonate across both FOSS and Digital Citizenship discourse. It is at the intersection – e-literacy that emerges through FOSS initiatives - that we seek new understanding. FOSS has been identified as enhancing Digital Citizenship for the already e-literate through:

- Better co-ordination of enabling infrastructure such as social, mail and markets (e.g. payments) than proprietary systems
- Stronger engagement with government via increased transparency and expanded access to public sector data online
- Reduced ICT costs through elimination of duplication and fragmentation and by running non-proprietary systems that are replicable, flexible and scalable
- Opportunities to develop better services through innovation and collaboration across sectors
- Enhanced integration of government and public sector ICT goals working with differences of scale and capability

In parallel with a global growth in e-literacy, McKinsey Global Institute (2012) has calculated around a fifth of GDP growth in advanced economies over the past five

years has arisen from the Internet and associated technologies – with 75 per cent of this growth occurring in sectors not traditionally seen as “technology” industries.

A digital, networked economy and society is about far more than just connectivity. It is about profound change in schools and workplaces – and the skills and capabilities individuals and firms need to succeed now and in the future. Without skilled programmers and designers to engineer solutions, and without an informed, platform agnostic public capable of using non-proprietary systems – systems will remain closed and inflexible, service delivery will be of low quality and experience low uptake and capacity to engage in the global digital economy and society in general will continue to be limited. Canvassing the intersection of FOSS implementation and public good, Thomas argues:

Public software... is organised on public goods principles, that certain goods whose production may not offer sufficient incentives for the private sector and whose availability is important to all in society, need to have an alternate model of production and distribution. Public Software thus emphasises the “positive right” of citizens – that basic software for negotiating digital society is their entitlement. (Thomas, 2012)

For ordinary people, the pervasive digitization of public services means that e-literacy is imperative and unavoidable. In Australia public services are projected to be digital-by-default within 5 years and citizens without ability to meaningfully feed into proposed open source planning and services etc. will become increasingly marginalised. In Australia, where regional and remote communities have a variety of culturally and linguistically diverse needs, FOSS-based literacy has the potential to

become the basis for innovative initiatives, in the context of both formal and informal education. The extension of e-literacy to a wider population than the traditional “geek elite” promises to address some of the issues of social, geographic and economic marginalisation.

### **Discussion of FOSS examples**

Our survey of the FOSS landscapes is focused on Australia and India and is by no means comprehensive. The following descriptions of key examples are derived from the information available online. In our preliminary survey we have drawn on four Indian examples and eleven Australian examples that have self-identified as organisations or projects engaging with both Digital Citizenship and some aspect of e-literacy.

#### **INDIA**

**IT@School** is a project of the Department of General Education in Kerala, India, to foster IT education utilising purely FOSS systems (Linux) since 2008.

**IT for Change** is an NGO working across education, social change and governance to explore how technological paradigms open up “novel approaches for deepening democracy”; they also engage in specific projects that explore bottom-up, participatory designs of governance systems.

**SPACE** is an NGO that promotes the use of Free and Open Source Software (FOSS) in academia, governance, corporate and individual use, and supports the use of FOSS for employment generation in Kerala. The VME (Virtual Micro Enterprise) model promoted by SPACE uses a decentralized and distributed mode of IT development where local employment, particularly using FOSS, is promoted and facilitated. SPACE

intends to promote more VMEs that can take up different services in Kerala, especially in smaller towns and rural areas.

**The Centre for Internet and Society** is a non-profit research organization that works on policy issues relating to freedom of expression, privacy, accessibility for persons with disabilities, access to knowledge and Intellectual Property Rights reform, and openness (including open government data, free/open source software, open standards, open access to scholarly literature, open educational resources, and open video), and engages in academic research on digital natives and digital humanities.

## **AUSTRALIA**

**GovHack** is an annual Australian event convening web and application developers and assorted technologists and geeks with the aim of creating innovative mash ups of existing government data sets.

**data.gov.au** is an Australian Open Data Government initiative that provides a new way to find, access and reuse public datasets.

**Linux Australia** is a peak body for Linux user groups in Australia (around 5000 people nation-wide), hosting conferences, education programmes, user groups, FOSS activism etc.

**QUT OSS group** is a self-organised group of students interested in collaborating on Open Source ideas in real world projects.

**Feral Arts** are a Queensland based community cultural development company that develops software and uses digital technologies to enable communication and collaboration through digital stories, maps and databases to enable creative solutions to cultural and social challenges.

**Trove** is a search engine to locate resources about Australia and Australians, which reaches many locations otherwise unavailable to external search engines. It is a centralised national service built with the collaboration of major libraries of Australia

**The Edge** is an initiative of State Library of Queensland, offering workshops, activities, events and exhibitions for individuals, access to a range of hardware and software, co-working spaces and extensive support for both organisations and individuals around programming, specifically with open source tools.

**RoboCup** is a project-oriented educational initiative that sponsors local, regional and international robotic events for young students. The ultimate goal is that by the middle of the 21st century, a team of fully autonomous humanoid robot soccer players shall play (and win) a soccer game against the (human) world champions.

**Young ICT Explorers** (using FOSS and Arduino) is a non-profit competition, which has been created by multi-national software company SAP (in terms of revenue SAP AG is the world leader in enterprise software and software-related services) to encourage school students to create their best ICT related projects.

**NICTA (GroupX)** NICTA is Government funded and Australia's Information and Communications Technology Research Centre of Excellence. GroupX is a four-year program aimed at increasing the number of tertiary ICT students – and indirectly, the number of ICT professionals – in Australia, by promotion of ICT study and careers. GroupX commenced as a pilot project in Queensland in 2007.

**CoderDojo** is an international volunteer led movement orientated around running free not-for-profit coding clubs and regular sessions for young people between 5 and 17 who learn how to code, develop websites, apps, programs, games and more. The main active Australian site for CoderDojo is based in Brisbane.

A review of these organisations and initiatives allows categorisation into the following criteria, distinguishing between organisations or initiatives that use FOSS platforms to engage people in creating product and those that offer access to data and “back end” without clearly determining end products. While not all initiatives are framed with “social change” as an objective, many have Digital Citizenship as an incidental consequence.

Our categories are scaffolded around these questions:

Access – is the primary enterprise open (back end accessible to participants and/or general public) or enclosed (based on FOSS platform however back end not accessible)?

Structure – is the organisation or initiative large and facilitated by an institution or is it a self-organising and organic community?

Support – do resources and finance come from government, private industry, community or a mixture?

Objectives – what narrative is outlined in web presence? Education? Social change?

Longevity – are initiatives one-off or annual events or ongoing?

Outcome – are outcomes carefully defined or evolving?

The following matrix collates this data and presents a brief overview of some examples.

TITLE	ACCESS Open or Enclosed	STRUCTURE Institutional or Grassroots	SUPPORT Financial & Resources	OBJECTIVES Narrative Description	LONGEVITY Ongoing or Finite	OUTCOME Defined or Undefined
IT@School	Open	I	Dep. of Education, Kerala	implemented in 2000 schools focusing on sustainable digital literacy	ongoing	defined
SPACE	Enclosed	I	international NGOs and agencies	promote the use of FOSS in academics, governance, corporate and individual; use FOSS for employment generation in Kerala; runs regular initiatives and workshops	ongoing	both
IT@Change	Open	I	consultative relationship with economic and social council of UN	working on information society theory and practice from the standpoint of equity, social justice and gender equality	ongoing	defined
Centre for Internet and Society	Enclosed	I	WikiMedia and international NGOs and agencies	non-profit research pertinent to freedom of expression, accessibility, IP, FOSS and Open Source	ongoing	undefined
The Edge	Both	I	State Library of Queensland	engaging community and library users in exploring arts, technology, science and enterprise	both	both
DataGov.au	Open	I	Aus. Gov.	find, access and reuse public datasets from the Australian Government	ongoing	undefined
GovHack	Open	both	Aus. Gov.	event to unite government, industry, academia and general public to mashup, reuse, and remix government data, finding new ways to do great things	annual event	undefined
Feral Arts	Enclosed	I	Aus. Gov. and Aus. Council for the Arts	community arts and cultural evolution digital age place stories initiative uses FOSS platform to facilitate community story sharing	ongoing	defined
RoboCup	Open	I	tech industry & education sector	project-oriented educational initiative that supports local, regional and international robotic events for young students	annual event since 2000	encouraging digital literacy and engagement with technology
CoderDojo	Open	SO	tech industry and community donations	open source, volunteer led movement orientated around running free not- for-profit coding clubs and regular sessions for young people	ongoing	undefined all projects are different and autonomous
Young ICT Explorers	Open	I	SAP (FOSS enterprise) and education sector	non-profit competition, created by SAP for school students to create ICT related projects aligned with school curriculum	annual event	projects assessed on the criteria of creativity, uniqueness, quality, level of difficulty and project documentation
QUT DSS group	Open	SO	Queensland University of Technology	for students and alumni to share in the culture and opportunity to Open Source, and to contribute actively to real world projects.	ongoing	undefined
Trove	Both	I	National Library of Australia	Public archive supplements search engines, providing access to deep web full text content	ongoing	defined
Linux Australia	Open	SO	Linux and community donations	Peak body representing FOSS, FOSS Community building	ongoing	undefined
NICTA (GroupX)	Enclosed	I	Gov funded	NICTA research organisation; GroupX initiative aimed at increasing the number of tertiary ICT students	NICTA ongoing; GroupX 3 years	defined



It seems in Australia (and possibly other developed countries) FOSS uses are often quite playful, exploratory or experimental in their outputs, despite their firm and sincere idealism. Internationally, this is reflected in examples like Maker Faire's utilization of Arduino, or in HackFests and Code-Ins, and events such as Summer of Code, hosted by Google. The focus is on innovation and unique, event based problem-solving, even when the context is national interest (e.g Trove, GovHack), or capacity building and/or corporate development (NICTA, Young ICT Explorers, RoboCup). Our Australian examples can be characterized as finite in scale, ad hoc or event-based, "loosely coupled" (Benkler, 2011), community-centric, informal and exploratory (in that outcomes are experimental or undefined).

In India (and possibly other developing countries) it seems FOSS ecosystems are often institutional or formally organized, ongoing, "tightly coupled", and less experimental/playful. The objectives are more focused on social development and change by directly addressing issues, such as technology for social inclusion, e-literacy and even larger systemic problems (IT@school, IT for Change, SPACE etc.).

The Indian initiatives we identified also deeply engage in the politics of FOSS and are public in their use of the libertarian rhetoric of "free", whereas the majority of Australian examples are not.

Deployment of FOSS in the state of Kerala, India (in projects such as IT@School and SPACE) and in large-scale problem-centered initiatives such as OpenIDEO or GovHack, demonstrate clear potential to contribute to innovation, creativity and empowerment. Benkler (2011) argues that adoption of free software correlates with emergence of state-of-the-art software and this is a central tenet of commons-based solutions to development.

However, the depoliticisation of FOSS that enabled its “normalisation” (as Benkler views it) has also enabled its power to re-define industries (such as marketing and advertising) and the entire process of mass commercialisation. Social media platforms such as Facebook have emerged in this more apolitical setting and this has also given rise to an alternative approach to economic engagement. A market first approach has not been as successful in the social media landscape as evidenced in the approach of companies such as Facebook and Twitter. Only after the technological innovations of each company became integral to the digital engagement of millions of people were commercialisation strategies implemented. The current global digital environment, which originally emerged from a socio-cultural, theoretical and non-commercial frame in which research, communication and social engagements drove growth, have, in turn, enabled the evolution of market driven applications as well as the capacity to re-imagine neo-liberal markets. FOSS based applications have created vast social change, evident in the fact that access to the Internet is now being argued as a human right (e.g. UNHRC, 2012).

## **Conclusion**

What we can learn from the “journey” of FOSS is that the direct contribution technology makes to social change and Digital Citizenship derives, in part, from the removal of impediments to access and use, paired with the sharpening of incentives to adopt and make creative, effective use of existing technologies. Large-scale and diverse use of these contributions is necessary to manifest this change.

As Benkler (2006) observed:

Open source and its wide adoption in the business and bureaucratic mainstream allowed free software to emerge from the fringes of the

software world and move to the center of the public debate about practical alternatives to the current way of doing things.

In Australia, both the broader ICT industry and the FOSS community share many concerns on the lack of education opportunities in formal settings and the lack of public understanding of FOSS (Waugh, 2008). Education is vital in order to embed an open source culture of sharing, re-use and collaborative development across government and its suppliers (and, in doing so, stimulate innovation, reduce cost and risk and improve speed to market). While it may not be necessary for every individual to be literate in software programming, they must, at least, be capable and confident in autonomous experimentation with emerging technologies. ACT senator and former Minister assisting for the Digital Economy, Industry and Innovation, Kate Lundy, argues that e-literacy connotes people being “productive, innovative, adaptable and empowered through the use of technology” (Lundy, 2010). A final and crucial component of how FOSS based e-literacy supports civic engagement in a digital society and economy is the development of social support networks that foster technical support and provide locally relevant contexts for engagement.

The increasing digitalisation of government (i.e. through open source software and open data movements) indicates the possibility of a new commitment to citizenship in the context of a networked society. Public desire to create “communities of practice” via access to and use of public knowledge is an evolving global issue.

Wenger et al., (2002) describe three elements that make up any given community of practice: “...a domain of knowledge, which defines a set of issues; a community of people who care about this domain; and the shared practice that they are

developing to be effective in their domain” (p. 27). It would appear that e-literacy through FOSS offers new and enhanced possibilities for creating many communities of practice, thus increasing empowerment and spaces and possibilities for social change. However, Ostrom and Schlager in refuting Hardin’s *Tragedy of the Commons* (1968) highlight the difficulty of singular solutions:

Instead of blind faith in private ownership, common-property institutions, or government intervention, scholars need a better understanding of: (1) the conditions that enhance or detract from the emergence of more efficient property-rights regimes related to diverse resources, (2) the stability or instability of these systems when challenged by various types of exogenous or endogenous changes, and (3) the costs of enforcing regulations that are not agreed upon by those involved. (Schlager & Ostrom, 1992. p.260).

Thus a re-valuation of existing models, be it market or state based, along with analysis of new approaches to software deployment for development and e-literacy, may proffer hybrid or multi-tiered solutions. Further, a forward looking approach to digital knowledge management, production and distribution in correlation with Digital Citizenship and social change, must come to terms with access based on both open source/open standards, and proprietorial, enclosed and familiar models.

## References

- Akamai, 2013. State of the Internet | Akamai ( No. 3rd Quarter).
- ATIP, 2010. ATIP10.021:Open Source Software (OSS) in Asia-Pacific. Asian Technology Information Program (ATIP).
- Australian Government Information Management Office, 2011. A Guide to Open Source Software for Australian Government Agencies. Terrace Parkes, ACT.

- Benkler, Y., 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. Yale University Press, New Haven.
- Benkler, Y., 2011. *Complexity and Humanity. Free Souls Captured Released*.
- Bollinger, T., 2003. *Use of Free and Open-Source Software (FOSS) in the U.S.* Department of Defense. The MITRE Corporation.
- Boston Consulting Group, 2013. *The 2013 BCG e-Intensity Index [WWW Document]*. [https://www.bcgperspectives.com/content/interactive/telecommunications\\_media\\_entertainment\\_bcg\\_e\\_intensity\\_index/](https://www.bcgperspectives.com/content/interactive/telecommunications_media_entertainment_bcg_e_intensity_index/) (accessed 2.27.14).
- Gurusamy, K., Campbell, J., 2012. *Enablers of Open Source Software Adoption: A Case Study of APS Organisations*. *Australas. J. Inf. Syst.* 17, 5–23.
- Lundy, K., 2010. *Open Submission to the National Curriculum Consultation [WWW Document]*. <http://www.katelundy.com.au/2010/04/22/open-submission-to-the-national-curriculum-consultation/> (accessed 2.19.14).
- Lundy, K., 2011. *Senator Kate Lundy: Openness in Government: from data to crowdsourcing - OSDC 2011*.
- Moyle, K., 2008. *Total Cost of Ownership and Total Value of Ownership*, in: Voogt, J., Knezek, G. (Eds.), *International Handbook of Information Technology in Primary and Secondary Education*, Springer International Handbook of Information Technology in Primary and Secondary Education. Springer US, pp. 615–631.
- Raymond, E.S., 2001. *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*. O'Reilly Media.
- Stallman, R., Gay, J., 2002. *Free Software, Free Society: Selected Essays of Richard M. Stallman*. Free Software Foundation.
- Thomas, P.N., 2012. *Public Sector Software, Participatory Communications and Social Change*. Glocal Times.
- Waugh, P., 2011. *Pia Waugh: Open Government: what does it all mean, really?*
- Waugh Partners, 2008. *The Australian Open Source Industry & Community Report*. NICTA, IBM, Fujitsu.
- Wenger, E., McDermott, R.A., Snyder, W., 2002. *Cultivating communities of practice: A guide to managing knowledge*. Harvard Business Press.
- Williams, S., 2002. *Free as in Freedom: Richard Stallman and the Free: Richard Stallman's Crusade for Free Software*, O'Reilly Series. O'Reilly Media, Incorporated.

**FOSS examples**

CoderDojo [WWW Document], n.d. URL <http://coderdojo.com/about> (accessed 5.2.14).

data.gov.au [WWW Document], n.d. URL <http://data.gov.au/> (accessed 5.2.14).

Feral Arts [WWW Document], n.d. URL <http://feralarts.com.au/> (accessed 5.2.14).

GovHack [WWW Document], n.d. URL <http://www.govhack.org/> (accessed 5.2.14).

IT for Change [WWW Document], n.d. URL <http://www.itforchange.net/> (accessed 5.2.14).

it@school [WWW Document], n.d. URL <https://www.itschool.gov.in/sitepage.php> (accessed 5.2.14).

Linux Australia [WWW Document], n.d. URL <http://linux.org.au/> (accessed 5.2.14).

RoboCup Junior Australia [WWW Document], n.d. URL <http://www.robocupjunior.org.au/about> (accessed 5.2.14).

Society For Promotion of Alternative Computing and Employment [WWW Document], n.d. URL <http://www.space-kerala.org/node> (accessed 5.2.14).

The Centre for Internet & Society [WWW Document], n.d. URL <http://cis-india.org/> (accessed 5.2.14).

The Edge [WWW Document], n.d. URL <http://edgeqld.org.au/about/the-edge/> (accessed 5.2.14).

The QUT OSS Group [WWW Document], n.d. URL <http://qutoss.org/> (accessed 5.2.14).

Trove [WWW Document], n.d. URL <http://trove.nla.gov.au/general/about> (accessed 5.2.14).

Young ICT Explorers Australia [WWW Document], n.d. URL <http://www.youngictexplorers.net.au/cms/> (accessed 5.2.14).