

Source Software
Open **OSS**

In Canada

Open Source Business Opportunities for Canada's
Information and Communications Technology Sector

A Collaborative Fact Finding Study

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e-Cology Corporation

September, 2003

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Acknowledgements

Designing and implementing this Study of open source software in Canada has been a challenge in complexity. The topic elicits streams of conflicting and diverse opinions against a background of rapid change and increasing activity. Every attempt was made to represent the facts with completeness and clarity.

We especially would like to acknowledge the invaluable edits, comments and suggestions provided by many volunteers throughout the public consultation process. In particular we would like to thank Claude Gagné, Joseph Potvin, Kenn Munro, Andrew Aitken, Dick Hardt, Matthew Ivis, Dan Razzell, Andrew Robinson, Linda Oliver, Janet Hopkins and David Haight for the time and effort they devoted to helping to improve the final product.

To the Reader

This report was prepared under the sole responsibility of the contractor. It does not necessarily reflect the view of the Government of Canada clients, nor does the Government of Canada accept responsibility for the accuracy or completeness of information contained herein.

The report is provided in the spirit of open source in that future work will greatly benefit from the new perspectives and comments. We gratefully welcome feedback and encourage use of the information presented.

This document is available at www.e-cology.ca/canfloss/report. Please email comments and suggestions to feedback.canfloss@e-cology.ca

Executive Summary

The overall goal of this report is to raise the level of understanding of why and how the open source paradigm and its products, services and communities are important to Canada, both domestically and internationally. The report addresses this goal by:

- Surveying the Canadian software landscape to understand what the current level of Open Source Software (OSS) adoption and development activity is
- Gathering and analyzing Canadian public and private sector opinions *vis-à-vis* the long term prospects of OSS and relevant strategic issues
- Presenting an environmental scan of the current state of OSS and relevant worldwide trends
- Developing a high level market analysis of opportunities, barriers and conditions for adoption
- Providing a synthesis of the findings and analyzing the implications and opportunities of OSS to the public and private sector

The topic of OSS is indeed *au menu du jour*. It is on the political agenda of many developed and developing countries and is being debated in a number of fora hosted by many of the most influential of international and regional political bodies.

Industry, foreign governments and technology analysts around the world are increasingly finding value in OSS. A June 2003 workshop hosted by the Center for Strategic and International Studies (CSIS) Washington noted that twenty-four countries are reviewing over 70 policy proposals to include OSS in software procurements.¹ A recent Forrester study reports that “72% of respondents expect to use more Linux in 2004” and predicts that the adoption of Linux “will explode in every data-center” in 2004². International Data Corporation Canada predicts the adoption of Linux will grow over 30 per cent next year, 10 times faster than its competitors.³

OSS has become part of mission-critical systems in organizations such as the US Department of Defense⁴, NATO⁵, and Wall Street investment firms.⁶ IBM and SuSE Inc. recently achieved Common Criteria security certification for Linux, which will encourage further adoption in mission critical applications⁷.

¹ Federal Policy and Open Source Software, www.csis.org/tech/opensource/agenda.htm, Center for Strategic and International Studies (CSIS) Washington, June 12, 2003

² The Linux Tipping Point, Forrester, March 2003

³ Firms buy in to open-source software, Globe and Mail, Thursday, Apr. 24, 2003

⁴ DISA finds widespread open-source use in DoD, Joab Jackson, Washington Technology, 11/13/02

⁵ “The North Atlantic Treaty Organization uses... Zope (an open source content management system), for a tracking system that locates both NATO's and antagonists' troops, vehicles and ships around the world”, Open Source Code: A Corporate Building Block, Charles Babcock, Interactive Week, May 2003

⁶ Linux based systems have been adopted by financial services firms such as Credit Suisse, First Boston, Charles Schwab, Morgan Stanley, Merrill Lynch, Goldman Sachs, and E*Trade.

⁷ “The Common Criteria are internationally recognized standards used by the federal government and other organizations to assess the security of technology products... “Definitely one of the obstacles that blocked lots of government folks from using Linux” has been removed, said John Pescatore, a vice president at Gartner Inc. Now Linux will be used more often for vital systems, he said.” IBM earns Linux certification, Rutrell Yasin, Federal Computer Week, Aug. 6, 2003.

Historically, dominant Information and Communications Technology companies are making major investments in open source capabilities. IBM, whose example other companies like Oracle and SAP are following, has invested \$1.4 billion establishing OSS capability because it says it is listening to what its customers want. There is mounting evidence that 2003 will be a watershed year for OSS adoption around the world.

THE CANADIAN LANDSCAPE

Adoption of OSS has resulted in significant, measurable savings in some organizations, but rigorous business case analyses are needed to guide investment decisions - the research findings indicate that there is sufficient implementation experience and evidence to support rigorous analysis of the cost and benefits of implementing OSS in Canada. At an industry level, it would be valuable to assess whether there may be long-term strategic benefit in what several countries believe to be a significant dividend of OSS – that is a shift from dependence on foreign software goods and services to more local high skilled ICT staff and suppliers. Rigorous business case studies and economic impact analyses would add greatly needed clarity to the business case for OSS.

Senior management are generally not aware nor fully understand the strategic value of OSS - although OSS adoption in mainstream business applications is common, senior management in most organizations need better information and education on the strategic benefits and advantages of open source and its collaborative development processes.

The federal government neither prevents nor encourages open source adoption ... but effective exploitation will require clear and well-communicated policy and proactive education - Government needs to seize OSS opportunities through clear and well-communicated policies and by being proactive without being provocative. There are numerous examples of effective use of OSS within the public sector today but lack of clear OSS policy is creating fear, uncertainty and doubt about its legitimacy preventing optimal exploitation.

OSS adoption will spread - there is strong agreement that OSS use will substantially increase in the next five years, in all product and service areas. The details of how this will evolve require further study.

Preparedness to support more OSS uptake is limited - if OSS gains rapidly in popularity across multiple sectors, shortages in terms of services and support will likely be experienced.

OSS suppliers in Canada are mostly small and would benefit from a national forum or network - the majority of OSS companies in Canada are small private businesses and individual developers. The fledgling OSS industry would benefit from having a collective voice, coordination and some form of national network. A Canadian OSS forum/network could help the public and private sectors connect to encourage greater national collaboration, standards (where necessary), awareness of and utilization of talent.

Development and sharing of rigorous business case studies should be encouraged - the overall economic justification for OSS adoption is critical to rational widespread adoption of OSS in Canada. Organizations, especially those in the public sector, should be encouraged to document and share their experiences implementing OSS.

Most OSS is obtained from external sources - in the sample population, more than 70% of OSS was acquired from external sources, as opposed to internally developed.

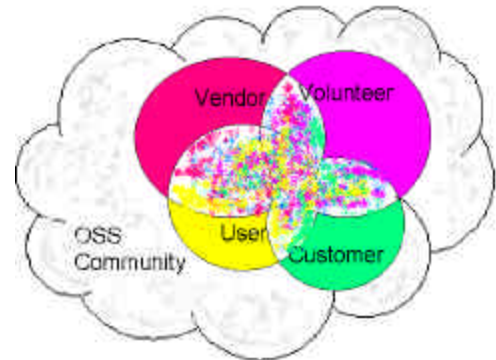
Most OSS is used in core business applications - the prime area of use for OSS in the sample population was for core business functions.

Hybrid commercial business models dominate - the sale of proprietary solutions running on top of OSS platforms was the dominant business strategy; customized implementation of OSS was also a profitable and common source of revenue.

OSS IN BROADER CONTEXT

The business of OSS is complex - filled with debates and distracting polarization, the business of OSS can be confusing due to the multiple and overlapping roles played by buyers, vendors, suppliers, developers, consumers, and volunteers.

Self-sustaining OSS communities rarely emerge spontaneously - simply releasing software as open source does not guarantee an open source community will establish itself to improve and adopt the software. Proactive effort to form and incubate communities is essential to improve the odds of success.



Understanding the OSS business models remains a challenge - the underlying philosophy and economic theory supporting the OSS business model requires more study.

OSS is commoditizing software - like the personal computer led to the commoditization of hardware OSS is accelerating the commoditization of software and changing the rules of success in the software industry. This has potentially significant ramifications for commercial software developers, services and solutions providers.

Porting of existing products to Linux - companies are actively porting their products to Linux where there is customer demand; many companies are porting their software to Linux without understanding the resultant business implications.

Competition from OSS is resulting in significant discounts - increasingly there are examples of large price reductions by vendors such as Microsoft when faced with OSS based competition in high profile accounts. A recent example is the substantial discount offered by Microsoft to the City of Munich when they were considering purchasing Linux instead of upgrading their existing Windows licenses. Conversely, software vendors incorporating OSS into their applications need not reduce prices thereby increasing profit margins.

Total cost of ownership is contextual - generalizations invite unnecessary debate and reduce opportunity for both proprietary software as well as OSS.

More leadership where it counts is needed - more senior management champions who understand the strategic and operational value of OSS are needed for more effective organizational adoption.

Open source companies are largely small to medium-size enterprises - they lack the skills and financial resources for effective marketing.

Open Standards and Open Source - Déjà vu - the concept of open standards is increasingly mentioned in the context of open source. It is important to their effective use to ensure that the distinction between open standards and open source is not blurred and that their interdependence is clearly understood.

Significant worldwide public sector adoption of OSS is on the rise - the rate of new OSS projects and replacement of legacy systems reported in the press is significantly increasing.

OSS platforms are reliable and secure - Linux, Apache and PHP and several other OSS platforms have the maturity and sustainability required of mission critical systems and broad market acceptance.

The OSS development model can offer significant advantages – software companies are finding that implementing the OSS development model can help them become more efficient resulting in better products and faster time to market.

Engaging with the OSS community is critical for realizing its full benefits – companies interacting with the OSS community on projects they are interested in helps them guide the development of the software to meet their needs and builds necessary goodwill.

REFLECTIONS

There needs to be an OSS strategy for Canada's future ICT public infrastructure - the absence of an open source strategy introduces the risk of underutilizing precious funding and underachieving in critical elements. This is especially important in the context of government funded ICT innovation and adoption initiatives such as in health care and education.

Public sector procurement practices should be examined to ensure that OSS competes on a level playing field - OSS should not be given preferential treatment but should be allowed to compete on its own merits and value. Government procurement practices will need to be updated to allow this to occur.

Cost saving is the primary driver for initial adoption, but adopting OSS is often transformative - when successfully implemented OSS opens a new world of possibilities and a whole new perspective on the opportunity cost of pursuing the status quo. Implementing and effectively using OSS can have significant impact on organizational policies and procedures, from human resources to operations to legal.

In many ways OSS can be seen as a shift back to reliance on highly skilled internal ICT talent – in several ways adoption of OSS represents a shift away from past trends of outsourcing skilled IT talent, back to greater user involvement and responsibility in ICT innovation, development and deployment.

Collaboration is an effective competitive strategy - research and support for collaborative communities development and a definition of an “electronic” commons by the private and public sector is of strategic importance to Canada's future.

It is clear that collaboration, the heart of open source, is an extremely effective accelerator for innovation and its dissemination. But this is not an exact science and needs support and research funding. Government is uniquely positioned to stimulate community “aggregation” in much the same way as demand aggregation has been used as a strategy for encouraging the adoption of new telecommunication technologies.

A participant in the public consultation process succinctly summed it the Canadian challenge and opportunity this way: “Will there be any government leadership or will the leadership continue to come from the Open Source, academic, and business communities. If education surrounding Open Source is a priority, it needs to be supported in a way that is pan-Canadian. This will only happen with federal support and incentives that are accessible to all sectors and regions. There is

potential to tap into the tradition of Canadian social equity and apply those nationally established values to Open Source innovation.”

1. Introduction

As of June 2003, it is estimated that over 70 policy proposals, positions or actual government decisions have been made concerning open source software (OSS) in some 24 countries around the world. This year, the topic of OSS is on the political agenda of many developed and developing countries and it will be debated in a number of fora hosted by many of the most influential of international and regional political bodies. OSS is indeed *au menu du jour*.

In Canada, the Federal Government's first public initiative in response to the OSS phenomenon was the hosting by Public Works and Government Services Canada (PWGSC) of the week-long "Open Source Software Solutions Showcase" in Ottawa, in May 2002. This event featured the author of a "Study into the use of Open Source Software in the public sector" for the European Commission (Unisys Belgium, 2001). Already the OSS phenomenon was making weekly headlines in the mainstream press in Canada and around the world, with reports on foreign governments being generally favourable to what they considered a new option for public administrations to put a rein on their escalating information technology budgets. This, of course, was not the only consideration. Each country invoked its own mix of arguments, also including interoperability and open standards requirements, ease of customization, due diligence and enhanced security, development of local expertise and communities of practice, as well as political considerations such as national autonomy.

In November 2002, the Government of Canada issued a call for proposals for a Canadian strategic study of open source business opportunities. The results were to serve the Information and Communications Technology Branch at Industry Canada, whose mandate it is to promote the global competitiveness of Canadian ICT suppliers. For its part, the Architecture and Standards Directorate at PWGSC sought to assess the direct and indirect implications of open source business models in government IT investments and selections as a means of operationalizing Treasury Board Secretariat's Federated Architecture Program. It was expected that study results might justify a review of existing practices and guidelines for the procurement of computer equipment and software by federal departments and agencies.

The Study

This study (the Study) remedies a lack of information on OSS awareness, initiatives, opinions and attitudes in Canada. The Study ran from January to June, 2003 and was conducted by e-cology Corporation. Specific deliverables included:

- A scan and review of commercial and non-commercial open source business models for software, applications and services delivery, to identify recent trends in Canada, the United States and other major markets, and the most credible forecasts of future trends;
- Industry profiles of key ICT suppliers in Canada who support or supply open source software, applications and/or services;
- Assessment of the engagement of business, government, academia and civil society organizations in Canada toward open source, to better understand awareness, concerns about support and liability and conditions for acceptance;
- Assessment of the business advantages of alternative open source software licenses and marketing strategies, from the standpoint of both suppliers and users;
- A synthesis of the issues, opportunities and constraints for Canadian industry and government decision-makers.

The Methodology

The methodology included scanning the vast international and Canadian literature published on open source, its historical milestones and coming of age, reports by proponents and detractors, neutral studies by well-known research consultancy and news reports of all kinds.

In February 2003, a workshop on the futures of software and open source in Canada was held in Ottawa. Some 25 stakeholders from industry and government were consulted on key drivers for OSS in response to the question: *“Would Canada be better off, financially and socially, if Government specifies open source as an alternative to proprietary licensing of its funded software development?”*

In March 2003, Canadians were invited to respond to a questionnaire posted on the Study website, www.e-cology.ca/canfloss. With the benefit of additional promotion in May, over 180 responses had been received and analyzed by June 15, 2003.

Finally, at the time of writing, 17 Canadian companies active in open source business had been profiled to produce fact sheets on their products and services. Individual, in-depth interviews had been held with 19 opinion leaders and experts. Collectively, the various forms of data and information permitted a triangulation of findings that proved very useful in assessing the implications and complex nature of open source business and culture.

The Report

The report is organized in two volumes. Volume 1, this document, contains five Chapters that cover the methods and data measured in the study, and the analysis of trends and forecasts of the future. Chapter 2 contains the primary research on OSS in Canada, augmented with general trends and global activity described in Chapter 3. Chapter 4 deals with market opportunities and Chapter 5 provides an overall synthesis of findings.

Volume 2 contains a single Chapter 6, which is a series of appendixes with detailed information from the Study, including questionnaire results, profiles, licenses and scenario workshop report. Both volumes are available on www.e-cology.ca/canfloss/report.

2. Canadian Open Source Adoption, Capabilities and Future

2.1. The Canadian Open Source Landscape in 2003

The Canadian press has recently begun to report significant open source adoption in Canada. Last April, The Globe and Mail reported that Toronto-based International Data Corp. (Canada) Ltd. anticipates Linux growing at a rate of 31 per cent a year, 10 times as fast as other operating systems. The main motivation for adoption of open source in firms like Mark's Work Wearhouse of Calgary is to be able to deliver more for less⁸.

This Study demonstrates there is significant open source development activity in Canada, notably in Vancouver, Calgary, Toronto, Ottawa and Montreal. The most significant player is IBM, with substantial investments in such open source platforms as Linux, Eclipse and Globus. Other notable Canadian software developers include Vancouver's ActiveState, which bills itself as a global leader in applied open source software, with over 70% of Fortune 500 companies depending on its technology. Many companies like InnoVision have ported their proprietary products to Linux are now considering offering these under open source license.

Among Canadian sectors, K-12 Education is particularly active. On June 1, 2003, the University of Sherbrooke launched EduLinux, a Linux distribution intended for office and educational use. Easy to set up and use, EduLinux includes a totally free operating system as well as a complete software suite for the personal computer: Internet navigator, word processor, spreadsheet, presentation program, CD-burner, DVD player and games. In British Columbia, all 40 elementary schools and many secondary schools of the Kamloops School District converted to Linux in the summer of 2001, achieving enhanced manageability and availability of a variety of educational software. In early 2003 a consortium of Quebec school boards working in cooperation with several public and private research organizations launched a project called MILLE, "Modèle d'Infrastructure de logiciels libres en Éducation", to document best practices for net-centric, open source portal architectures in Education using broadband networks. Other examples include the Battlefords district and Edam Saskatchewan, Seven Oaks School Division No.10 in Winnipeg, and Monarch Park Collegiate in Toronto⁹.

Numerous web-based advocacy¹⁰ and community groups¹¹, as well as special interest groups support OSS in Canada. Linux user groups exist with over 38 formally registered groups in 10 provinces and territories¹². Specific examples include: Python user groups exist in Ottawa, Toronto, Vancouver and Winnipeg¹³. Perl is another example of a platform supported by a well-organized user community with registered locations in four provinces¹⁴. Conferences that include open source are now too numerous to list; they range from IT specialties that include open source as a major theme¹⁵ to specialized open source topics for business¹⁶.

⁸ April 24, Globe and Mail. Firms buy into open-source software. Kevin Marron.

⁹ <http://casestudy.seul.org/cgi-bin/caseview0.pl>

¹⁰ See for example, Canopener, www.canopener.ca and www.linuxhelp.ca/lugs/canada.php

¹¹ See for example; Flora, www.flora.org

¹² See, www.linux.org/groups/canada/

¹³ See, www.python.org/UserGroups.html

¹⁴ See, www.pm.org/groups/north_america.html

¹⁵ For example, the Canadian National Higher Education IT Conference; www.brocku.ca/it2003/topics.html

¹⁶ For example, the Business of Open Source Software; <http://oclug.on.ca/boss/>

Two national industry associations, the Information Technology Association of Canada (ITAC), and the Canadian Advanced Technology Association (CATA) have made public position statements on OSS as a viable approach to be considered along with contemporary proprietary models. The National Research Council of Canada (NRC) is developing an OSS guidebook for investigators who use and/or develop OSS as part of publicly funded research. Public Works and Government Services Canada and the Treasury Board Secretariat of Canada acknowledge both OSS and proprietary software are in use within federal departments and they expect both will play a part in the renewal of the enterprise architecture for government on-line delivery.

A recent workshop sponsored by the Center for Strategic and International Studies (CSIS) in Washington reported 24 countries were reviewing over 70 policy proposals to include OSS in their software procurement. The message here, as elsewhere, is that public administrations are being pressured to procure the best solution, whether open source or proprietary, and that OSS should be a fair option. Often fairness requires a higher level of awareness to create a level playing field. An example of a small but significant first step towards fairness is Public Works and Government Services Canada reviewing its guidelines and processes with the view of making it easier for suppliers of OSS solutions and services to register on the Software Acquisition Reference Centre (SARC) website.

Canada continues to debate the merits of OSS while the technology continues to diffuse into most large organizations, both public and private. A search on websites hosting open source projects, such as SourceForge, shows Canada is very much present but behind countries like the US and UK. Canada will have a distance to go to take full advantage of open source productivity and business opportunities. The genesis of this Study was precisely to characterize this gap by measuring Canadian OSS adoption and development.

2.2. Methodology

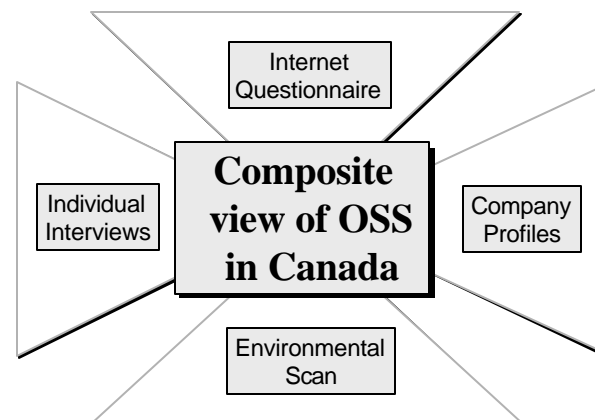
Three primary methods of data collection were used for the Study:

- Quantitative on-line *questionnaire*,
- Qualitative individual *interviews*, and
- Succinct *profiles* of Canadian companies that develop or use OSS for business advantage

Secondary methods included an environmental scan with content analysis of documented reports and studies, trade magazines, and media reports. Study findings were posted on the Project web site for public consultation and feedback via an online open discussion forum (canfloss-discuss@lists.sourceforge.net).

The methods enabled OSS in Canada to be observed through four lenses: the Internet questionnaire, company profiles, individual interviews and an environmental scan through the literature. Each perspective tells a different story of what OSS is and may become in Canada. The composite picture developed from these views (Figure 2.0) provided the opportunity to triangulate data and increase (or decrease) confidence in their accuracy.

Figure 2.0

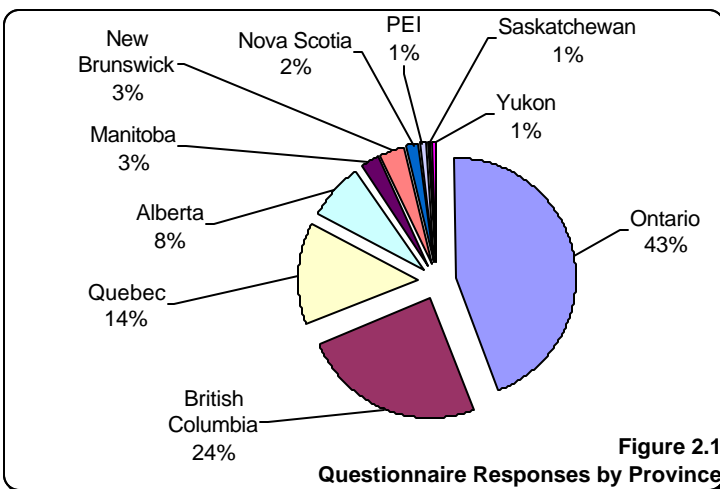


2.3. Primary Research – The Online Questionnaire

2.3.1. Questionnaire Design and Characteristics of the Sample Population

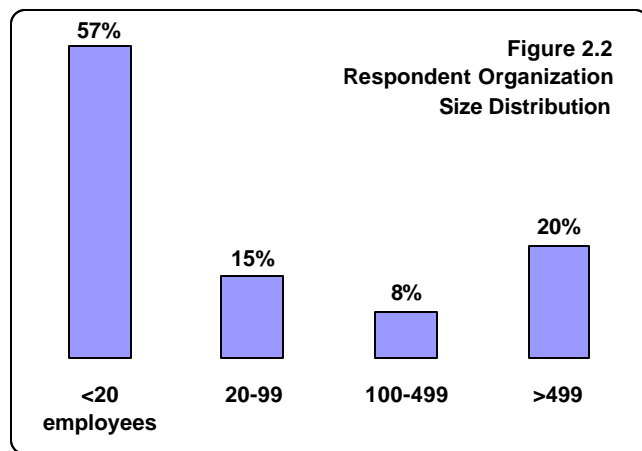
The questionnaire (see Appendix A) was designed to assess awareness, development, and use of OSS in Canada. Its design was influenced by previous research on OSS and it was developed in consultation with the Project Advisory Committee. The invitation to respond to the online questionnaire was announced at the end of March 2003 on numerous list servers and through several industry associations. An invitation was also placed via the MERX electronic tendering system. The questionnaire was structured in five parts:

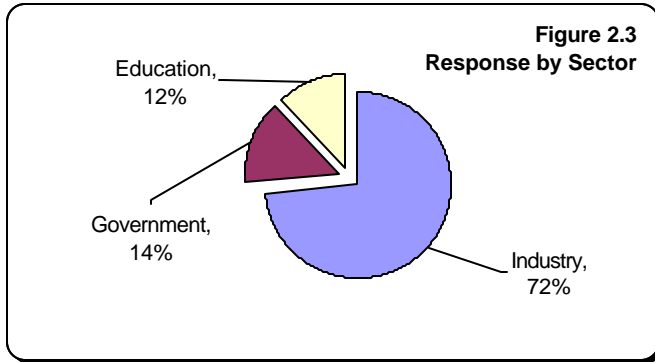
- Respondent identification and organization profile
- OSS Application Use and Development
- Open Source Services purchased, sold and donated
- Open Source Strategic Considerations, such as maturity, strategic fit, business benefits and drivers related to open source, and government procurement
- Final comments, which solicited opinion and invited respondents to volunteer for subsequent interviews



By June 20, 2003, 183 valid responses had been received. Less than one percent of responses were rejected on the basis of duplication or frivolous entries. The number of responses from each province is approximately proportional to population size. The exceptions shown in Figure 2.1 are B.C. and Quebec, which respectively had approximately twice and half the number expected, relative to provincial population size.

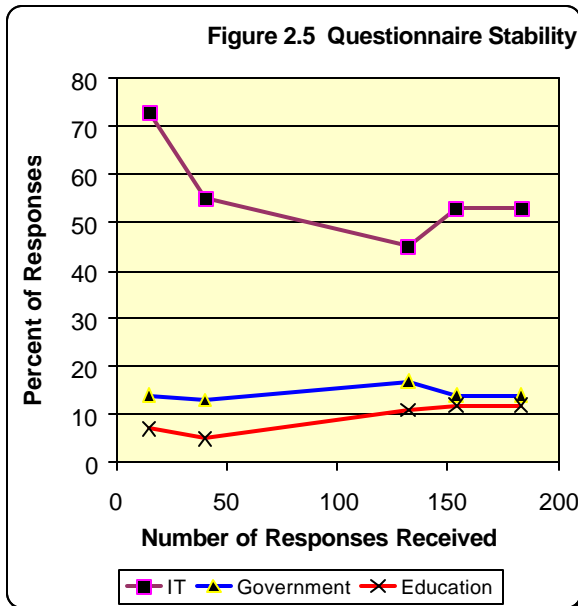
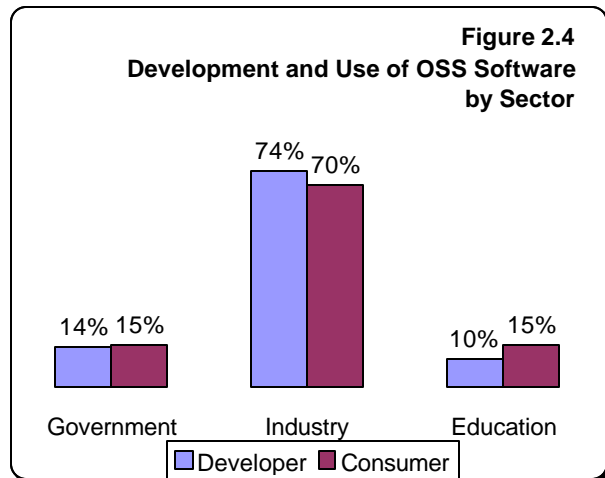
Figure 2.2 shows that the majority of respondents (57%) were from small organizations of less than 20 employees. There were 20% from large organizations with 500 or more employees.





The distribution of responses by sector is illustrated in Figure 2.3. The largest number of respondents were from the Industry sector (representing Information Technology, Banking, Financial Services, Manufacturing, Retail, Telecommunications, Entertainment), followed by Government (Government-Federal, Government-Provincial, Government-Municipal, Government-Other, Health) and Education. Not shown is 'the smallest category other' at 2%.

Another characteristic of the population of respondents is that OSS developers and consumers are almost equally represented in each sector, Figure 2.4. This may point to a similar level of OSS sophistication in government, industry and education.



A measure of the consistency of the population sample was obtained by monitoring the relative number of responses by sector. After approximately 150 responses had been obtained, the relative proportions stabilized. Figure 2.5 shows three examples, the percent of responses classified as either IT, Government or Education.

2.3.2. Open Source Software Application Development and Use in Canada

The goal of this part of the questionnaire was to measure the extent of OSS application development activity, sharing and use in Canada. The questions sought to obtain an indication of the level of involvement in open source development “communities”.

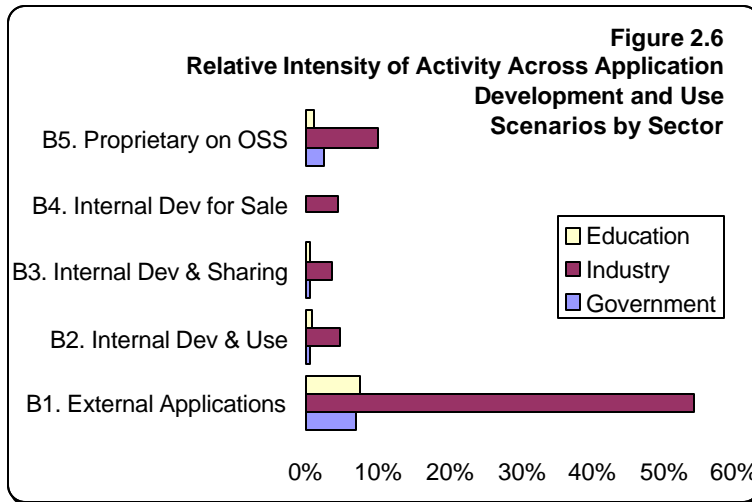


Figure 2.6 summarizes the relative intensity of OSS development and use under each of five scenarios described in the questionnaire (see Appendix B for definitions). Findings indicate that the respondents use mainly OSS applications developed outside their organizations and that in-house OSS development is greatest in Industry.

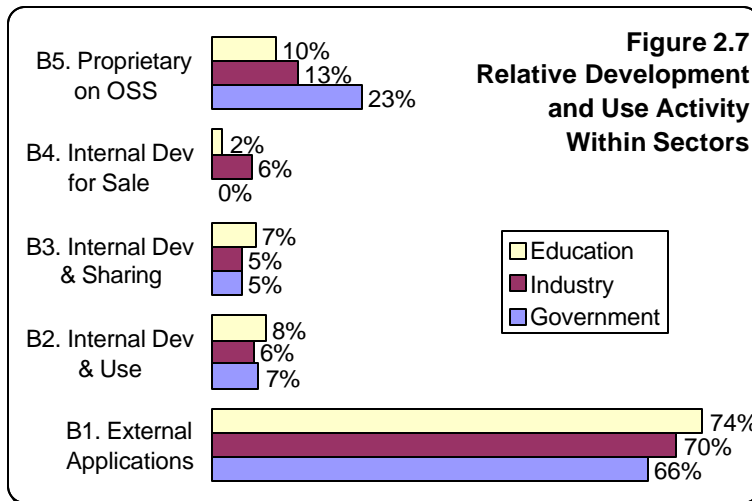
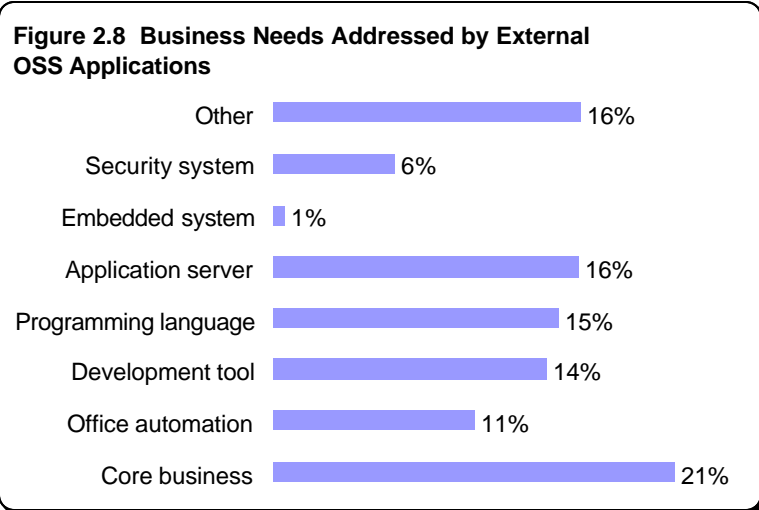


Figure 2.7 indicates that each sector has similar patterns of intensity under each scenario. A key exception is the development of proprietary applications on OSS platforms, where the Government Sector showed twice the level of activity of the other sectors.

These findings are analyzed and presented in greater detail under separate headings in the following narrative.

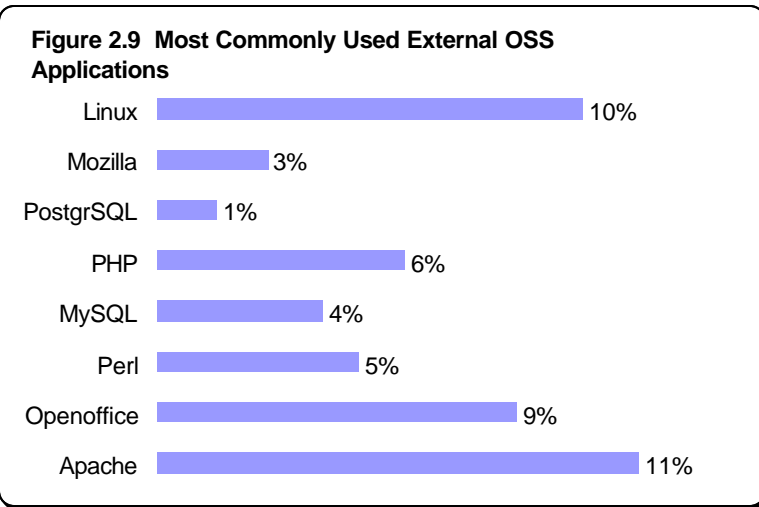
Use of Externally Developed Open Source Software

Figure 2.8 illustrates the range of business needs being addressed by external OSS applications. Of the 1185 entries, Core Business¹⁷ was the primary business need met, accounting for 21% of entries. The other categories of needs, other than Embedded Systems and Security Systems, were listed with approximately equal frequency.



These observations point to the availability of a significant range of externally developed OSS applications capable of fulfilling core business needs. This finding was unexpected because of the strong association of OSS with customization and customer driven development and enhancement. This suggests that the respondents trust open source technologies as substitutes for proprietary solutions.

Figure 2.9 lists the externally developed applications that respondents reported using.



Apache, OpenOffice and Linux received the most frequent mentions, together accounting for 30% of OSS applications in use.

¹⁷ For definitions please refer to the Glossary located in the Appendix.

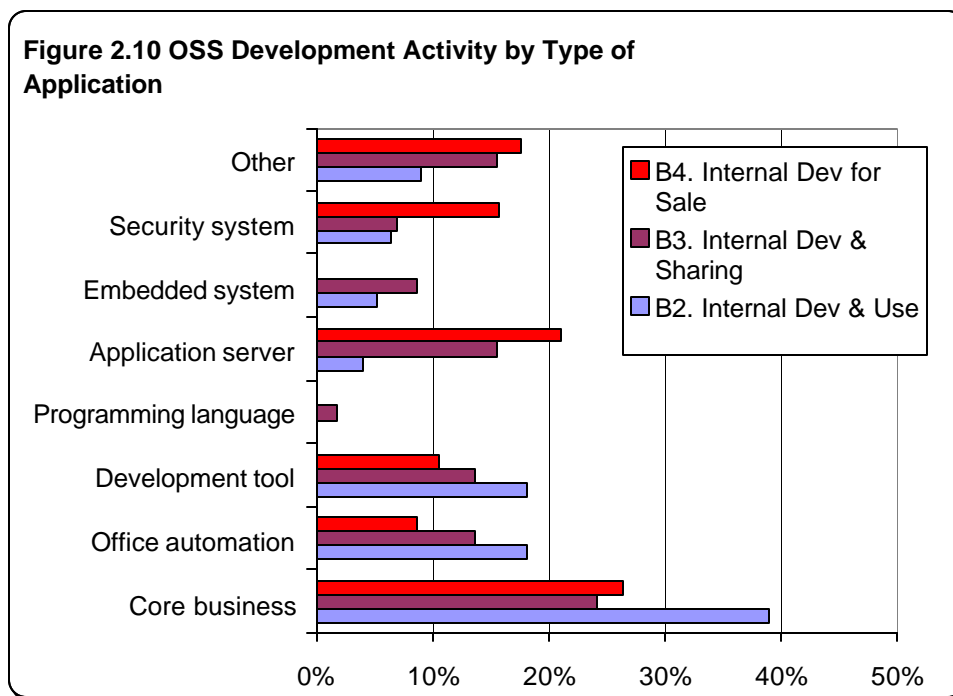
Open Source Software Development Activity – Internal Use, Sharing, Commercial

The next segment of the questionnaire focused on OSS development activity for internal use, development for internal use and sharing, and for commercial exploitation.

The objectives were:

- To gauge how much in-house OSS development is taking place,
- To identify the business needs being targeted,
- To understand sector participation and involvement in OSS development
- To develop an overview of OSS development activity for commercial purposes

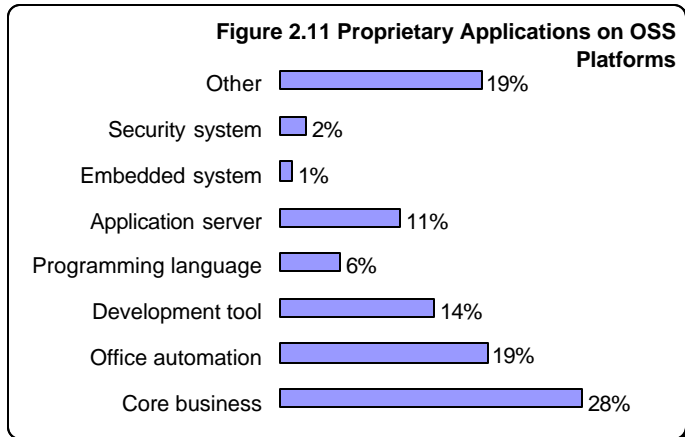
Figure 2.10 summarizes responses for each of the three development scenarios by type of application (see Appendix B and G for definitions). Core Business is the dominant target application for all three scenarios. OSS applications developed for commercial exploitation target primarily Core Business, Application Server, Security and Other categories. No activity in Embedded Systems and Programming Language categories was recorded. Core



Business applications development for internal use only accounts for 40% of in-house OSS development activity. A possible explanation is that Core Business applications tend to be more specialized and strategic and therefore on average are less likely to be shared. By contrast Application Server and Embedded Systems may be more generic and attract more community involvement in external peer review and improvement.

Development of Proprietary Applications on Open Source Platforms

A critical success factor for a new operating system or hardware/software platform is the rapid development of a large selection of end user applications. This can be accomplished by convincing successful software companies to port their applications to the new platform. In the case of Linux, IBM's investment of more than \$1.4 billion has had an important impact on its market share. Companies such as Oracle, HP, PeopleSoft, SAP and many others are now porting their applications to the Linux operating system.



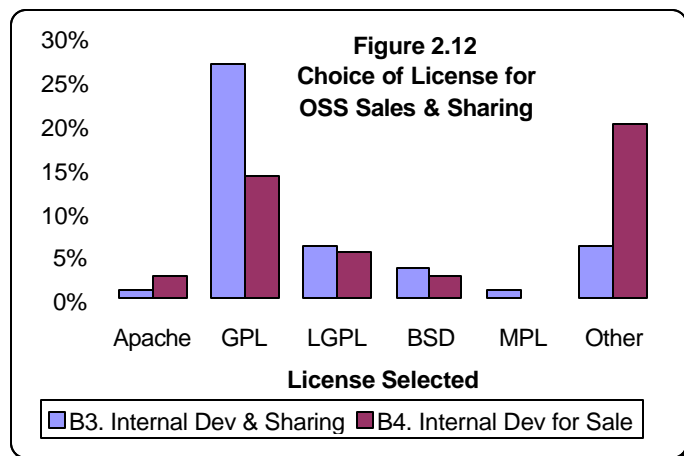
The respondent data include 162 instances of Proprietary Applications implemented on open source platforms. Figure 2.11 summarizes the observations. From highest to lowest, Core Business, Office Automation, Other and Development Tools were the categories with the greatest number of implementations.

Given the open source paradigm shift under way in Canada, questions for follow-up would be: what are the next steps for organizations that “dip their toes in the waters” of OSS via popular proprietary applications? How many venture in deeper and how quickly? These are important questions with respect to timing and sizing investment in OSS capability for the ICT industry as well as factors to consider if you are an organization poised to adopt OSS.

Choice of Software Licenses

Respondents were asked to identify what types of licenses are being used under each scenario. Most respondents did not indicate the type of license associated for externally developed OSS applications, which could imply either they do not bother with this information, did not know the answer, or assumed it was not worth reporting. Similarly, most respondents did not indicate the type of license for applications developed for internal use only, which is logical since there is no intention of sharing.

Figure 2.12 shows that the GPL license is most frequently used overall, followed by the LGPL and BSD licenses. For internally developed OSS applications intended to be shared, the GPL was selected five times more often than the LGPL, the next most popular license. For software sold as part of a commercial offering, GPL was used less frequently but still more than twice as often as the LGPL. There were numerous responses in the ‘Other license’ category for applications developed for commercial purposes. Further investigation is needed to determine whether these were OSS or proprietary licenses, or under a dual license.



2.3.3. Open Source Services in Canada

Types of OSS Services Sold and/or Donated

Combining all sectors, the 183 respondents reported 898 instances of OSS services bought, sold or shared. Figure 2.13 shows the relative distribution of the entries by type of transaction.

The proportion of services sold points to the existence of a reasonable level of commercial activity with respect to OSS services. Additionally there is much OSS service ‘donation’ taking place, which will be discussed later in the section exploring involvement in open source development communities.

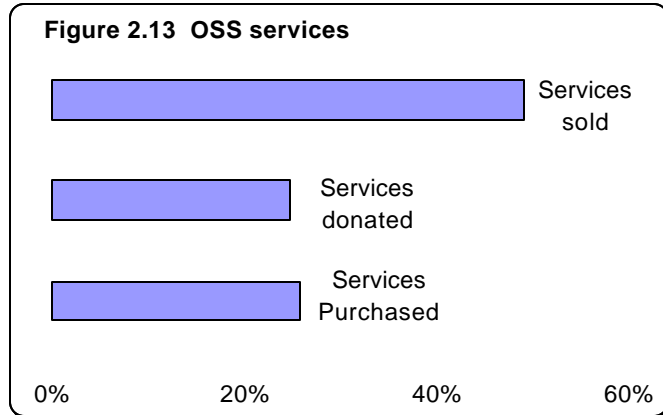
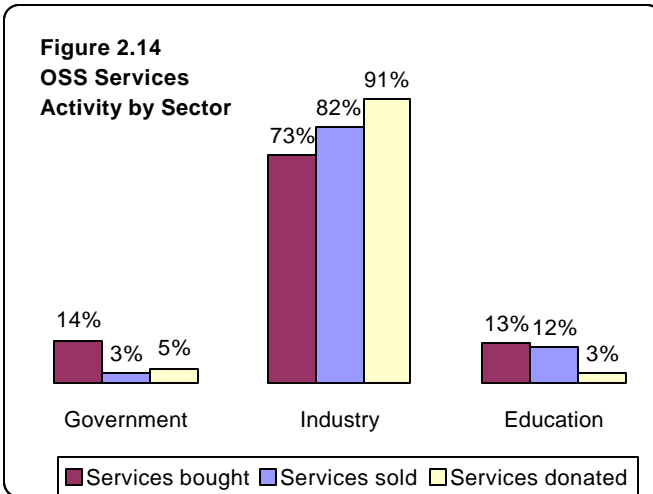


Figure 2.14 illustrates the relative level of service activity reported for each scenario: buying, selling and donating by sector.

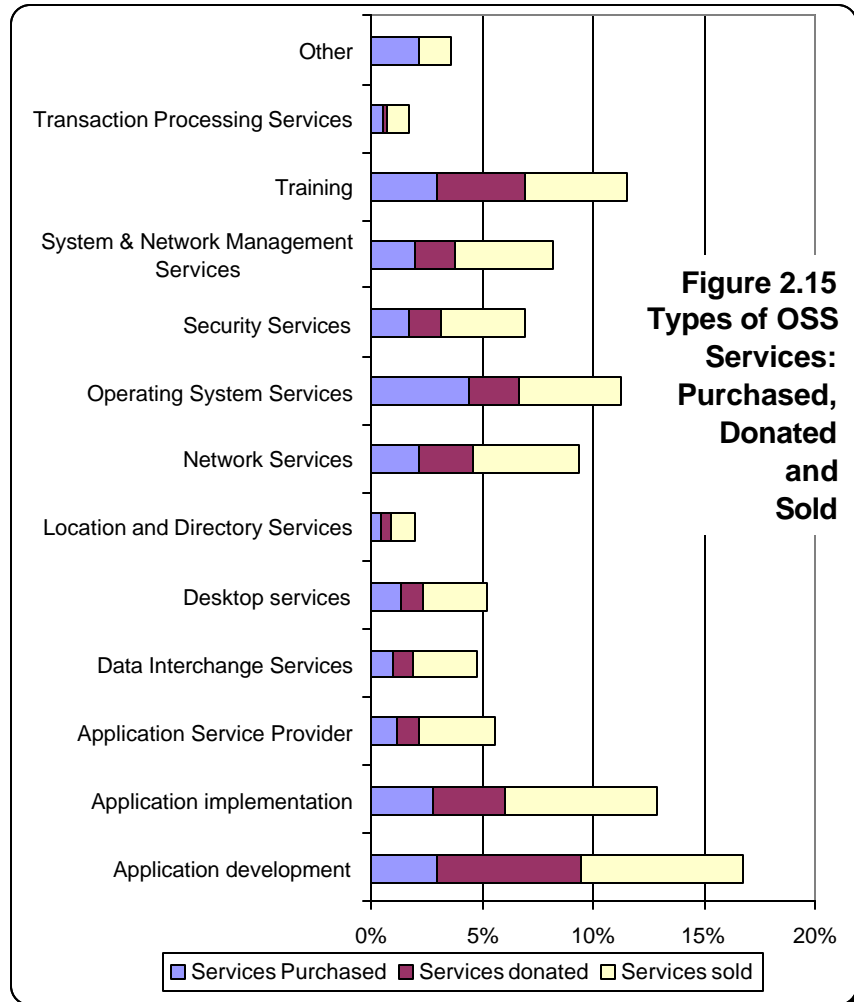


Most OSS service activity takes place in the Industry Sector, under all three scenarios. Further probing and analysis would be required to explain the nature of OSS service sales in the Government Sector.

Figure 2.15 shows the relative proportion of responses for OSS Services donated purchased or sold.

Application Development Services represent the highest proportion, followed by Implementation Services, then Training, Operating Systems and Network Services with each of type representing at least 10% of the responses.

These findings are consistent with the expectation that initial areas of adoption and growth for OSS are in custom development and support for operating systems and platforms. Desktop Services activity reported was low at 5%.



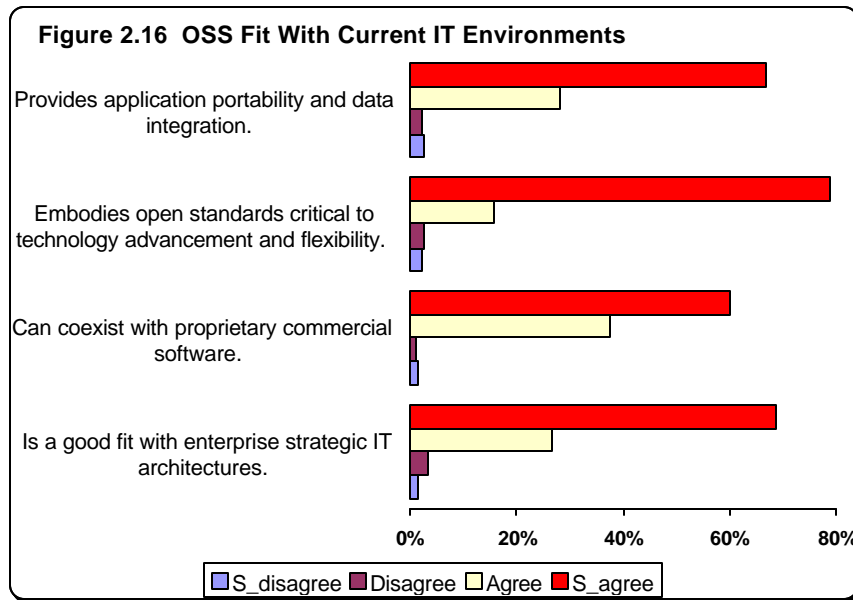
2.3.4. Open Source Strategic Considerations

Respondents were also asked about their strategic perspective on OSS applications and services, about the fit of OSS into existing IT environments and strategies, business drivers and benefits, future trends and government procurement policies.

Open Source Fit into Current IT Environments

Figure 2.16 presents the range of respondent opinion regarding how well open source applications fit into current IT environments. The dimensions explored were: fit with respect to data integration, IT architecture, standards compatibility and coexistence with commercial applications.

Over 90% of respondents expressed “agreement” or “strong agreement” that open source is a good fit for current IT environments for each of the four dimensions of “fit.” Some 79% of respondents strongly agreed that open source embodied “open standards critical to technology advancement and flexibility”.



Business Value of Open Source – Drivers, Benefits and Maturity

Respondents were asked about business drivers for the adoption of open source, the perceived business benefits of open source and the level of maturity of open source vis-a-vis its suitability for business use. The objective was to get a sense of the considerations or motivations for adopting open source.

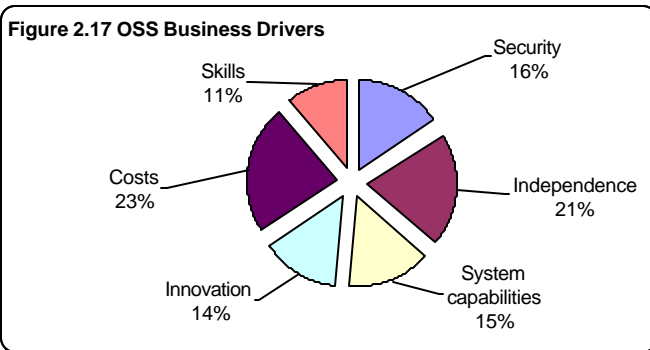
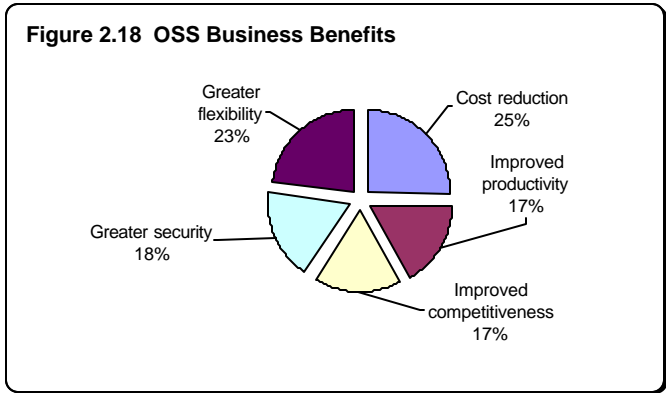
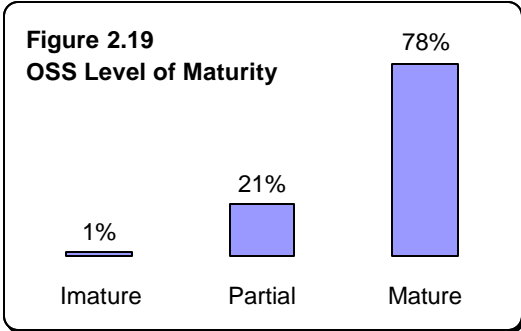


Figure 2.17 presents the six business drivers listed in the questionnaire. It indicates that all six were considered to be important in influencing adoption of OSS solutions. The major business drivers were cost reduction and vendor independence.



The top rated benefits were cost reduction (25%) and greater flexibility/independence (23%), as illustrated in Figure 2.18. Respondents were asked to rate the overall maturity of open source as follows: "still bleeding edge and not ready for business use", "suitable for some "infrastructure" open source applications such as web servers, firewalls and data servers" or "sufficiently mature for business use".

Figure 2.19 indicates that the majority of respondents were of the opinion that open source applications were sufficiently mature for business use. Very few (1%) felt that open source applications were immature and not suitable for business. These findings are consistent with the opinions on business drivers and benefits. This level of response may also reflect a self-selection bias in the population of survey respondents. It can be assumed that the majority of respondents are those with interest and experience in OSS and thus may not reflect the total population of technology users.



OSS Business Drivers, Benefits and Maturity – Respondent’s Comments

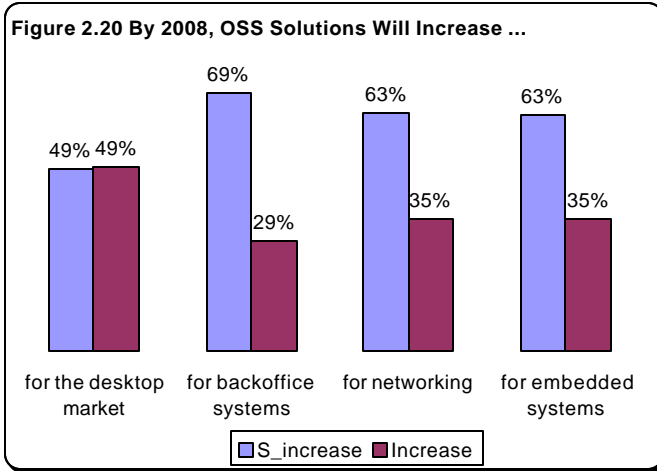
Business drivers not listed on the questionnaire which were frequently identified in the written comments included innovation, reliability, determined interactions, code independence, response time to bug-fixes, and compliance with open standards. These were accompanied by comments such as "... for a government agency, reducing licensing costs makes long term sense, considering limited budgets and the source of revenue". There were a few comments expressing an anti-proprietary software sentiment, in reaction to what is perceived abusive marketing tactic: "I believe this is more of a move away from something (Microsoft) than a move towards something".

The reported benefits emphasized quality and customizability. "[We] can create well-fitting solutions quickly and then are able to support them after-the-fact", and, "[OSS provides] access to high quality developers, and [the] ability to share development strategies, insights, and best practices". The importance of vendor independence was stressed, with comments such as, "Only with Open Source can organizations build on mutual success and cooperation. Everyone wins; nobody is held hostage." Costs were also mentioned, "OSS can reduce costs, improve security and provide a more stable environment than proprietary solutions". Security, too: "Security problems are rare and are fixed quickly". There were opinions on the broader impact of OSS, "there are also benefits that can be realized in education and training as well as social impacts". Of the very few qualifications made in the comments, the lack of support for OSS was raised as an issue that should be assessed in context, "The tradeoff in using open source software is the lack of support which can impact productivity in software development".

Comments on OSS maturity were mixed. . "Different domains have different maturity. Some desktop-centric enterprise applications are new ... but in web-services FLOSS [free/libre open source software] has always been ahead". OSS for server and web-service applications was seen to be very competitive, while desktop solutions received very mixed reviews.

The Future of Open Source Software and Services

Respondents were asked to provide their opinions on what the future holds in store for OSS, whether the use of desktop, middleware or back office, networking and embedded applications would increase or decrease.



98% of respondents believed that the use of OSS applications would “increase” or “increase significantly” across categories; only 2% of respondents said that OSS use would decrease or decrease significantly. As may be seen in Figure 2.20, only for desktop applications were opinions equally divided between “increase” and “increase significantly”. In all the other categories the majority opinion is that use will “increase significantly”.

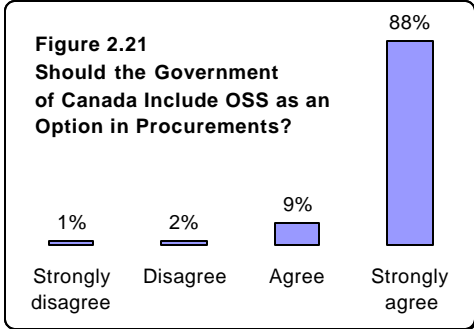
Respondents were then asked to voice their opinion on whether the use of open source services will increase or decrease over the next five years:

Future of Open Source Software and Services – Respondent’s Comments:

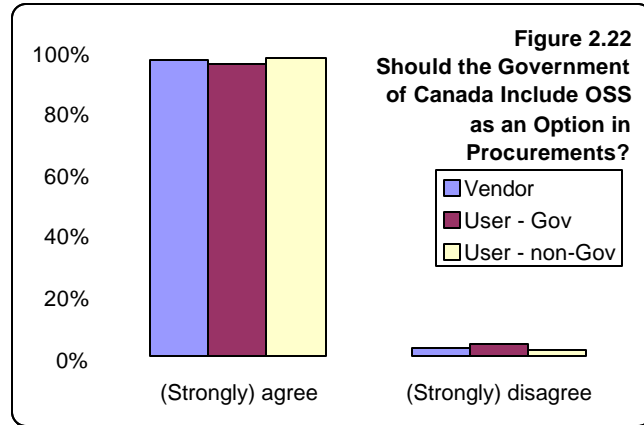
Overall the future of OSS, as described in the comments, is very positive, but not without some cautionary notes. Many respondents expressed a sense of impending acceleration in the use of OSS, with variations in speed depending on the type of applications. “Desktop market is [the] polar opposite to [an] embedded market”. The desktop is seen by most as a “final frontier” and embedded systems are a possible gateway to this market. The crucial role of services for OSS sustainability was acknowledged: “The service component is extremely significant to OSS success, but adoption requires a major cognitive shift.” The increased popularity of OSS offers new opportunities for the IT service industry.

Government Procurement and Open Source

The statement “Canadian Federal Government IT procurement policy should include the option of open source solutions” was supported by 88% (strong agreement) and 9% (agreement) of respondents. Several respondents acknowledged “incentives” such as decreases in government funding and public pressure for more accountability and transparency



The data were recast to assess any variation in support between the respondents identified as “Vendor”, “Government User” and “Other User”. The results, shown in Figure 2.22 clearly indicate a strong level of agreement and little variation among all respondents.



Government Procurement and Open Source, Respondent's Comments:

Most commented that the Government of Canada should include OSS in its procurement policies, on an equal footing with proprietary software. It was pointed out

that this would require changes to the current evaluation procedures: “[with OSS, it] ... becomes too difficult to qualify competing bids”. Extreme positions were also supported; some calling for Government-mandated procurement of OSS, others advocating that the Government wait several years before engaging with OSS. There were several comments on possible cost savings with OSS in response to taxpayer demands for better value for money spent: “much stronger policy is warranted - only use proprietary products as a last resort, all government developed software must be freely available to all citizens”. Local economies were also a focus of comment. Many comments demonstrated a deep understanding of OSS issues and the notion that software is only part of broader system of technology and organization. “...secondary effects of free software ... procurement should [never] be evaluated in isolation from other public policy”. The majority of comments had to do with Government as a purchaser of OSS; a smaller number of comments addressed possible roles for Government in the promotion of OSS as an industry. “The government should fuel development and aid adoption” by providing more information and support for effective decision-making.

The Final Word – Respondent's Final Comments

The comments provided by the respondents at the end of the questionnaire are a rich source of qualitative information. Half of the 183 respondents provided more than 180 comments. The most frequent comments concerned “E2 – Government inclusion of OSS as a procurement option” and “D4 – maturity and readiness of OSS for business use”.

A Sample of Respondent's Final Written Comments:

OSS applications were seen as a viable option and even as options of choice for secure web servers. “Our research consistently shows open source as having the greatest potential for assuring secure computing infrastructure”. The comments suggest that bottom-up support for OSS is now hampered by a lack of policy and leadership in large organizations. One respondent commented that the Government of Canada could take a leadership role in promoting OSS for enhanced public accountability and transparency “... only Open Source guarantees the transparency and public accountability needed for Government. Governments all around the world are adopting Open Source software”.

Respondents believed that Canada is well positioned to reap OSS benefits for competitive advantage. “The technology sector has taken a huge beating over the past year or so and there are many tech savvy people looking for work. If the Canadian government gets on board with OSS it could create many jobs, improve the economy and best of all reduce operating costs”. One of the few comments on the fundamental nature of open source insisted on the essential dynamics driving OSS; “you should think of software as something similar to scientific data - it increases in value when it is published for everyone to use”.

Canadian Participation in OSS Development Communities

The following section examines how Canadian users and developers of OSS applications and services are engaged in OSS development communities. Do they critique, improve and re-use OSS, or do they simply draw on the resources of the global open source commons?

We hypothesize that more community participation would be an indicator of a more sophisticated level of adoption of OSS and deeper penetration into organization culture. Data collected in the Study provides some insight into the answers to these questions.

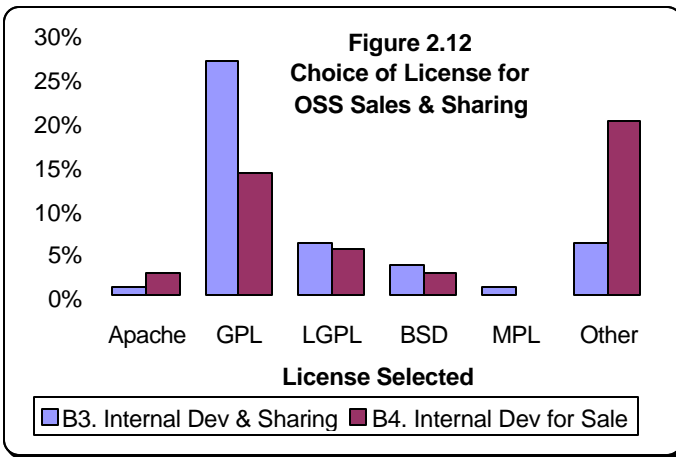
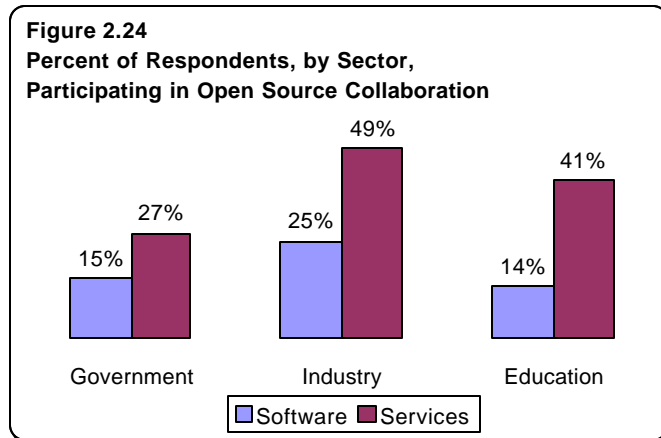


Figure 2.12 (previously shown and repeated here) indicates that the GPL license followed by the derivative LGPL license is the dominant license of choice for respondents who share their applications externally. For those selling their applications, the GPL license is second to “Other” in the license categories.

Such findings suggest a moderate level of commitment and participation in open source development communities.

A more direct indicator is the relative percentage of respondents who reported their organization donated software applications and services to open source development communities. Figure 2.24 shows that organizations belonging to the Industry and Education sectors donated many services, essentially employee time and skills, to OSS development communities. The contribution of software was highest in Industry at 25% compared to Government and Education at 15% and 14% respectively. These findings suggest that it would be worthwhile to better understand how and why drivers and motivation vary by sector.



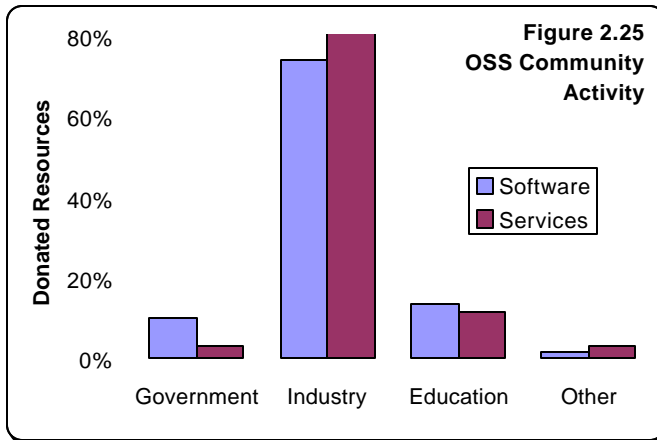


Figure 2.25 compares the relative contribution of each sector to OSS development communities. Industry is clearly the dominant contributor of resources to open source communities from this perspective, followed by Education and Government.

In summary, the data and its analysis strongly suggest that Canadian users and developers of OSS applications are engaged in the open source cycle of development, critique, improvement and re-use. Open source is penetrating organizational culture and behaviour. The extent to which this extends to all management and operational levels is an important question for further study. This is especially relevant given the grass roots nature of OSS cultural change and the majority opinion of respondents that open source is of significant benefit to organizations and is ready for core business use.

2.4. Interviews

2.4.1. Methods

An ethnographic approach was used for the qualitative analysis of questionnaire data, largely because of the affinity of ethnography with OSS culture¹⁸. As part of the Study, 19 interviews were conducted with individuals drawn from Industry, Education and Government in approximately equal proportion. Represented were major universities and colleges, healthcare facilities, basic research facilities, software vendors, and IT service companies. Participants were selected for their senior level involvement in information technology, as educators or decision-makers, and not necessarily for any prior knowledge of OSS. This was deemed important for providing a balancing perspective to that obtained in the questionnaire.

The same protocol was used for each telephone interview. It consisted of an introductory explanation of the Study and clarification of the purpose and expectations of the interview process. The interviewee was asked to explain their role in the organization and their general awareness of open source. The interviews then followed a semi-structured and open-ended dialogue, based upon thematic inquiry¹⁹. A literature review and a pilot group of four individuals were used to identify initial themes that guided the remaining interviews²⁰. For each initial theme, the interviewee explained their perspective; new topics and emergent lines of thinking were encouraged. After all initial themes were completed, the question, "what have we missed" was asked, which sometimes elicited the most valuable comments. Interviews generally lasted 30-45 minutes.

2.4.2. Findings

There were 8 themes that emerged, collectively from the interviews:

- congruence with the questionnaire
- balanced awareness
- OSS is present or absent for good reason
- educational preparedness
- business dynamics
- public accountability
- role of government
- fuzzy future

Questionnaire Congruence

The interviews served to validate the results of the on-line questionnaire and the written comments.

We were told that Apache and Linux were the dominant OSS products in use. Most interviewees reported that proprietary software was used for desktop applications. Many felt OSS was most applicable to niche solutions, with limited application where development effort is large and market potential small.

¹⁸ Ethnography describes and interprets a cultural or social group or system. Data analysis includes themes and patterns, narrative; data collection includes groups, participant observation, interviews, and documents.

¹⁹ See, for example, J.W. Creswell (1998). *Qualitative Inquiry & Research Design*.

²⁰ The initial themes were: products and services, business strategy, internal and external culture, open standards, future trends, intellectual property and government.

Balanced Perspective

Interviewees shared a high level of awareness of OSS and of tensions between proprietary software and OSS “camps”.

In most organizations, OSS generally co-existed with proprietary solutions. There were few dogmatic stances for or against OSS. Software developers felt that the OSS culture was beneficial for organizational culture: “The key benefit [of OSS] is cultural, not ... code.” Decision-makers, although not necessarily committed to OSS, favoured some level of internal OSS competence given potential for more OSS use in the future.

OSS is Present or Absent for Good Reasons

Despite the common portrayal of OSS and proprietary software as competing options, the vast majority of interviewees reported that decisions to implement OSS, or not, were made on the basis of pragmatic considerations.

Where OSS is extensively deployed, cost is an oft-quoted factor, as is rapid prototyping for quick entry into a function or market. Where OSS is not deployed, there were also valid explanations for not making the transition, such as current installed base, legacy systems or not having the right local skill mixes.

Educational Preparedness

At the university level OSS is extensively used in research and OSS community participation and software contribution is common.

OSS provides real world code and a rich educational experience for students. It is present in the curricula of Computer Science and Engineering faculties, generally within traditional courses such as operating systems and networking. OSS is also suited to research where the duration of a project or product is increasingly shorter, and emphasis is more on rapid innovation and less on sustainability. In these cases, OSS was seen as a more competitive solution.

There are few barriers to OSS in academic computing; the two that appear to be present in some cases were mentioned as particularly troublesome. The first is the dominant presence of proprietary software in campus computer services, and the associated intolerance for OSS solutions. The second barrier, particularly in research facilities, is the pressure to generate revenue from software rather than place code into the research commons.

With respect to administrative computing, OSS is beginning to be adopted in the K-12 school level, but is less prevalent in post-secondary education; “... [OSS] has not yet percolated up to the administrative systems”.

Business Dynamics

The OSS economic model was acknowledged to be crucially important, poorly understood and in need of resolution: “it is critical to solve the economic puzzle”.

Companies successful in selling OSS applications and services provide a very different business perspective. “We are constantly exploring new ways of doing business using the open source model.” Several interviewees reported that Linux is already a significant growth area for certification and training.

For traditional software consumers, where IT budgets are under intense pressure and proprietary software is extensively deployed and supported, OSS was seen as a costly distraction of high risk. Most favoured a case-by-case evaluation approach to OSS. In many cases, again characterized by fiscal pressure, a “wait and see” attitude prevails. Most were concerned about “total cost of ownership”, or more appropriately re-phrased “total cost of use”: training, documentation, consulting, application development, maintenance and support cost and worker productivity. The distraction of the short term pressures was for many a total barrier to fully evaluating OSS alternatives.

Interviewees view security as an issue that is both strongly for, and against the case of OSS. In favour of OSS is the fact that code is open to scrutiny of many developers; against OSS are the limited ability of most consumers to scrutinize applications and a broadened opportunity for malicious code to be introduced. “...at a time of intense security ... even the word ‘open’ is a problem ... when you want to be closed.”

With respect to barriers, consumer behavior received several mentions. The history of business transactions has established roles and expectations that are well engrained in our society. Buyers, sellers, and established equivalent monetary value all play important parts in consumer perceptions. Something free, be it an OSS license, is seen by some with suspicion, “there must be a catch”. Experience in large software procurements have taught the importance of legal accountability, and the Y2K bubble in IT spending has left as a residue the use of heightened discernment – all of which place OSS as the new entrant at an implicit disadvantage.

Consumers were also seen by several interviewees as risk averse and willing to tolerate less price-performance to remain with well-branded proprietary software. Documented in one response was, “the toughest thing to overcome is [to have the client] just to look at it, to overcome the religion”.

Several key IT decision makers were minimally aware of OSS but felt it was not a significant issue: “Not given it much thought”. Compared with more pressing issues, a choice between proprietary software and OSS lacks relevance and introduces unwanted risk. This is the case when the total costs of ownership are comparable. “[OSS is] not even in the radar, no questions from the field.”

Public Accountability

The overwhelming message was that all governments should avoid software vendor lock-in. OSS is seen as a legitimate option that should be considered on a level playing field with proprietary software. It was acknowledged that key OSS features are difficult to assess using conventional evaluation methods, and that new criteria in competitive bids are needed. “Government has a duty to save money ... and should consider OSS”.

Role of Government

As a promoter of Canadian industrial competitiveness in information and communications technology, interviewees encouraged the government to establish a framework for equal opportunity that would allow the marketplace to decide the best solutions. Public funds should be available to underwrite large OSS projects that have potential for widespread use and business opportunities for subsequent support.

Many viewed the most appropriate role of government in standards and education as one of informed facilitator. The primary opinion expressed on intellectual property was support for open knowledge in the public sector. There was strong support for the principle that software paid for with public funds should be returned to the public commons in the form of OSS. It was believed

that innovation is limited with proprietary software arrangements. One concern that was expressed was reduced tax revenue as a consequence of significant market penetration by OSS.

Fuzzy Future

Similar to questionnaire respondents, the majority of interviewees believe that OSS will be more prevalent in the future. Unlike the respondents, interviewees thought that its role on the desktop, and the rate and progression into proprietary software markets were very uncertain.

For business solutions, interviewees thought OSS will do well if it is competitive, but for the home market successful solutions must be characterized by absolute reliability (no support required) and interoperability with the most popular established solutions.

Commentary

In addition to the themes described above, the following comments reflect interpretations made during the interview process.

Open standards: this was a theme that remained silent for the most part. When questioned, most interviewees affirmed the value of open standards, with the acknowledgement that these have existed for a long time and can be used by proprietary software vendors to subvert the marketplace.

Source code: the value proposition for actually having source code was seen to be important for large organizations that will adapt code to unique requirements, and less so for individual consumers who may never make use of this capability.

Community: although few interviewees were active in the OSS community, those that were acknowledged the importance of community in developing international presence.

Reactivity: a number of interviewees raised the possibility that a significant component of the enthusiasm in OSS may be related more to anti-proprietary systems than to the intrinsic value of the approach itself. "Some people will be looking at OSS as a vote against Microsoft". The implications of this are that OSS sustainability may be overrated.

2.5. Profiles of Companies Engaged in OSS Business in Canada

2.5.1. Methods

The Study was mandated to include 20 profiles of Canadian IT companies using and developing OSS for competitive advantage. The standard format in Table 2.1 was used for individual requests for profiling.

Table 2.1

Company Profile Format	
Company Name	<i>In this cell, enter the legal name of your company</i>
Corporate Overview	<i>In this cell, describe your company in terms of markets, products and services. Include core competencies, particular strengths, and alliances, if any. If your company is a focused business unit within a larger organization, restrict this profile to your unit</i>
OSS Strategy	<i>In this cell, describe your approach to OSS; licenses used, distribution and packaging</i>
OSS Business Strategy	<i>In this cell, describe how you make money, whether from proprietary applications build upon OSS platforms, training, distribution, etc.</i>
Community Roles	<i>In this cell, describe the participation of your company in OSS community; sharing code, supporting projects and applications, etc.</i>
Corporate Address	<i>In this cell, enter the full address of your company</i>
Telephone	<i>In this cell, enter the area code and telephone number(s) of your company</i>
Parent Organization	<i>In this cell, enter the legal name of any holding or parent organizations</i>
Stock Listing	<i>In this cell, and if your company stock is publicly traded, enter the market and listing most applicable to your OSS activity</i>
Website	<i>In this cell, enter the URL of your web site(s)</i>
Number of employees	<i>In this cell, enter the number of full time equivalent employees</i>
Annual Gross Revenue or Budget	<i>In this cell enter the gross annual revenues or IT budget applicable to OSS. Itemize each product and service in the case of multiple offerings and activities</i>
Percent Exports	<i>In this cell, indicate the proportion of international sales or exports</i>
Sector	<i>In this cell indicate the sector(s) that most describe where your company is focused: choose from industry including voluntary sector, government including health care, education, and other (please specify)</i>
OS Community Participation	<i>In this section, include the specific participation in common OSS projects such as PERL, PYTHON, PHP, and APACHE</i>
OSS Products	
Used	<i>In this section include the OSS used by your company, distinguishing between those applied to development and those used to operate your business</i>
Developed	<i>In this section, list the OSS products developed by your company. Describe the licensing applied to each, and if proprietary components are included</i>
OSS Services	

Company Profile Format	
Purchased	<i>In this section, include those OSS services purchased for your business; include distributions, training, etc.</i>
Donated	<i>In this section, indicate OSS – code, training, bug fixes etc., donated to the OSS community at not cost</i>
Sold	<i>In this section, list the OSS products and services sold as part of your business model</i>

The profiles were designed to help understand what type of products and services were used in OSS business, and the types of strategies private companies use to derive a value proposition or competitive advantage using or developing OSS. The level of activity of each company in the various open source communities and the types of customers they attract were also assessed.

Over 75 candidate companies were identified; detailed profiles have been developed for the following 17 companies, which responded to the invitation.

Table 2.2 OSS Companies Profiled

Active State	www.activestate.com
CGI	www.cgi.com
Concept Solutions Corporation	www.conceptsolutionsbc.com
Emergence by Design Inc.	www.emergence.com
Etraffic Solutions Inc.	www.etrafficsolutions.com
IBM Canada	www.ibm.com/ca/en
Innovision Inc	www.innovision-inc.com
Linux Business Solutions	www.lxbiz.com
Macadamian Corporation	www.macadamian.com
Momentum IT Group	www.momentumitgroup.com
Open Concept Consulting	www.openconcept.ca
Palomino System Innovations	www.palominosys.com
PostgreSQL	www.pgsql.com
Roaring Penguin	www.roaringpenguin.com
Smaller Solutions	www.smallersolutions.ca
Starnix Inc.	www.starnix.com
Teledynamics Communications Inc.	www.teledyn.com

2.5.2. Findings

The profiles collected in this version of the Study are contained in Appendix C. They largely reflect the entrepreneurial nature of OSS business. If the two largest firms in the sample, being IBM and CGI, are excluded, the average length of time the companies have been in business is 4 years, with an average of 14 employees. In this reduced group, none was publicly traded, and exports averaged 1.3 million dollars, representing on average 30% of gross sales.

The 15 companies reported five different strategies for revenue generation, as shown in the following table. While single companies often reported multiple strategies, the dominant source of revenue was "Strategy 1 – proprietary solutions on OSS platforms", which was used by almost 90% of the companies profiled. "Strategy 2 - billable solutions that are contractually contributed back to the open source community", was least observed (10%). The remaining strategies for revenue generation were each used by approximately half of the companies.

Revenue Strategy
1 - Proprietary solutions on OSS platforms
2 - Open source solutions on OSS platforms
3 - Training in the installation and use of OSS
4 - Custom installation, application service provision
5 - Consultation and strategic advice on OSS options

Companies showed very little vertical market focus; instead, they were opportunistic in their marketing of OSS products and services. The notable exceptions were seen in companies focused on education and telecommunications.

The profiles captured an extensive range of active involvement in OSS project development communities, such as: Perl, Python, Apache, PHP, Mozilla, Linux, Tcl, Zope, PostgreSQL, WINE, Lucene, MySQL, BackEnd and OpenOffice. Thirty percent of companies did not report any OSS community involvement, whereas 25% reported being involved in four or more projects. Larger companies showed broader involvement in projects, likely due to diversity of interests and organizational capacity. Smaller companies with less resource appeared to be more focused in their contributions.

2.6. The Canadian Open Source Landscape in 2010

The previous sections in this chapter have developed a current state picture of open source in Canada. How might this change as we move towards the year 2010? How can such a forecast be developed when conventional trend analyses are not able to cope with the high level of unpredictability inherent in the open source model?

Scenario planning techniques are designed to *navigate* uncertainty rather than out-guess it and thus were chosen to paint a picture of OSS in Canada for the year 2010. Scenario planning is a group process that first seeks to discover the underlying forces of uncertainty. The essence of the scenario approach is identification of multiple futures, which are concurrently explored for OSS characteristics. Options for future action will likely prove to be dependent upon which scenario might play out, but in considering more than one future strategies become iterative and emergent, not fixed, and thereby more resilient to future unknowns.

2.6.1. Methods and Approach

The scenario planning method developed by Global Business Network (www.gbn.org) was used in the Study²¹. A combination of workshop and web-based consultation was used to obtain a high level of diversity and consultation. Planning began with a workshop sponsored by Industry Canada and attended by 20 participants²². The workshop completed the first three of a six-stage approach:

- Stage 1 – brainstorm factors and events affecting the answer to the focus question
- Stage 2 – select factors of highest impact and uncertainty
- Stage 3 – cluster similar factors to uncover underlying driving forces
- Stage 4 – reduce driving forces to the scenario framework
- Stage 5 – detail each scenario with measurable indicators
- Stage 6 – on-going scanning of the environment or signals of emergence

The focus question the workshop participants developed for Stage 1 serves as a rudder for the process. The specific question developed by the workshop participants was:

“Would Canada be better off, financially and socially, if Government specifies Open Source as an alternative to proprietary licensing of its funded software development?”

This question was particularly useful because it posed a tangible and provocative possibility, and in doing so was able set the tone and direction for the subsequent Stages.

Stages 2 and 3 produced a ranked list of driving forces (DF) that affected the focus question. Of these, the most significant forces were determined to be:

- Alignment of Open Source policies with other, more significant objectives, policies and international initiatives of the Government

Driving Force Votes	Title
175	Alignment with more major Government Objectives and Policies
155	Consumer trust and confidence
60	Use of open standards
55	Full cost accounting - total cost of ownership
50	Proper supportive services, including training
40	Business ~ scarcity versus OSS ~ abundance
40	Reliable, effective, scaleable architectures
30	OEM – preconfiguration
30	Ability of Canada to resist huge lobbies
25	Different component behaviours: operating systems, applications, networking
25	Software is an emotional issue

²¹ See, ‘The Art of the Long View’ by Peter Schwartz (1991); also www.gbn.org

²² For details see; www.opensourcescenarios.org/oss.html

- Degree of consumer trust and confidence in Open Source systems for mission critical applications.

Stage 4 and a high level preview of Stage 5 were developed in first draft form with the help of the web-based consultation. In all, over 40 experts in information technology, government and business contributed to development of the preliminary scenarios and their implications to OSS in 2010. These developments also addressed several of the concerns expressed in the workshop, specifically the absence of more fundamental factors associated with social and economic forces. Although preliminary, these results provide the first iteration of a framework to explore what OSS might become, as described in the following section.

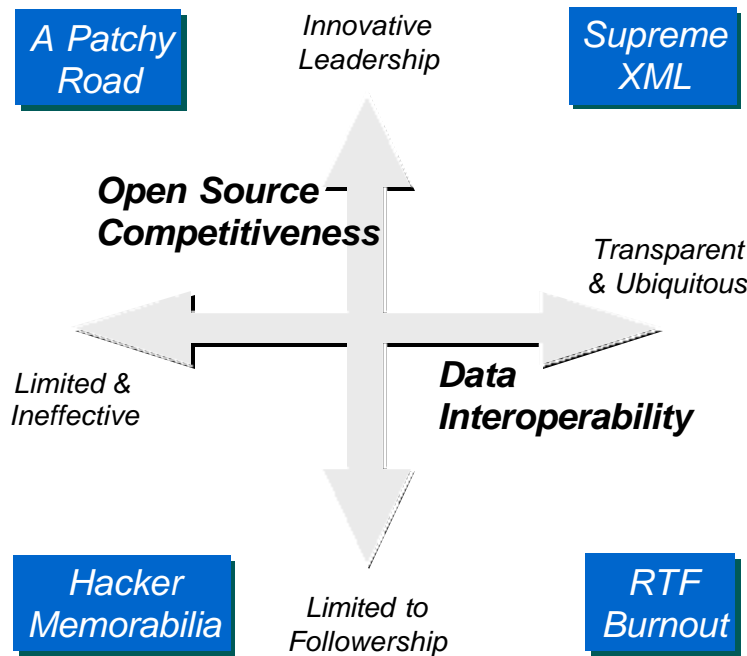
For more details on these activities and on-going work on Stages 4, 5 and 6, please see www.OpenSourceScenarios.org/oss.html.

2.6.2. Preliminary Scenario Framework – OSS in 2010

There are many differing opinions of what OSS might look like in 2010. The first goal of the scenario process was to determine the reasons why the picture is so obscure. This was done iteratively, searching for the *causes of the causes* of unpredictability.

The top two reasons the future of OSS is obscure were estimated in Stage 4 to be the fundamental uncertainties surrounding data *interoperability* and the *competitiveness* of open source solutions. In time, data interoperability may become transparent and ubiquitous, taken for granted – or it may become very limited and largely provided within small clusters of proprietary vendor partnerships. Similarly, OSS solutions may achieve broad, innovative leadership in all markets – or they may not, and remain always behind proprietary software leadership. The scenario framework is a practical 2 dimensional matrix formed with the extreme cases of these powerful driving forces of uncertainty. The two driving forces of uncertainty, in their extremes,

define the four possible futures show in Figure 2.26. Each scenario world is given a name to facilitate its identification.



This framework is clearly *not* unique. What about the economy? What of genetic discoveries? These are examples of important factors that played a role in the development of the framework and which are contained, in context, in the fabric of each scenario world. Collectively, the scenarios capture the essence of hesitation and thereby enable effective risk management to occur.

Figure 2.26

The scenario logic is used to push and provoke future planning. It is meant to be inclusive so that the future does not take one by surprise – and it does *not* claim to be precise. The center of the grid can be thought of as today, with the future unfolding as an unpredictable trajectory into any of the quadrants. The scenarios themselves are where uncertainty is removed, by definition, and thus answers to specific questions become clear, scenario-by-scenario.

A Patchy Road is a frustrating journey for open source communities, whose innovative efforts fail to achieve significant diffusion, all for lack of data sharing standards. There is room only for the most competitive applications, which are largely proprietary and adopted despite their lack of inter-operability. In A Patchy Road, there is likely sustained, gradual progress in wealth and well being in societies. The world economy is in a slow but stable growth pattern that has not fully recovered from 2000/01. Technology innovation has shifted, possibly to energy but away from computers and telecommunications. Where is OSS? Here, it involves mainly niche players who have expanded their dominance in back office solutions. Trust in OSS has been slow to build in organizations and OSS business models are still based on license savings despite high technical support costs.

Supreme XML is a world where standards like XML are highly effective and reign supreme. The choice of a solution has become strictly based on matters of cost, function and preference, and not on interoperability, which is taken for granted. Vertical market specialization thrives on interoperability. Proprietary solutions are deployed in niches where complexity is high and the user base is small. In Supreme XML, world economies have likely rebounded and are growing. Interoperability has progressed to the desktop. There are many coexisting brands, and OSS business models are based on the total solution, including hardware, which has been enabled with a flourishing market of embedded systems. The IT workforce is shifting from big business to a diverse range of small and cooperative companies. Continent wide trade groups with world wide free trade is looming.

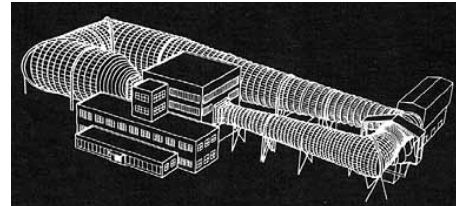
RTF Burnout is characterized by OSS communities that do not progress beyond Rich Text Format, the low level form of data compatibility. OSS fails to keep up to innovative private sector competition, which operates at the process level in business-to-business integration. Private sector experience in selling to business and large organizations prevails. Proprietary applications all are very successful in their use of common data formats. OSS is limited to insulated, cost-conscious communities. The focused nature of proprietary solutions proves to be more successful at generating innovation in rapidly changing product cycles. In RTF Burnout, governments are supportive of the sustained growth of private wealth and big business. There are a small number of strong brands of proprietary solutions. Web services flourish and business models for OSS are based on cost and focused in closed communities of practice. Trust is given only to brand names with demonstrable endurance.

Hacker Memorabilia is a world of dysfunctional open source communities and as with RTF Burnout, very strong branding in proprietary applications. A true tragedy of the commons has unfolded, caused in part by technical elitism. A combination of proprietary self-interest and technical feuding has prevented broad adoption of data standards. In Hacker Memorabilia the economy likely remains positive but weak with investment capital cautious. Information technology has largely abandoned standards based interoperability, moving instead to proprietary solutions that are extensively re-invested in all sectors. Business models for OSS are absent and OSS has become an elite group remembered for the Arpanet and Apache. There is a significant increase in venture capital investment in proprietary applications.

The scenario framework distills the forces of highest uncertainty, showing four plausible futures²³. The fundamental purpose of the scenarios is to not be surprised by the future, in effect to rehearse the future. This is done by always considering multiple concurrent futures, not betting on one. The challenge to the planner is to develop strategies that succeed regardless of which scenario emerges.

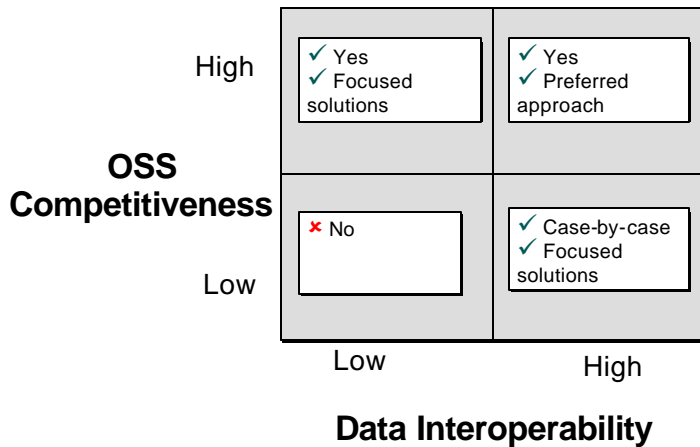
2.6.3. Future Implications

The scenario framework for OSS in 2010 is a sort of wind tunnel that can be used to test-fly plans and model strategies for their future robustness. Strategies that work in all scenarios, so-called common strategic options, have the lowest risk of failure. Options that work only in one scenario carry the highest risk of failure; these should be mitigated if possible through delay or reduced levels of investment.



Returning to the focus question of Stage 1 for example, *Would Canada be better off, financially and socially, if Government specifies Open Source as an alternative to proprietary licensing of its funded software development?* The scenario-based answer is yes.

OSS licensing in a procurement policy would be a required strategic option in the two scenarios where OSS solutions are highly competitive (upper quadrants). Where OSS is not competitive, the value of an OSS option may be lower, but it is noteworthy that it comes without risk and so would still be advisable (Figure 2.27)



Similarly, OSS investment is advisable in the two upper quadrants, but not necessarily in the lower quadrants where OSS is not always commercially viable. However, it is important to assess the timing of these options when considering strategic action. The commentary and insights gained in development of these scenarios, and those received during the web-based consultation, suggest that it will be at least 3 years before any significant downturn in OSS would be possible, implying that cautious and monitored investment in the next few years is reasonable.

Figure 2.27 OSS Licensing in publicly funded systems

Finally, one result of the scenario workshop suggested that OSS policy in any government would need to be congruent and integrated with its broader policies and objectives. This important insight relates not to internal policy and use of OSS, but to external investment and support. This complex question can also be tested in the scenario framework by anticipating what these broader policies might be in each scenario and then asking the question, *are these consistent with the OSS strategic option?*

²³ The notion of attaching probabilities to scenarios was debated over a decade ago on the now historic, Well, with the conclusion, “attaching probabilities to scenarios is ... inevitably inaccurate” (www.gbn.org).

The results in Figure 2.28 are very preliminary and speculative. They do imply however, that assessing external support for OSS and the fit with broader government objectives remains a challenge and would require significantly more detailed study of the scenarios. For example, only in the upper right quadrant, Supreme XML, is OSS fully consistent with anticipated public policy and objectives. In the other scenarios there is a mixture of positive and negative alignment.

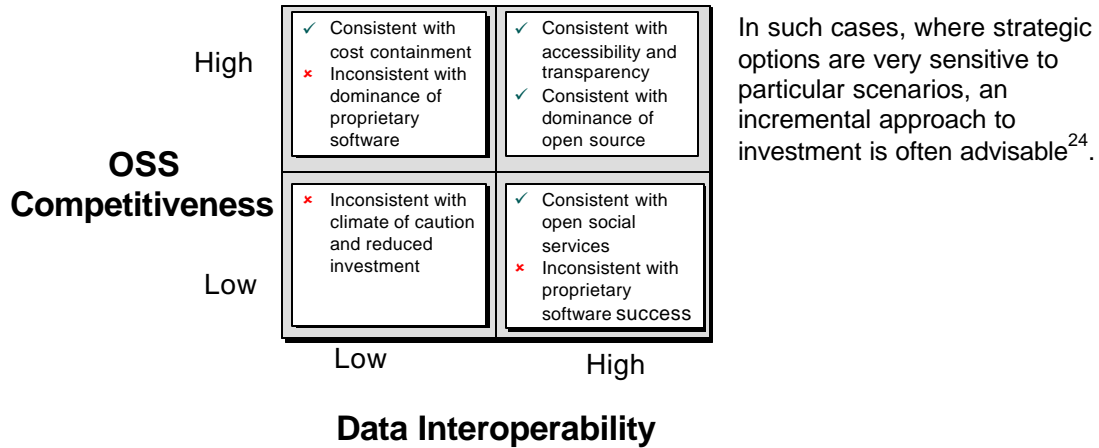


Figure 2.28 OSS in Context: fit with broader public policies and objectives

²⁴ Note: The scenario study of OSS is on-going. New challenges and insights are most welcome. For more details on these activities and to contribute, please see www.OpenSourceScenarios.org/osss.html.

3. Open Source Current State and Trends

The open source model is a controversial paradigm shift for both the ICT industry and users. Understanding the current state and global trends of adoption of the open source model, OSS products and services is critical to understanding the opportunities and challenges open source represents for Canada both domestically and internationally. This chapter provides a worldwide overview of the current state and trends of OSS from three perspectives:

- Public sector, from a strategic and operational perspective as seen through government funded studies, policy statements and adoption;
- Private sector, as seen through market research, media coverage and significant investments;
- Academic research and publications

Of particular importance is the extent to which Canada's private and public sectors are in step with global trends and what the trends imply. Is there a *tsunami* in the making or simply a ripple in the pond or something else? And how well is Canada prepared for these possibilities? The next sections compare and contrast how each sector is adapting and responding to these external and internal cues.

3.1. Public Sector - Current State and Trends

Overall, public sector interest in OSS is intensifying for a number of reasons²⁵, which include:

- Significantly increased costs imposed by new licensing schemes
- The need to mitigate the risk of domination by a single software platform
- The realization that technology expenditures have not benefited domestic ICT industries
- Lowering the cost of e-government
- Choosing open source products is increasingly "good enough" to address requirements

What are the messages in the multitudes of reports and communications now available to the public?

²⁵ Open-Source Software Running for Public Office, Gartner Group, April 2003

There has been a proliferation of Government sponsored OSS studies and policy development initiatives.

Numerous government and public sector organizations have commissioned and published studies of OSS in the last two years. Examples include the UK²⁶, Denmark, the Netherlands²⁷, Italy²⁸, France²⁹, Norway³⁰, Sweden³¹, Germany³², the European Union³³ and the US Department of Defense³⁴.

A shared goal for most of these studies was gaining a better understanding of OSS and associated issues, to guide public sector policy development, procurement policy, and government OSS development and use. An underlying goal is to better understand the impact of OSS on domestic ICT industry. The recent study published by Interchange of Data between Administrations (IDA)³⁵ and funded by the European Commission, identified several barriers to the use of open source software in the public sector:

- Weight and quality of existing ICT infrastructures
- Contractual and legal obligations
- Fear of global budget reductions due to lower software costs
- Lack of turnkey solutions
- Interoperability concerns
- Perception of insufficient public sector oriented applications

Governments are seeking confirmation and confidence in their various responses to the open source challenge.

²⁶ Office of the e-Envoy (2002). Open Source Software: use within UK Government; www.e-envoy.gov.uk. Also, Peeling, N. and Satchell, J (2001). Analysis of the Impact of Open Source Software. Qinetiq CR010223.

²⁷ Dalle, J-M, David, P.A. and Steinmueller, W.E. (2002). The Economic Organization and Efficiency of OS/FS Software Production: An Agenda for Integrated Research. European Union, FLOSS study. See: www.infonomics.nl/FLOSS and www.infonomics.nl/FLOSS/report/index.htm

²⁸ Italian Ministry of Innovation and Technology (2003). Indagine conoscitiva sul software a codice sorgente aperto nella Pubblica Amministrazione Rapporto della Commissione

²⁹ ATICA (2003). Agency for Information and Communication Technologies in Administration. Guide to choosing and using free software licenses for government and public sector entities. December www.atica.pm.gouv.fr/

³⁰ Statskonsult, Norway. Open Source Software

³¹ Statskontoret (2003). Free and open source software – a feasibility study. The Swedish Agency for Public Management. Also Appendix 1; www.statskontoret.se/english/index.htm

³² Wichmann, T. (2002). Free/Libre Open Source Software: Survey and Study. Berlecon Research, Berlin.

³³ Ghosh, R.A., Kreiger, B., Glott, R. and Robles, G. (2002). Free/Libre and Open Source software: Survey and Study, Part 2B: Policy within the European Union. International Institute of Infonomics. University of Maastricht. See also IDA, <http://europa.eu.int/ISPO>.

³⁴ Bollinger, T. (2003). Use of free and open-source software (FOSS) in the U.S. department of defense. The Mitre Corporation. TR MP 02 W00DOD101, January. Also, OSS Policy statement by the CIO of the US Department of Defense: www.egovos.org

³⁵ www.europa.eu.int/ISPO/ida

The majority of government studies recommend action to address OSS challenges and opportunities. These include new procurement processes, acquisition policy and technology transfer licensing policy.

Common recommendations in government studies include:

- Legitimizing existing internal use of OSS
- Establishing infrastructure to facilitate OSS industry development
- Ensuring that OSS is given fair treatment in government procurement

The benefits attributed to OSS in these reports include:

- Cost savings
- User responsive application development and customization
- Maximization of return on taxpayer dollars
- Open systems, interoperability and vendor independence

The Mitre study conducted for the US Department of Defense (Bollinger, 2003) suggests three additional aspects of OSS in large public sector institutions that need to be considered when assessing the value of OSS projects:

- OSS adds diversity and therefore robustness in response to threat
- Unfounded fears of security issues prevent optimum use of existing OSS resources
- Cost savings are substantial and often unrecognized, particularly in research facilities

All in all, governments are being advised take action to exploit the potential of OSS.

Policy recommendations vary on the level of prescription to be applied in legislation, from optional to obligatory use - and on the role of government in the establishment of standards, open and otherwise, from active involvement to indirect support of industry direction.

The recent US Department of Defense policy statement on software procurement is a key example of action to ensure that OSS will be assessed and subjected to the same rules that apply to acquisition of proprietary software. Also by example, Sweden (Statskontoret, 2003) and Zimbabwe (Gitoc, 2003) have both recommended that OSS be given equal consideration to proprietary solutions for government.

The European Commission's recent working paper entitled "Linking up Europe: The importance of interoperability for e-government services" defines the key role that open standards and open source software will play in promoting interoperable e-government services. The document urges the adoption of "open interfaces and specifications" for e-government services components including "open and non-proprietary document formats" and "the means of communicating with supporting back-office processes"³⁶.

The conclusions of the Berlecon study of Germany, Sweden and the UK (Wichmann, 2002) recommended that selection criteria be more fairly established to include full OSS, and open standards should be mandatory in all procurements, regardless of licensing.

³⁶<http://europa.eu.int/ISPO/ida/jsp/index.jsp?fuseAction=showDocument&parent=news&documentID=1475shows>

Germany, in contrast, has taken a non-prescriptive approach by ensuring that open source applications are given equal consideration in government procurements. While non-prescriptive the German government is taking proactive steps to ensure that open source software will be deployed successfully in the public sector. Germany's Federal Ministry of the Interior has published software deployment guidelines for the public sector. The guidelines are designed to "help IT managers in the public sector decide, whether to continue with their current commercial software licensing agreements, use both commercial and open source software, or whether it makes more sense, both economically and technically, to abandon their commercial licensing agreements altogether and migrate fully to open source products."³⁷

The UK Office of the e-Envoy has recently made a number of policy decisions whereby the UK Government shall:

- Consider OSS solutions alongside proprietary ones in IT procurements, award contracts on a value-for-money basis
- Use only products for interoperability that support open standards and specifications in all future IT services
- Seek to avoid lock-in to proprietary IT products and services
- Consider obtaining full rights to bespoke software code or customizations of common, off the shelf (COTS) software
- Explore OSS as the default exploitation route for Government funded R&D software

The Gartner Group reports that "despite levels of actual use, open source software exists largely in a state of policy "limbo" between calls for wider adoption and positive action, and approaches to ensure fair treatment and inclusion."³⁸ As in Canada, OSS in many countries is neither officially sanctioned nor explicitly prohibited.

Some governments are mandating or very strongly encouraging the use of open source through legislation.

Some national, state, and local governments have, or are in the process of implementing policy and legislation mandating or very strongly encouraging the use of open source in the public sector. The following table summarizes some of the international policy and legislation activity relating to the adoption of open source in government.

Table 3.1 International OSS Policy and Legislation³⁹

Policies or Legislation in Place today
Trans-national: European Commission
National: United Kingdom / France / Venezuela
Local: Brazil / Germany / Belgium - Brussels Government
Pending Policies or Legislation
Peru / Israel / South Africa / Texas / Oregon / California

Municipal legislation mandating the use of free software has been implemented in Brazil, in the cities of Amparo, Solonopole, Ribeirao Pires and Recife. These cities have passed laws giving preference to, or requiring the use of "software libre."⁴⁰ In the US at

the state level, Texas⁴¹ (S.B. 1579) and Oregon⁴² (H.B. 2892) and California, have bills being drafted that would require administrators to justify purchasing proprietary software when open

³⁷ IDG News Service, John Blau, July 10, 2003

³⁸ Open-Source Software Running for Public Office, Gartner Group, April 2003

³⁹ Linux in Government, Mary Ann Fisher, IBM, February 2002.

⁴⁰ Governments push open-source software, Paul Festa, Staff Writer, CNET News.com, August 29, 2001

⁴¹ www.capitol.state.tx.us/

⁴² www.leg.state.or.us/03reg/measures/hb2800.dir/hb2892.intro.htm

source alternatives exist. For a current listing of laws, bills and motions for the use of free software within the state, see Association Francophone des Utilisateurs de Linux et des Logiciels Libres⁴³.

Internal Government adoption is substantial, especially in less visible applications such as Web servers.

In addition to the trend of open source policies and legislation, governments are increasingly announcing major open source acquisitions, legitimizing their current state and initiating important OSS projects or other initiatives.

The recent survey⁴⁴ by the Interchange of Data between Administrations (IDA) on behalf of the European Commission investigating OSS use in public administrations in Europe showed that 63 percent of the interviewees said they already use OSS typically for Web or file servers. Another recent survey also on behalf of the European Commission (www.infonomics.nl/FLOSS/report/) shows that public sector organizations in Germany, Sweden and the United Kingdom have above-average use and planned use rates compared to for-profit sectors (37 percent and 31 percent, respectively).

Significant public sector OSS acquisitions are on the rise.

High profile OSS projects and replacements are increasingly the content of headlines in the ICT press.

- In May 2003 the City of Munich decided to convert to Linux and an OSS Office package. "The migration of the 14,000 PC systems and Notebooks ... also over 16,000 users is to take place "gently." The combination of Linux and OpenOffice was the chosen alternative as long-term switch position" (www.heise.de).
- Germany recently signed a large contract with Linux software distributor Suse and IBM, which will implement open source solutions in the Interior Ministry. "Germany's Interior Minister, Otto Schilly, said the move would help cut costs and improve security in the nation's computer networks."⁴⁵
- The UK Government organization responsible for procurement policy recently selected Linux as the platform for a new on-line system (Hayday, 2003). Although limited in its initial deployment, the system called "purchase & pay" is meant to also act as a test case.
- Japan recently announced that it has chosen a proposal submitted by a group made up of Fujitsu, IBM Japan and Oki Electric Industry Co suggesting the use Linux to manage salary and other personnel data for the nation's 800,000 central government employees⁴⁶.
- The Korean government announced⁴⁷ a project to migrate one hundred and twenty thousand civil servants, or 23% of its installed Microsoft systems, to the Korean Linux distribution. Like many other governments a cost savings, in the order of 80%, and local economic development were key motivators.

⁴³ www.aful.org/politique/perou/english/referencias.html

⁴⁴ www.europa.eu.int/ISPO/ida/

⁴⁵ IBM signs Linux deal with Germany, BBC News, Monday, 3 June, 2002

⁴⁶ Japanese government sizes up Linux, Associated Press, Jul. 9, 2003

⁴⁷ Korea migrates 120K civil servants to Linux desktop, The Register, Jan. 14, 2002

- A year earlier in a similar move the Beijing municipal government awarded covers contracts for office automation, anti-virus and operating software to six local software vendors including Linux OS vendor Red Flag. The added twist and a strong motivator for China, besides cost and economic development, was addressing the intellectual property concerns of WTO. Ironically, this trend means many of the western vendors who lobbied for China's entry in the WTO will miss out on the market they hoped to open up if they do not adapt to this new development.

These acquisitions are significant signposts illustrating that some governments have moved through the awareness-understanding phases of change, and are well into commitment-action.

Resource-constrained countries are using OSS as a strategic tool to overcome legal and economic barriers of proprietary software.

It is not surprising that a strong global trend is the adoption of free software by resource-constrained countries facing challenges with balance of payments and software piracy related to proprietary software. The cost of information technology in developing countries is "beyond the means of most individuals and organizations, including those belonging to the public administration. As a consequence, they either forfeit benefiting from technological advances and thus miss the "IT revolution" (the equivalent for these countries to missing once again the industrial revolution -- hardly a choice they can afford if we want them to prosper and develop), or they simply infringe copyright laws."⁴⁸ The following Table 3.2 illustrates this issue using Vietnam as an example:

Table 3.2 Windows XP Affordability in Vietnam⁴⁹

	Windows XP OS+OP Standard	Windows XP OS+OP Professional
Cost (Amazon 13-5-02)	\$560.00	\$800.00
Cost as % of Vietnam's GDP p.c. (\$440/year)	127.00%	182.00%
Cost as % of US's GDP per capita (\$30,200/year)	2.00%	3.00%
Price-equivalent for Vietnam in absolute terms	\$38,436.00	\$54,909.00
Price-equivalent for Vietnam in % of GDP per capita	\$8.00	\$12.00

Faced with the option of legal and economic sanctions, and the flow of badly needed hard currency out of these countries, open source software has become an obvious choice in both the private and public sectors of the developing world.

Priming the Pump – Governments are increasingly taking measures to encourage the growth of an open source based ICT industry.

⁴⁸ The Case for Free, Open Source Software as Official Development Aid Tool, Jordi Carrasco-Muñoz, Economic advisor, European Commission's Delegation to Vietnam, Asia Information Technology News, Issue 17, June 2002, European Commission

Several countries have announced, or are already involved in significant open source projects or implementations (Table 3.3). One of the most significant examples is the European Commission, which since 1999 has been actively encouraging the growth of profitable open source businesses. It has done this through various mechanisms including the 5th and 6th Framework⁵⁰ funding programs and through the coordination of workshops⁵¹ and studies. "Open source software is increasingly seen by European governments as a way of encouraging local software industries because it is not owned by any one entity, and thus theoretically places small, local developers on a level playing field with large foreign companies."⁵²

Major OSS Initiatives ⁵³	
Germany	Finland
Australia	Norway
China	USA - DOD adopted Linux Standard for Command and Control Applications
Malaysia	South Korea
India	Italy
Thailand (desktop)	Spain
Philippines (desktop)	Brazil
Mexico	

Table 3.3

Another significant development is the creation of joint efforts between government and industry to create local expertise centers for training and software porting. IBM, for example, is vigorously cultivating partnerships with the public sector to establish local expertise in open source by opening a series Linux Centers⁵⁴ around the world. Examples include:

- **China** - IBM Linux Solution Cooperation Center: IBM China, in cooperation with the Beijing Municipality Science and Technology Commission and the Beijing Municipality Information Working Office, created this center to help customers port applications to Linux; create end-to-end Linux solutions; as well as provide training for Linux professionals in China.
- **Singapore** - Open Computing Center in Singapore: providing an environment to rapidly build, test and deploy a wide variety of Linux-based solutions.
- **South Korea** - Linux Hub Center of Seoul National University: focus on a variety of areas, including Linux optimization, data mining, wireless application technologies, distribution handling systems and e-learning
- **Brazil** - Linux Labs in Brazil: software development labs to help developers create Linux-

⁴⁹ Source: *The Case for Free, Open Source Software as Official Development Aid Tool*, Jordi Carrasco-Muñoz, Economic advisor, European Commission's Delegation to Vietnam, Asia Information Technology News, Issue 17, June 2002, European Commission

⁵⁰ Implementation of the Information Society Technologies (IST) programme support to research in and take-up of free / open source software, 2001 action line Free software development: towards critical mass: Overall objective: create a more favourable ecosystem for free / open source software development in Europe, by supporting some critical components: Support service for developers; Bootstrap of some types of innovative development; Assessment of technology, economics and business models, EC Workshop , May 2001

⁵¹ Workshop on Advancing the Research Agenda on Free/Open Source Software, Brussels, May 2001

⁵² Europe to push for open source, Matthew Broersma, ZDNet (UK), July 21 2003

⁵³ Linux in Government, Mary Ann Fisher, IBM, February 2002.

⁵⁴ www.ibm.com/news/ch/de/2003/04/30back.html

- based applications for the financial industry
- **China** - in an arrangement that includes a partnership with Sybase, Red Flag Linux is now a supplier to the Government (www.redflag-linux.com)

ATICA in France, through "*Le bouquet du libre*" acts as a resource centre for "best practices" in open source software (ATICA, 2003). Operating since 1999, "*Le bouquet du libre*" provides information on open source software solutions and implementations within government. More recently, and based on defined principles of neutrality, transparency and nondiscrimination, ATICA has been more proactive in defining OSS opportunities and engaging public administrations and businesses in developing OSS solutions. A recent initiative is the publication of a very detailed guide to open source licenses for developers and users (this document is discussed in greater detail in Appendix D).

Cost-benefit data and case studies of public sector implementations are becoming available.

Empirical data on the cost benefit impact experienced by organizations implementing open source ICT strategy is beginning to surface. In Canada, School Board 73 in Kamloops BC was able to reduce its IT budget by 66% and reduce the number of staff required to manage servers from six to two. In addition, this staff is also actively engaged in developing new applications. By using a software-based thin client strategy they were also able to greatly expand the number of computers in the classroom by recycling older computers donated by local government and industry. It should be noted that recruitment of more technically competent staff was crucial in achieving these savings and the positive outcomes.

Fitzgerald and Kenny (2003) described a particularly illuminating case study of the Beaumont Hospital in Ireland. In the Beaumont study, OSS is extensively deployed vertically, onto the desktop, as well as horizontally on servers. Although the cost of implementing specific OSS applications was typically € 10,000, the 5-year total cost of ownership (TCO) was estimated to be 20 times less with OSS than closed source.

3.2. Private Sector - Current State and Trends

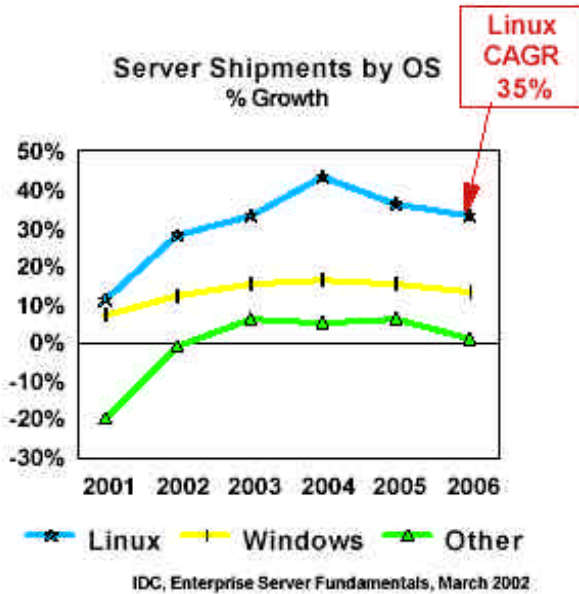


Figure 3.1

media reporting, or market position papers. The following highlights the current state and trends in the private sector as characterized by the research and reporting taken as a whole.

Linux-based servers are increasing at a compound annual growth rate of 35%, Figure 3.1, which is substantially higher than all other server platforms. There is every indication that these trends will continue if not accelerate.

Further evidence to support this is that Linux based solutions currently represent 25% of IBM's shipment base. The percentage of IBM software value-added resellers intending to port their software solutions to Linux has increased from 5% in 2000 to 47% in 2002 and the number of sales staff focusing on Linux based solutions has increased from 7 to 700 in the last four years.⁵⁵

Like the public sector, ICT analysts, corporations and consultants in the private sector are also studying OSS with great interest. The objectives of these studies generally have to do with market research,

OSS is here to stay. Linux, Apache and PHP have, according to Forrester Research, the maturity and sustainability required of mission critical systems and broad market acceptance.

There are cautionary notes however. According to Maher (2000), complexity as a characteristic of complex adaptive systems, has been a major factor in OSS success. "The only way to ensure that this highly technical achievement continues is to ensure the continued complexity of the open source model ... while this may provide a general guideline for others to attempt to replicate this incentive structure in similar contexts, it also highlights the fact that specific activities can pose a threat to the beneficial complexity". Maher warns that natural attempts to control process and remove uncertainty might result in a significant reduction of product quality and adaptability.

2003 may be a watershed point, where OSS will move from the early adoption phase to general market uptake.

"Smart CIO's will set aside the religious wars to see the truth: open source is good enough for many data center tasks" (Schadler, 2003). Linux is also recommended for embedded systems and commodity platform software. Conversely, the general consensus is that desktop applications

⁵⁵ IBM Interview data

are not ready for general distribution. Vendor marketing and technology articles in various media assert an irreversible tide towards OSS has taken place.

OSS will be a major force in making software a commodity

Like the personal computer drove the commoditization of hardware, OSS is accelerating the commoditization⁵⁶ of software and changing the rules of success in the software industry.

The extension of OSS beyond traditional data processing applications is promising, but still in the early stages and unclear.

The majority of reporting on OSS is from the IT sector; perhaps surprisingly, relatively little is seen to date in other domains such as embedded systems. For example, In the telecommunications sector, OSS is seen as a viable option for certain telecommunications environments (Eurescom, 2001), whereas in the relatively advanced technology in military modeling and simulation, Katz (2000) found that OSS did not serve as well as did competitive proprietary solutions, largely owing to the limited contribution of quality intellectual property to the product space.

There are pockets of OSS emerging in vertical market applications such as education and health care.

While basic computing platforms such as the Linux operating system, and server software such as the Apache web server have dominated the discussion of the open source model, recent developments indicate that diffusion of the open source model has and is moving well beyond these technical building blocks to vertical industry applications and mission critical systems. In the healthcare sector the American Association of Family Practice recently announced⁵⁷ an initiative to develop an open source electronic health record (EHR) for family physicians. In Canada, the McMaster University, Department of Family Medicine, OSCAR open source primary care EHR has been in production for over a year now.

The META Group recently predicted that “Linux will rapidly mature and gain momentum as an ISV reference platform, moving beyond high-volume Web, technical computing, and appliance server environments into mainstream application and DBMS server roles by 2004/05.”⁵⁸ This growth will initially be at the expense of Unix but will “eventually vie for dominance with Windows (2005/06)”.

There is limited management readiness of the market for OSS.

Weiss and Drakos (2003) from Gartner estimate, “that by 2005, 70% of enterprises will have neglected to implement formal corporate guidelines and best practices ... deploying poorly documented and unauthorized systems running on open source code or combinations of OSS and commercial code”. Compounding this impact will be the increasing importance of political agenda in IT (Caldwell, 2003a).

⁵⁶ Software licenses don't work, Tim O'Reilly, IDG News Service, July 2003.

⁵⁷ AAFP Seeks Partners to Support Open-Source Electronic Health Record Initiative, AAFP Press Release, January 22, 2003

⁵⁸ MySQL Open Source Essentials, Infrastructure Strategies, Server Infrastructure Strategies, Delta 2006, 6 March 2003, Charlie Garry, MetaGroup

Religious debates are harmful.

The Economist (2003) warns of the impact of “debate and religious warring over open source. This conflict is being used divisively by all parties, with the net result that the industry is embroiled in a win-lose battle that will delay consumer benefit”. These statements echo with those of Benkler (2001); “we are in the midst of a pitched battle over the spoils of the transformation to a digitally networked environment and the information economy ... as economic policy, letting yesterday’s winners dictate the terms of tomorrow’s economic competition is disastrous. As social policy, missing an opportunity to enrich our freedom and enhance our justice while maintaining or even enhancing our productivity is unforgivable”.

OSS, most often in the form of Linux, has become an important and increasingly visible element of major ICT companies’ strategy.

A very significant trend is the visibly escalating competitive response to OSS of established software vendors, signaling the transition of open source from “interesting fad” to serious competitive threat. What is unique about this competitive threat is that it is coming from a “concept” rather than a specific tangible competitor and an “altruistic” one at that.

Nevertheless, the tactics being adopted to counter the threat of Linux for example, have become quite tangible in recent months. SCO, a Unix software vendor, has initiated legal action claiming infringement of intellectual property.

Microsoft “is offering large discounts on its products and has dedicated funds for a battle against the license-free Linux operating system”⁵⁹ While the hardware industry has seen significant downward pressure on prices with the advent of personal computers and then clones, this is the first time that the software industry has faced such broadly based price competition.

Smart companies are porting to Linux, there is more to come.

Yet, the commercial world carries on. What can be learned of the behavior of successful companies? The first step of major vendors has been to port applications to Linux. For example, Oracle now runs on Linux, as do many of the applications from PeopleSoft.

However, SAP may represent a more significant signpost for the future. By 2001, SAP concluded databases had, from a functional viewpoint, become a commodity and that it would only be a matter of time until their cost substantially dropped to reflect this reality (Munz, 2002). It was also at this time SAP chose to open source its proprietary database, as a means of expanding its market share of SAP applications. SAP is also committed to OSS as a platform and expects by 2003 to ship 5 percent of its applications on Linux (Koch, 2003).

The next step taken has been to contribute substantially to the OSS community with expertise and application. IBM is the most substantive and impressive example of a response from the private sector in this regard, both from its investment in Linux and its role in the toolset platform Eclipse⁶⁰.

⁵⁹ Microsoft aims discounts at Linux, Lucas van Grinsven and Siobhan Kennedy, Reuters, 05.16.03

⁶⁰ In addition to IBM, the Board of Stewards of Eclipse proprietary systemse is represented by Rational Software, Red Hat, SuSE, Sybase, Fujitsu, Hitachi, Oracle, SAP, the Object Management Group (OMG), and Ericsson to mention but a few.

Merging into Mainstream Business Thinking

An important trend, indicative of the maturing of open source, is the fact that OSS has been the subject of articles in popular business magazines such as Business Week⁶¹ and the Economist, and trade journals aimed at IT executives such as CIO Magazine⁶².

Another bell weather signaling a strong trend towards the acceptance of open source as a serious topic for mainstream business is that most if not all the major technology analysts have started to follow its market penetration and predict its progress, albeit in the form of Linux. In August 2001 the META Group stated that "exploring Linux - especially on the server side - should be part of an organization's IT investment portfolio ... viewed as an insurance policy to hedge against future incursions into your wallet." Later that year the Gartner Group reported "Linux will have the fastest growth in 2002, at almost 50% over 2001"⁶³. Then in January, IDC predicted that "Linux will have a "breakout year" in 2002. Now it seems clear that Linux has become a viable alternative for enterprise use."

Open Standards and Open Source – Déjà vu

The principle of open standards has been broadly accepted as key to effective development and use of ICT solutions. The concept of open standards is increasingly mentioned in the context of open source. What is not clear is how the "top down" development and governance processes of the "traditional" standards bodies will interact with the "bottom up" standards evolution model of the open source community.

Steinreich in his review of legislation aimed at anti-trust protection (Steinreich, 2001) exposes how open-standards processes can be manipulated. These cautions underscore the tendency for proprietary interests to subvert public interest, and reinforce conclusions of Wichmann et al (2002) in their specific review of open standards.

Parenthetically, it is interesting to note that reports on international standards for software and systems engineering for the defense industry fail to even mention open source software despite its intensive use in organizations such as the US Department of Defense (Coallier, 2003).

3.3. Academic Research – New Insights

Perhaps one of the most obvious indicators of the legitimacy of OSS in business is the mushrooming growth of academic research and publications at such respected business schools as Harvard, MIT Sloan School of Management and George Washington University. The open source model and culture is increasingly becoming the subject of study in business, law and other academic fields. Open source focused academic research is being coordinated by several prestigious universities including, MIT, George Washington University, the University of Maastricht and Harvard University. MIT has established an online repository and discussion forum focused on research and academic papers relating to open source⁶⁴ business strategy and socio-cultural dynamics. George Washington University (GWU) has created The Center of Open Source & Government⁶⁵ and the Cyber Security Policy and Research Institute. GWU has organized two successful conferences on the application of open source in government. Harvard

⁶¹ [The Linux Uprising, Business Week, March 3, 2003](#)

⁶² Your Open Source Plan, [CIO Magazine, Mar. 15, 2003](#)

⁶³ Gartner Group, December 2001

⁶⁴ <http://opensource.mit.edu>

⁶⁵ www.egovos.org

Law School's Berkman Center⁶⁶ for Internet & Society is actively involved in studying the legal aspects of open source and open knowledge.

The dynamic behavior that makes OSS communities successful is being studied in earnest but is far from being completely understood.

There are numerous studies and speculation on the motivation of OSS coders. Volunteer programmers who develop code and donate time to find and fix errors, without direct monetary compensation appear to render traditional economic analyses invalid.

Analysis of the SourceForge Web site has afforded researchers like Munuz (2002) the opportunity to characterize OSS projects; who works on them and what are their motivations⁶⁷. Within this database, Lakhani et al (2002) described four types of participants on SourceForge:

- Stimulated Learners - accounting for 29 percent of the participants, stimulated learners write code for both skill improvement and fun.
- Hobbyists - very few hobbyists use the skills they develop for work, but are all stimulated by the opportunity to develop skills for non-work activities [27%].
- Professionals - involved in the OSS community to enhance their work skills, professionals comprise 25 percent of the OSS community.
- Community Believers - individuals who believe strongly that source code should be open, accounting for 19 percent of the participants.

On the other hand one large ICT company's opinion based on unpublished figures is that "programmers paid to do so write a majority (more than 50%) of code in the major OSS projects (Linux, Apache, Samba, etc.) In the case of Linux specifically - it's higher, probably 80+ percent"⁶⁸.

The picture of community changes when assessed from the perspective of user-to-user assistance in OSS platforms. Studies suggest that support of OSS is less distributed than expected (Lakhani and Von Hippel, 2000). For example, with Apache user-to-user support is *by* and *for* only a few.

Similarly, on reviewing SourceForge data in more detail Hunt and Johnson (2002) showed only a small number of OSS projects account for the majority of activity. Healy and Schussman (2003), studying the same database, showed that "the distribution of projects on a range of activity measures is spectacularly skewed, with only a relatively tiny number of projects showing evidence of the strong collaborative activity". Using a sociological lens, they offered 3 hypotheses for these discrepancies:

- successful projects are staffed by professionals
- successful projects are organized and mobilized similar to social movement organizations
- successful projects have a strong hierarchical basis

⁶⁶ <http://cyber.law.harvard.edu>

⁶⁷ Parenthetically, Lakhani et al (2002) show the only indication of an inflection point found in the present Study. On slide 40, an S-curve shows an inflection point about the year 2000, and implies saturation of OSS community approximately 2007-2010 (Modis, 1992)

⁶⁸ Response to public consultation

Total Cost of Ownership (TCO) is contextual; generalizations invite unnecessary debate and reduce opportunity for both proprietary systems as well as OSS.

The superficial acquisition cost of an OSS application can be very low, and depending upon the local context of the consumer, the life cycle cost of the software can also remain low. These facts have attracted considerable attention, as evidenced by the fact that total cost of ownership (TCO) has been the top ranked reason given by CIO's for using OSS in new deployments (Ware, 2002).

A survey by Dravis (2002) assessed the common drivers responsible for the use of OSS to be:

- Similarity [familiarity] between Linux and Unix, combined with availability on Intel platforms
- Emphasis on reduced technology expenses
- Access to global community of software developers
- Desire to reduce proprietary lock-in on the desktop

In a sequel case-based study, Dravis (2003) found a number of key success factors in large OSS environments, both public and private:

- Cost was a significant driver
- Flexibility was provided with broader options for support and platforms
- Change strategy is evolutionary, adding OSS to existing infrastructure
- OSS is now extending from the operating systems into large server applications; enterprise resource planning (ERP), customer relationship management (CRM) and databases

As with proprietary software, product support remains of concern with OSS according to Dravis. Development still requires the same methodologies as learned with proprietary systems.

Environments that require dedicated and sophisticated IT support resources appear to be well suited to reducing TCO with OSS. A good example of this is Intel, which reported a migration from RISC to Intel processors running Linux in which the overall hardware and software costs were reduced by 90 percent (Intel, 2003).

The OSS paradigm is a complex system. Numerous academic studies suggest a variety of models to explain the social dynamics and economics of open source.

The perspective of socio-political economies has led to many valuable contributions to OSS business theory. Benkler (2003) positions OSS development as a third model of organization of economic production. Benkler's hypothesis, called commons-based peer production (CBPR) is based on groups of individuals collaborating on large-scale projects driven by diverse motivational forces and social signals, rather than the commonly accepted ones of market prices or managerial commands.

Von Hippel and von Krogh (2003) proposed a model for OSS that combines the traditional 'private investment'⁶⁹ and the 'collective action'⁷⁰ models. It may be that the condition for market failure may be relaxed, considering that cooperation is arguably an evolutionary strategy that emerges as a collective property in a complex system (Axelrod, 1984).

⁶⁹ Private investment' model - returns to the innovator from private goods and efficient regimes of intellectual property

⁷⁰ Collective action model - under conditions of market failure, innovators collaborate in order to solve shared technical problems, revealing innovations without appropriating private returns

In contrast, Chiao (2003) introduced a somewhat controversial analysis that distinguished between economic and legal ownership, analogous to what he termed “Chinese-style” socialism. From this perspective, public good properties of OSS are not observed in reality. This model, in contrast to the two previous models, illustrates the diversity of opinion present in how OSS is viewed.

One traditional tool for the study of ecosystems is SD, systems dynamics⁷¹. The limited understanding of market place dynamics has reduced the impact of models to date. Nevertheless, Diker and Scholl (2002) used SD to study the evolution of OSS and its impact on the proprietary software. Their conclusion was that OSS is here to stay, and that it has a capacity to outperform “monopolistic market leaders”. The authors also concluded, “Internet-based, large-scale intellectual collaborations lead over time to broader, deeper, and more rapidly attained results than closed, small-scale, and profit-oriented R&D undertakings in some areas of the software sector”.

The simulation of OSS economics by Johnson (2001) showed there might be a critical size threshold for community effectiveness. Khalak (2000) with a separate model of OSS drew the same conclusions. And Webber (2000) postulated that OSS development is path dependent, which if correct makes repeatability difficult in complex projects.

New options for intellectual property transfer may emerge.

One example of efforts to reduce IP barriers is the O-Step program (Stanco, 2003), which attempts to address risk aversion in the private sector. The program introduces the idea of an open source threshold escrow in which companies or individuals would escrow source code to be released under open source license once predefined sales targets are achieved.

Classical economic theory may explain more about OSS than first thought.

Lancaster (2001) suggested that classical economic theory might offer more to explain OSS than previously thought. Lerner and Tirole (2002), and later Lee et al (2003) argue that successful OSS coders in fact signal their peers, and can later turn these signals into personal and monetary rewards. This, according to Lee and his colleagues made standard economic theory valid. What in fact, was introduced in these reports was the concept of “token currency” as a key element of open source community transactions. In a business transaction, each actor has an expectation or anticipation of the present and future value of the exchange. In the case of OSS, code and work time will have a present and future value – or token, that will balance the transaction for the individual. The actual code or work time donation is sold and a real or virtual token received.

⁷¹ See for example, www.systemdynamics.org for more on systems dynamics. New methods to study entities in an ecosystem include agent-based simulations, which model from the basic level of peer-to-peer interaction (Dalle et al, 2002).

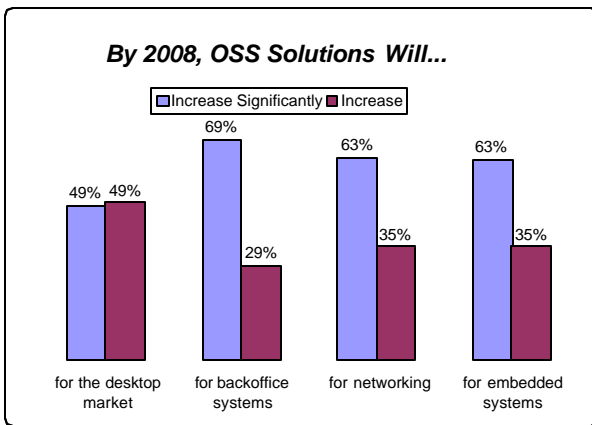
4. Open Source Market Analysis

The following discussion is based on information and data from the primary research findings, and inferences made from trends in Chapter 3 and the environmental scan of the global open source current state.

4.1. A Snapshot of the OSS Market in Canada

Overall the Canadian private sector market lags global adoption rates and depth of penetration of OSS⁷². It is no longer a low risk position for suppliers or consumers to “wait and see” with global adoption accelerating rapidly and global competition well on its way to becoming a force to be reckoned with.

While behind the curve, Canada has internal market strengths that are yet to be leveraged in the context of OSS. These include a highly skilled population, advanced penetration of broadband networks, and high degree of technology literacy and ICT implementation in the private and public sectors. What Canada lacks are basic catalysts, the most significant being a sufficient level of senior management awareness and understanding of the strategic and operational value of open source solutions.



The primary research data, see Figure 4.1, suggest perceptions of accelerating demand for open source products and services. On the supply side, numerous small companies with very specific talents are responding to the expressed and pent-up or latent Canadian demand for OSS solutions.

Figure 4.1

Numerous government initiatives, studies, policies and funding programs in a host of other countries are evidence that the market for open source products and services is a global one⁷³. This is confirmed by the authors' direct experience in the U.S. and European markets. Canadian companies interested in pursuing OSS business opportunities should be approaching the market from a global perspective.

There are several paths inherent to open source that can be followed by Canadian OSS suppliers to establish an international presence in the market. The most common path consists in leveraging participation in Internet based open source communities by establishing contacts and partners through participation in and contribution to open source projects. Another useful strategy is to focus on vertical markets and participate in communities catering to a specific sector.

⁷² “Linux deepening its Canadian foothold”, Ryan B. Patrick, IT World Canada, June 25, 2003

⁷³ IDC and others anticipate an increase in OSS markets, particularly Linux, in excess of 30% next year.

Examples of active sector-specific, open source communities include health, education, bio-informatics, and public administration.

4.2. Barriers and Concerns

Paradigm shifts as disruptive as open source by their very nature generate serious concerns while in the early stages of adoption. The following is a summary of the most common and significant market barriers and concerns from the dual perspective of supply and demand, which surfaced in the research:

Awareness and Understanding

While open source has become a topic of mainstream business, the level of awareness and depth of understanding of the open source paradigm still varies considerably and represents a significant barrier to broader adoption. OSS has inherent paradoxes, which easily discourage further investigation:

- Something that is free cannot be good.
- The development community is chaotic and therefore unreliable
- OSS businesses are not sustainable because they give things away

It takes time to understand that the strategic value of open source is created by user driven, collaborative, peer review processes operating in a community of diverse and skilled developers and users. Education and sharing of experiences are essential to raising awareness and understanding to the level necessary for commitment and action.

Avoiding the Pitfalls of Evangelism

The early adoption phase of open source was driven by the strong philosophical views of a number of outspoken pioneers. While an evangelistic approach was necessary for open source to gain a foothold in a world of business models dominated by proprietary technology, evangelism is increasingly generating diminishing returns, if not negative returns in moving open source to the next level of adoption. The noise generated by polarized points of view often obscures the underlying value and more subtle nuances of the model. As pointed out by one of the more experienced open source user/developers in the primary research; "like many new movements, [OSS] has religious zealots that portray extreme positions and [one] ... should not let the views of a few zealots cloud the practical benefits of OSS".

Need for Harmonious and Explicit ICT Policy

Organizations have a number of business, information management, IT, financial, human resource and procurement policies, which interact to form their overall ICT policy. Lack of harmony or alignment among policies in support of a level playing field for OSS can delay or impede their adoption of OSS. Poor communication or understanding of actual policy, combined with the fact that OSS is often seen as "controversial", can lead to a number of unarticulated assumptions that pose a significant barrier to serious consideration of OSS alternatives.

Need for Skilled Software Development Staff

The shift to turnkey solutions and outsourcing over the last ten years has reduced or eliminated skilled software developers in many organizations. Several of the most successful open source adopters indicated that a critical success factor was to have fewer, but more highly skilled staff on

board. For many organizations, the hiring of skilled software development staff would be something new for which they may not be prepared and thus would find too demanding.

Lack of Marketing, Sales Staff or Collateral

The majority of open source companies are small and medium-size enterprises (SMEs) that lack the skills and financial resources to mount the kind of marketing campaigns and develop the marketing collateral that customers have become accustomed to. Additionally, for some community-developed software, there is no single entity to market it. For the most successful OSS platforms, such as Linux and Apache, "software foundations" have been established as not-for-profit entities for the purpose of handling public relations on behalf of OSS development communities and to facilitate interfaces between the communities and private sector entities.

Threat of Major Disruption for the IT Industry

A common and very important concern, which is shared by both proponents and adopters of open source, and proprietary solutions, is that many software companies will be put out of business by open source solutions. Customers worry about the disruption this would cause, and governments and industry associations worry about the impact on the software industry and the economy. It is difficult to predict how software product companies will adjust to increased OSS market opportunities and how much software service companies will profit from increased opportunities to customize OSS solutions for their clients.

Poorly Integrated Policy and Restrictive Procurement Processes

Procurement, licensing, contracts and intellectual property rights and other business policies have "co-evolved" with industry business practices associated with "proprietary" software. Organizations need to rethink or at least reexamine procurement methods and policies to ensure that a level playing field exists for open source to compete fairly or be considered at all⁷⁴.

4.3. Conditions for Acceptance

The research uncovered several key conditions that need to be met to encourage broader acceptance of OSS products and services. Addressing these challenges presents some significant market opportunities.

Migration Roadmaps

Change is much easier to accept when predicated on a sound roadmap which explains how to get from "A" to "B" with minimal disruption and risk. Business and organizations that have decided or are in the process of deciding whether to adopt or acquire open source need clear and proven migration plans to mitigate the risks of transitioning to a new business model for their IT requirements.

Documented Business Cases and Reference Implementations

Many potential clients will be seeking case studies and reference implementations before considering the adoption of a proposed open source solution or ICT strategy. The enhanced

⁷⁴ Note: several sources in the primary research suggested that a first step is to legitimize the open source software already in use

public availability of business cases and case studies that convincingly document the benefits and experience of implementing solutions or weaving open source into the ICT strategy of an organization would facilitate their acceptance.

Reputable and Reliable Technical Support

First time users of open source solutions may be wary of the “hacker” origins of freely available code. It is essential that reputable and reliable support and implementation services be developed and easily accessible to ease their concerns

Better Senior Management Understanding of the OSS Business Model

While the findings of this study indicate that open source has transitioned into the realm of mainstream business solutions, understanding the underlying philosophy and dynamics of the model and how this translates into business value is less common. For broader acceptance, it is essential that senior management gain a deeper understanding of OSS to be able to leverage its full potential.

Making the Business Case for OSS

Open source is fundamentally one more option in the range of possible ICT solutions for an organization seeking to address a need. The process of selecting an open source solution, just like any other, must be based on sound business value and minimization of risk. While this may be stating the obvious, an important condition of acceptance is that solution providers invest the time and effort needed to ensure that benefits, value propositions and business cases are solid and clearly presented. Corel's unsuccessful porting of applications to Linux and its own, short-lived Linux distribution demonstrate that OSS business models warrant very careful study.

Integration of OSS with Legacy Systems

Integrating open source solutions with proprietary legacy systems can be perceived as problematic for technical or legal reasons. One reason for this is the incorrect generalization that OSS licenses are incompatible with proprietary licenses when integrating applications. While this may be true in very specific and rare circumstances, such as the direct commercialization of the composite result, this is an incorrect generalization. Due diligence must be exercised as it should be for any software license, to understand the rights and obligations of its use. The onus is on the OSS vendors to make the implications of their choice of licenses as clear as possible, and on the customer to make the effort to read and understand the limitations imposed by a specific license. Similarly, from a technical perspective, OSS vendors must confirm compatibility with key international ICT standards to prospective adopters.

Achieving the Minimum Threshold for Adoption

For any application there is a minimum threshold of acceptable functionality that needs to be achieved for a solution to be considered a viable substitute or alternative. In many cases, this threshold can be well below the full functionality of existing proprietary and OSS solutions; therefore one of the most practical and important conditions to be met is identifying this minimum threshold, and then achieving and communicating compliance with it. A medical doctor and open source adopter summed it up this way: “[whereas] I am totally at the mercy of the vendor regarding the maintenance and repair [of my car]; I am saved by the commoditization of the automobile; this is one of the things that open source is beginning to do.”

4.4. Summary

At this point in time understanding and exploiting the open source market opportunity is like learning a new language and culture, it is best done by immersion. The markets for new disruptive innovations are inherently difficult to analyze⁷⁵ and in essence, in the case of open source, are in the midst of inventing themselves (Christensen, 1997).

A key entry point to participating effectively is to understand the broad and sometimes confusing overlap between products and services, and buyers and sellers in the OSS world. The areas of overlap create both tension and confusion in the market and at the same time a more effective translation of needs into solutions, as OSS is in many cases "user built" software. New roles are constantly and opportunistically being explored, which underscores the importance of acquiring a deeper understanding of OSS dynamics for Canada. Open source has been characterized as a giant ongoing negotiation (O'Mahony, 2003), it can also be considered a kind of virtual permanent focus group.

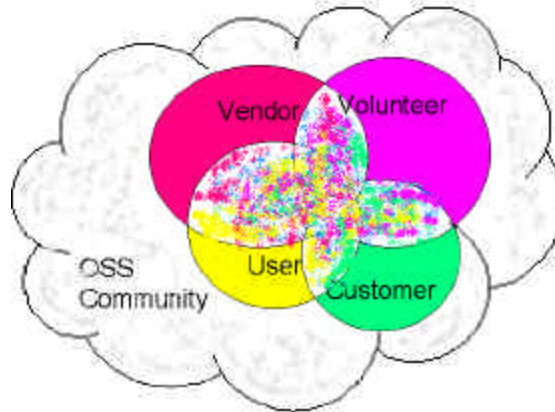


Figure 4.2

⁷⁵ The Innovator's Dilemma, Harvard Business Review by Clayton Christensen, published on 01/01/97,

5. Synthesis

Paradigm shifts like open source occur at such a fundamental level and with such simplicity that they, "...can disrupt not only systems and business models, but also organizational cultures ... creative destruction indeed" (Bruner, 2001). Why does this happen?

Open source is counterintuitive: The open source model is so fundamentally counterintuitive for both suppliers and consumers, who have co-evolved in the proprietary software business ecosystem, that it is often rejected outright as a viable option because of the perception that "it cannot be capable of supporting profitable, sustainable businesses."

Open source polarizes stakeholders: Open source is easily capable of inciting religious arguments, easily polarizing positions and leading to missed or unperceived opportunities

Trust and collaboration is the DNA of open source: Open source requires an uncommonly deep understanding of the dynamics, conditions and belief in the power of collaboration; something that many organizations strive for but find difficult to achieve in our competitive cultures.

Open source thrives on paradox: Open source requires a high degree of comfort with the confusion generated by the paradox of entrepreneurial altruism. Unlikely as it may seem, cooperation can be a very successful competitive strategy (Axelrod, 1984)

Tsunamis aren't obvious when off shore: Despite its clearly disruptive nature many of the benefits and opportunities of open source remain subtle and embedded in the dynamics of the model. Like the Internet, it is easy to deny its importance until it is upon us.

The immediate financial benefits of open source may be straightforward, however recognizing and understanding the strategic benefits of the model is not. Embracing and integrating the open source model, and leveraging it in the public and private sectors requires the combination of an open mind, systems thinking (Senge, 1990) and an ethnographic perspective. Observations, opportunities and constraints synthesized from this Study provide a means to better understand these dynamics.

5.1. A Composite View and Interpretation of Findings

The following diagram presents a composite view of the pulse of OSS in Canada based on the primary research findings. A technology diffusion model (Figure 5.1) originally developed by Industry Canada (Simpson, 1999) was adapted and applied to facilitate a high level interpretation of the study findings in the context of the three aggregate sectors in the study: Industry, Government and Education.

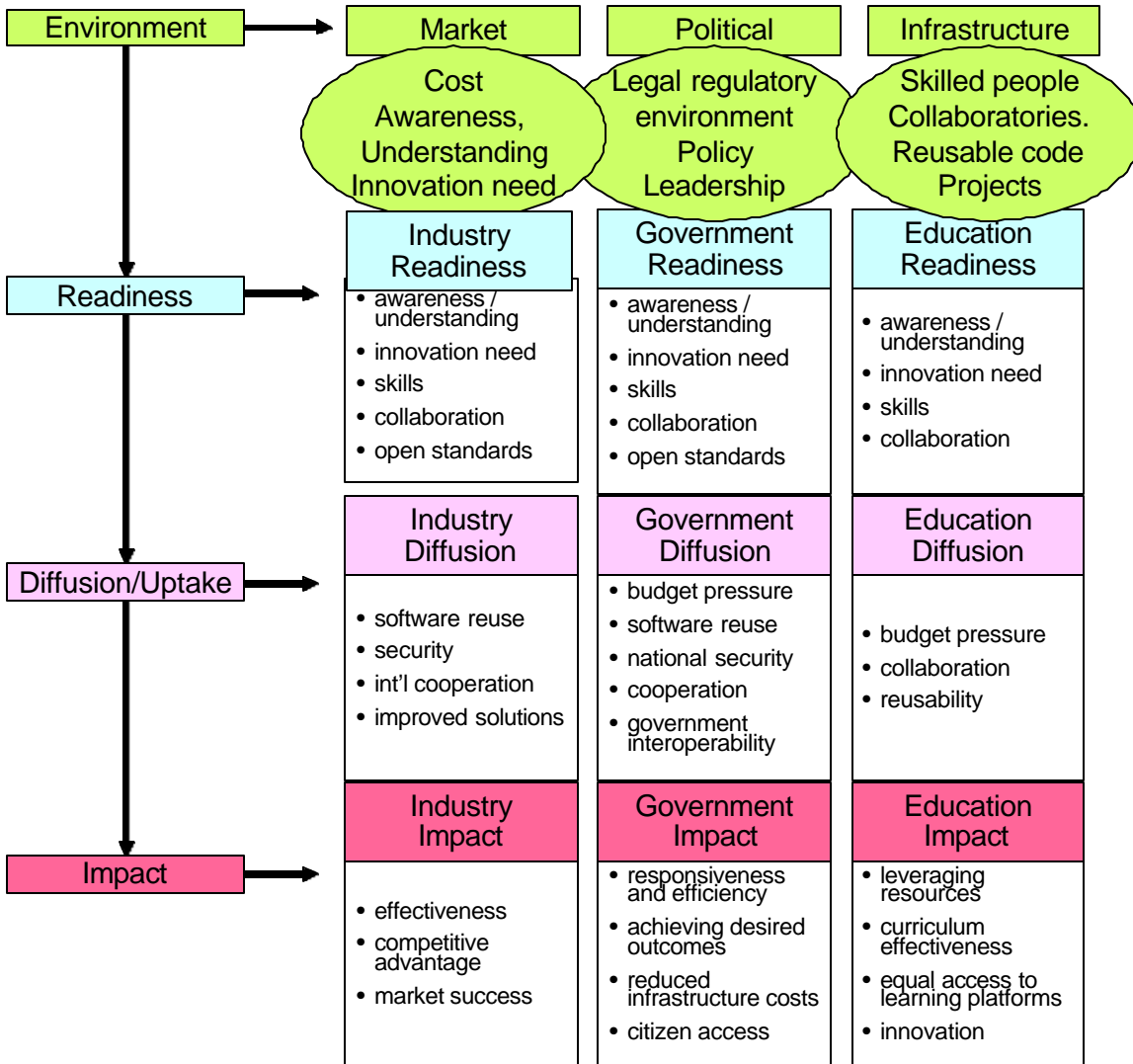


Figure 5.1 A Readiness, Uptake, Impact Overview of OSS⁷⁶

Open source adoption is framed in the context of its Political, Market and Infrastructure Environmental factors, which determine the starting conditions, and ongoing forces, which influence adoption of open source.

⁷⁶ Adapted from, World's Most Effective Policies For The E-Economy, UK e-Envoy, November 2002

The Canadian Market must clearly have the need for and value what open source can offer, and it needs to be aware that open source is a viable option. Awareness has increased dramatically in the past year and at this point in time the value of OSS is for the most part seen as lowering the cost of technology.

The political context of policy and regulation as well as the degree of leadership demonstrated by government can heavily influence adoption. At this point in time Canada is essentially neutral in this regard, with government neither encouraging nor discouraging open source adoption.

The necessary and sufficient level of Infrastructure is a third important environmental factor. Canada has the network infrastructure and skilled talent for adoption to take place and for collaborative infrastructure to be implemented. What are missing are catalysts to stimulate OSS developer aggregation into active communities and an inventory of projects and reusable software components that benefits Canada's business, political, and technology goals and needs.

Figure 5.1 summarizes the key drivers or value propositions that are active in each stage of adoption. The adoption process flows from establishing Readiness, to broader Uptake and Diffusion, to realization of Impacts. Adequate awareness, understanding and adoption of collaborative behaviors are key to Readiness across all sectors in the Canadian context. Canada is still in the very early stages of Diffusion and Uptake and only a few examples exist where Impacts have been observed and realized.

5.2. Issues, Opportunities & Constraints for the Canadian Public Sector

Government ICT Infrastructure Transformation

Government has a huge and rich installed base of proprietary and non-interoperable IT solutions and systems that it needs to gradually transform into client-centric, standards-based internal operations and business delivery solutions. Adding pressure are ambitious timelines for the Government's on-line programs and scarce resources to achieve these goals. The new federated architecture is to be modular in design and made up of components facilitating vertical and horizontal integration. Adoption of open standards XML and ebXML is expected to assure sustained support and access to a large supply of complementary assets.

A significant opportunity exists, before the business transformation program of the Treasury Board Secretariat (TBS) is implemented, and in departments that continue to invest in proprietary IT solutions. Major investments in development, training and support might be leveraged to raise awareness on OSS, educate on its advantages and shortcomings and provide guidelines for making technology decisions about open source platforms.

Government Procurement Policy and Practices

Government of Canada policy mandates fair procurement practices that preclude procurement preference for a given business model. PWGSC should revise procurement directives and guidelines to ensure that a level playing field exists for all categories of software. It should also ensure that its reference web site SARC also promotes this level playing field.

Exploitation of Government Software

Under current policy, the copyright for software developed under government contract is by default assigned to the contractor. There are currently no explicit provisions for software that is developed by government employees, except that it can be offered to the Knowledge Exchange

at PWGSC for sharing with others in government. Given the “new” option of open source licensing the merits of the practice of automatically assigning software exploitation rights to contractors needs to be reassessed, especially in the case of software that is intended to benefit citizens.

Government Collaborative Software Development and Reuse

More efforts are needed to encourage software development collaboration and re-use across government (e.g. project or thematic communities) and between governments to ensure maximum value for taxpayer money. To enable this, the following practices will need to be embraced:

- Component reuse: software to be written with reusability of code as a design requirement.
- Portability: any funded software has to be written in a portable way: that is, simple recompilation and/or little to no modification should allow the software to run on any platform potentially able to serve the purpose of the developed software
- Vendor independence: in order to prevent the costs and built-in obsolescence of vendor lock-in, no vendor specific tools or programming languages should be required to build or maintain the subsidized software unless they can be replaced with free and/or standard compliant alternatives
- Standard compliance: wherever standards exist related to one or more task of the subsidized software, these standards must be used instead of development of proprietary solutions. Whenever existing standards appear to suit only partially, preference should be given to an attempt to officially extend the existing standard via the appropriate standards body, rather than developing proprietary extensions.

Government funded research

The open source option for dissemination of the results of government funded research should be seriously investigated from the perspective of the long-term benefit to Canadian citizens and impact on further innovation. The implications to current business models, which research organizations depend on, should also be studied.

Government IT human resources development

The Government should identify employees with expertise in OSS to optimize use of their knowledge and involvement in OSS communities. This would also make a positive contribution to recruitment, retention, professional development and knowledge building. Training should be offered to Government employees on guidelines for participation in OSS communities.

Stimulate the benefit multiplier effect

OSS is a proven way to lower the cost of ICT infrastructure. More effective ICT investments mean that health care and educational institutions, for example, can allocate more money to and broaden the realization of desired social outcomes. Similarly, the voluntary sector, which is always faced with limited resources and depends on donations of time and money should be “educated” about the availability of OSS and how it can leverage ICT investment. Practical demonstration projects are a good way to raise awareness (e.g. MILLE project, IM/IT Portal for the Voluntary Sector)

International Cooperation

Open source provides a unique vehicle for effective collaboration between nations and especially for innovative technology transfer to developing countries. Canada should develop and support policies and initiatives facilitating access to OSS by developing countries and support the transfer of Canadian government OSS solutions to governments in developing countries.

Open Standards

Canada needs to have a stronger voice in open standards bodies to ensure that standards development is truly open and so that our unique perspective and contributions will be valued and implemented.

5.3. Issues, Opportunities & Constraints for the Canadian IT Industry

The Canadian software products industry has a strong export orientation toward global markets. In contrast the Canadian IT services industry tends to generate most of its revenue domestically.

Acknowledgement of OSS as a Game Changer

The majority of Canadian software product companies continue to rely on ownership or exclusive commercial licensing of intellectual property to succeed in the marketplace. With the OSS movement gaining momentum, they are confronted with both the threat⁷⁷ and opportunity of a counter-cultural business model.

For example, Red Hat, initially a Canadian company, was quick to perceive the growing demand for the Linux operating system, and successfully established itself as a legitimate and credible distribution channel for this software. At IBM, a gathering of its key strategists in 2001 resulted in a decision to invest more than \$1.4 billion in Linux in order to make it a core component of the IBM value proposition. This year Oracle committed some \$250,000 for a Common Criteria Level 4 Certification of Linux as a platform for its products. Others such as Sun, HP, SAP and PeopleSoft also have an OSS strategy. Even Microsoft has had to respond to the OSS challenge with the introduction of its "shared source software" initiative.

By comparison with such world IT giants, Canadian software companies are small niche players or purveyors of vertical solutions, who are not yet aware of the need to review their market positioning and product offerings. Many will likely opt to port their products on OSS platforms of increasing popularity, but some companies may have to review their business model in order to survive. Others like ActiveState (profiled in Appendix C) already leverage OSS software development by communities in order to devote more resources to the final product development and marketing to end-users.

⁷⁷ Successful "innovating managers who were faced with disruptive technologies created organizations whose cost structures enabled them to make money in the value network where the disruptive technology was taking root, and where customers' power and the managers' intentions were aligned." Robert Morris, www.eastbook.com/InnovatorsDilemma.html, Review of "The Innovator's Dilemma" by Clayton M. Christensen

Implications of OSS as a game changer, for Canadian IT services companies are not as severe. Many like CGI, have integrated OSS solutions in their service offerings in order to provide clients with the best mix in terms of functionality, cost and evolutionary path.

Leveraging OSS Software Development by Communities

Sourceforge lists more than 60,000 projects, but the most interesting could be the 17,000 small active projects that were created in the last year⁷⁸. This represents an enormous reservoir of energy. Interestingly one quarter of the OSS projects listed on Sourceforge are for the Windows platform. Canadian software companies interested in OSS would be advised to explore whether there are OSS solutions, projects and communities of value to them.

This Study like others has demonstrated that there are no road maps or short cuts to open source. One common denominator is companies that have made the transformation, from intellectual property strategies to open collaboration for innovation, have realized the crucial value and strength of collaboration.

Participation in OSS Non-Profit Foundations and Standards Bodies

Contributors to many community managed OSS projects have created non-profit foundations to hold software assets and property rights, to represent the project for public relations in transactions with commercial firms and to protect themselves from individual liability. There are some 20 such non-profit OSS foundations. For example:

- the Apache Software Foundation provides support for the Apache community of open source software;
- the Free Standards Group is dedicated to accelerating the use and acceptance of open source technologies through the development, application and promotion of standards;
- the GNOME Foundation provides a user friendly suite of applications and an easy-to-use desktop for free systems.

Such foundations provide a mechanism for firms to gain a voice on a project to which they sponsor individual contributors or donate code and assign copyright. In return the firms bundle and sell community owned software on the open market. Thus the foundation acts as a mediating entity between the technical authority of the community and the market imperatives driving demands by the firm (O'Mahony, 2003).

Legal Minefields and Confusion

Software was protected primarily by copyright until 1979, when the US Patent and Trademarks started using the more liberal interpretation that it applies to any invention that "uses" software. Software patents represent 15% of all 20,000 patents granted each year; they account for 25% of the annual growth. Nefarious use of software patents by dominant IT players, such as their hoarding and the use of "continuation tactics" for submarine attacks on open standards, is detrimental for software innovation in general, and OSS developments. The SCO lawsuit against IBM for \$3 billion is but the latest incident in a long saga of intellectual property lawsuits. Small Canadian firms should seek protection from such legal minefields when building upon open source platforms. For example, this could be the form of obtaining a license agreement with a dominant IT player.

While the enforceability of OSS licenses remains open for debate, Canadian firms are well advised to scrupulously respect their terms.

⁷⁸ Founder of Slashdot, Harvard/MIT Open Source Conference

5.4. Concluding Remarks

What would it mean to the future of Canada to have a strong culture of collaborative innovation in ICT? What will the downstream impacts be on knowledge based industries in terms of innovation, competitiveness, attraction of investment, research and development funding and talent? These overarching questions are the backdrop for the following concluding discussion, its genesis being the insights gained during our explorations for this study.

In many ways OSS can be seen as a form of “market correction.”

The trend for many years has been to “outsource” skilled IT talent either directly or indirectly to shrink-wrapped software or turnkey solutions. For organizations who see software as a source of their competitive advantage or the means for delivering the best possible return for taxpayers money this has also led to “outsourcing” innovation. While there has been tremendous growth and improvement in systems through this approach it is not perfect and subject to diminishing returns. The adoption of OSS is a shift back to greater user involvement and responsibility in ICT innovation, development and deployment. OSS is a way for the market to address the inefficiencies and in some cases diminishing returns of the current industry business model.

Cost savings is the primary driver for initial adoption but OSS is a transformative process that when done successfully, opens a new world of possibilities and a whole new perspective on the opportunity cost of pursuing the status quo.

It is becoming very difficult to ignore the opportunity cost of inaction as evidence builds for the value of OSS in terms of innovation, integration, interoperability. At the same time the hidden costs of diminishing returns of many proprietary approaches are becoming more obvious.

The federal government neither prevents nor encourages open source adoption ... but seizing the strategic opportunity requires a clear and well-communicated policy and being proactive without being provocative.

There is a remarkable amount of awareness and adoption of open source in the public sector, much of it invisible, not intentionally, but simply because it works well and is deployed on basic computing platforms such as web servers. Someone described this situation as the “tripping point” for OSS, as many executives will find that their organizations are already using OSS if they look closely enough. The time is ripe for strategy and policy to catch up and leverage reality otherwise exploitation of open source will be sub-optimal.

Senior management needs be educated in order to understand that open source is a strategic element of ICT and beyond.

Open source is counter intuitive and counter cultural, and will require some unlearning as well as new learning to be effectively integrated at the policy and strategy level.

Key federally supported ICT innovation and dissemination, catalysts such as CANARIE and Canada Health Infoway, need to factor open source into their strategic initiatives.

The absence of an open source strategy introduces the risk of underutilizing previous funding and underachieving in critical elements of Canada's future ICT infrastructure.

There are pockets of innovation across Canada - experienced, successful implementations ripe for leveraging.

Taking a page from the open source philosophy, documenting these examples so that others can replicate and improve on these successes would be a valuable investment for the public sector.

Research is a critical success factor - establishment of collaborative communities and a creative commons *vis a vis* the private and public sector is of strategic importance to Canada's future.

It is clear that collaboration, which is the heart of open source, is an extremely effective accelerator for both innovation and its dissemination. Successfully establishing collaborative communities requires the right conditions for their startup and nurturing. This is not an exact science and it would be highly beneficial to support and encourage research in this area. A key element that should be investigated is the role, structure and governance of not-for-profit organizations as stewards, coordinators and facilitators in the virtual commons. As well, alternative approaches to transfer and licensing of publicly funded "seed" software for establishing open source communities should be seriously considered. Government is uniquely positioned to stimulate community "aggregation" in much the same way as demand aggregation has been used as a strategy for encouraging the adoption of new telecommunication technologies.