Project title: Free Open Source Software for SMEs

Project activity:
O3/A3 – Final Policy Recommendation Report

Brussels, Belgium

CONTEXT

Grant agreement	2017-1-EL01-KA202-036112
Programme	Erasmus+
Key action	Cooperation for innovation and the exchange of good practices
Action	Strategic Partnerships
Project acronym	FOSS4SMEs
Project title	Free Open Source Software for SMEs
Project starting date	01/10/2017
Project duration	24 months
Project end date	30/09/2019
Project Activity (A) Intellectual Output (IO) Multiplier Event (E) Short-term joint staff training events (C)	O3/A3 – Final Policy Recommendation Report
Deliverable title	Final Policy Recommendation Report
Nature of deliverable	REPORT
Dissemination level	Public
Due date of deliverable	M23
Produced	P3 - OpenForum Europe

Table of Contents

Table of Figures

Acronyms & Abbreviations

CEO	Chief Executive Officer
CERN	European Organization for Nuclear Research
DG	Directorate General
DIGIT	Directorate-General for Informatics
DITO	Develop in the Open
EC	European Commission
ECVET	European Credit system for Vocational Education and Training
EPSC	European Political Strategy Centre
EU	European Union
FOSS	Free and Open Source Software
FSF	Free Software Foundation
GB	Gigabyte
GDP	Gross Domestic Product
IaaS	Infrastructure as a Service
ICT	Information and communications technology
IDE	Integrated development environment
KPI	Key Performance Indicator
OSI	Open Source Initiative
OSOR	Open Source Observatory
PaaS	Platform as a Service
R&D	Research and Development
RAM	Random Access Memory
SaaS	Software as a Service
SLA	Service Level Agreement
SME	Small and Medium Sized Enterprise
VET	Vocational education and training
WDDM	Windows Display Driver Model

Executive summary

Many European SMEs lack the necessary skills and resources to adapt their business to the digital transformation. Yet, digital skills have been identified by the European Commission and researchers as a crucial factor for the economic performance of a business. The FOSS4SMEs project provides managers and staff of SMEs with a free online course equipping them with the skills and competences to use Free and Open Source Software (FOSS) to improve their digital performance and competitiveness.

In this report, we explore the tangible economic benefits for SMEs by employing FOSS and how studies have shown FOSS to be uniquely placed to benefit European SMEs. FOSS offers the potential for SMEs to collaboratively develop or adopt software that can have a high innovative potential, no-lock into proprietary solutions, lower cost and the ability to customise software to all needs.

After having adopted FOSS, the success for such SMEs is dependent on a number of factors besides digital skills. SMEs work in a policy and competitive environment. With this Policy Recommendation the FOSS4SMEs consortium aims to provide to policymakers a road map to improve the policy environment for SMEs employing FOSS on the European level.

This report provides a total of 37 recommendations in three policy areas:

- **Vocational Education and Training (VET)**

  ◦ Supporting SMEs training through an online platform structuring training resources and providing funding for covering training hours.

  ◦ Increasing the diversity of technology education, thereby making digital jobs such as at FOSS SMEs more attractive.

  ◦ Realising the value of transferable and sovereign digital competences by moving away from teaching specific product knowledge toward generic competences.

- **Business policy**

  ◦ Supporting the scale and growth by increasing capital flow into SMEs, providing business training opportunities for the many technically-educated entrepreneurs; ensuring the European Innovation Council supports a modern understanding of innovation and openness; creating a directory of FOSS solutions and improving the legal environment for the governance of FOSS.

  ◦ Making sure public procurement rules create a level playing field by adjusting the public procurement directive to take into account the specific needs FOSS SMEs have, especially considering open innovation; taking into account total cost of ownership, including exit costs and considering the added-value due to the reusability of FOSS solutions.

- Understanding the implications of the open innovation paradigm of FOSS on intellectual property (IP) policy by, reviewing alternative ways to measure innovation; removing requirements in public procurement to protect intellectual property; studying the effects of the current IP-regime on open innovation, taking into account SMEs lack of patents in IP and public procurement policy.

- Internalising openness as the new technology and innovation paradigm and adjust EU policy accordingly, taking into account a wider set of dimensions, such as open standards, open science and open access and the positive impacts these have.

- **EU institutions policy**

  - There is a lack of up-to-date EU-focused research on FOSS. The institutions should: strategically research their own role in FOSS sustainability and communities; strengthen the role of openness when funding research; tender continually updated research into the FOSS market and investigate how to build communities around the institutions software solutions.

  - FOSS and openness is often being overlooked when drafting legislation. The institutions should: explore the creation of an open technologies unit; foster a dialogue with the openness community for consultation; reinvigorate the European Parliament FOSS user group and place an adviser on open technologies in the EPSC.

  - The European institutions have made robust commitments to openness, but they need to be followed through. The institutions should: ensure the Tallinn Declaration is being implemented; consider a follow-up to the Tallinn Declaration and investigate a Develop in the Open approach for its own software development.

  - FOSS has become ubiquitous in the IT world, yet there are dangers of free-riding. The European institutions should: endorse the established definitions of the Free Software Foundation and Open Source Initiative as well as consider a platform to archive all FOSS for the benefit of reuse.

  -

1 Introduction

This Policy Recommendation Report is an integral part of the FOSS4SMEs project. It aims to support the exploitation of the project results and therefore also to support the impact of the project. This aim encompasses the uptake of the course itself in Small and Medium-Sized Enterprises (SMEs), supporting the re-usage of the course (including any of its parts) as well as the European policy environment for Free and Open Source Software (FOSS).

The Project

The FOSS4SMEs project intends to equip European SMEs with the skills and competences to properly use Free and Open Source Software, and so to improve their digital performance and competitiveness. To reach this objective, the project has developed a set of free online educational training materials for managers and staff of SMEs or start-ups, allowing them to profit from the opportunities offered by the digital era. The course will be freely available to individual learners and offered to public and private bodies providing support, consultancy and training to businesses, which will be able to organise training courses using the results of the project. The project also aims to facilitate recognition and transferability of competences, thus mobility, by applying the ECVET system to the professional profile of the FOSS Business User (FOSS-BU).

FOSS awareness and education can be used as a tool to increase the technological competence of European citizens, businesses and the public sector. Under the 'New Skills Agenda for Europe', the European Commission has identified digital skills as crucial for the competitiveness and development of the European economy.[1] The proposed upcoming EU multi-annual budget will devote €700 million to Digital Skills.[2] The European Commission directly supports a number of FOSS initiatives, such as the Commission's own Open Source Strategy and the EU FOSSA bug bounty program.[3] These initiatives increasingly acknowledge the ubiquitous role played today by FOSS for digital economies. Although by supporting the FOSS4SMEs project the European Commission can be seen to have strategically connected these two important developments, at the same time the role of FOSS for European businesses has not been adequately acknowledged on an EU policy level. This Policy Recommendation Reports aims to provide strategic advice about how the EU policy environment can be adjusted to take into account the value of FOSS for European SMEs. Whilst the scope of this report is focused on EU policy, at the same time these recommendations may be equally relevant to national, regional or local policymakers.

FOSS may have particular benefits for SMEs as part of their business model; this is because without FOSS SMEs are often not able to offer products covering the whole production cycle. With FOSS, SMEs can more readily collaborate with other SMEs to link products into a productivity chain. FOSS is conducive to interoperability, linking different products together into a coherent productivity workflow.

Aside from the business realities, the collaborative development and usage environment which is characteristic of FOSS means that users have the potential to become more than just users, and be part of the project; they become collaborators. Using FOSS fosters collaboration between organisations and people, based on open collaboration and

---

[1]European Commission, 'A New Skills Agenda for Europe'.
[2]European Commission, 'EU Budget: Commission Proposes €9.2 Billion Investment in First Ever Digital Programme'.
[3]European Commission, 'About EU-FOSSA 2'.

innovation. In this lies one of the core advantages for SMEs – FOSS has the potential to help make SMEs into digitally savvy, collaborative, linked-up, competitors on an international scale.

In this, the FOSS4SMEs course aims to teach SMEs how to make a well-reasoned decision about switching, and then to help SMEs migrate successfully. Yet, essentially, the course is only an introduction. Using and collaborating through FOSS teaches much more than this training course could. Understanding a concept on an abstract level is less impactful than seeing it in action and experiencing it through one's own interaction. One of the goals of the FOSS4SMEs course is to provide an introduction to the FOSS collaborative development model. It is a means to an end, as the competences taught by the course are a catalyst for collaborative software development.

Objectives of this Policy Recommendation Report

1. Demonstrate how the strategic use of FOSS in the area of adult learner skills (VET) can improve the economic competitiveness of SMEs;

2. Provide a series of FOSS-specific recommendations for policymakers responsible for education and business policy, focusing on SMEs.

As we outline the potential benefits of FOSS usage with SMEs, besides adjusting policy, it is also important to consider how the FOSS4SMEs course can be used to achieve those benefits. Thus, another aim of this report is to explore how awareness can be raised, both for the FOSS4SMEs course in SMEs and for re-use in other projects. The report will recommend actions that create and take advantage of institutional opportunities to use and re-use the course and its contents. The European Union institutions, on a continuing basis, launch initiatives on the intersection of education and technology and these initiatives should take advantage of work already done, including this course, to achieve efficiency gains. In addition, the course will be released under an Open Access license. The project explicitly welcomes a "fork" of the content and its re-use for any other project.

The scope for this report is thus two-fold. On one hand, it will make recommendations for European education policy, especially in the area of adult learner skills (VET). On the other hand, European digital policy needs to be addressed in order to impact the European policy environment for FOSS in a positive way. Here, among others, the areas of innovation, interoperability, procurement, and licensing all need to be considered specifically. In addition, this report will make recommendations on ways in which FOSS should be considered by European institutions. FOSS necessarily belongs to digital policy, which is a policy area that has developed into a horizontal policy field impacting all policy fields. In this, the report will focus on pain points for FOSS adoption, institutional blocks, organisational and legal issues that require action, as well as more positive actions, and creating a positive policy environment.

Structure of this document

This report is organised in two distinct parts which correspond to the objectives of the Policy Recommendation Report.

After this introduction, chapter two will explore the VET and economic case for FOSS. Firstly, an introduction to FOSS as a concept and to the collaborative model that stands behind it will be provided. Following this, there will be an overview exploring how FOSS and SMEs fit together, including a more in-depth look at specific factors that can create potential benefits for SMEs.

Chapter three will be dedicated to the policy recommendations that this report sets out to provide. These policy recommendations will be split up between education and VET policy, business policy and EU institution internal policy.

The report will end with a summary and conclusions of the report in chapter four.

2 The VET and economic case for FOSS

2.1 Introduction to the FOSS case for Europe

FOSS has the potential to support job-creation and growth in Europe, due to its open, inclusive and collaborative nature. Already today many European companies in all sectors (such as pharmaceuticals, telecoms, banking and manufacturing) rely heavily on FOSS to innovate and compete globally. FOSS development today is a crucial component of Europe's efforts in Artificial Intelligence, High-Performance Computing and the Internet of Things. The ecosystem consists of developers from the public sector, industry, universities and SMEs. If the right choices are made, Europe could become a FOSS champion.

Openness can be key to a truly European Digital Transformation, bringing the security, scale and speed needed to ensure Europe's future competitiveness in the global market. For example, a study of the French law Circulaire 5608 which required all French public administration departments to consider FOSS when procuring software showed that within France, the regulation led to significant benefits. The increased experience with FOSS has lead to improved availability of the required sills and therefore "reduces the barriers to entry for new technology-related companies […] allowing for an increase in the number of IT startups. The study identified a 0.6% - 5.4% yearly increase in companies that use FOSS, a 9% - 18% yearly increase in the number of IT-related startups, and a 6.6% - 14% yearly increase in the number of individuals employed in IT related jobs.[4]

Similar to the EU's own four freedoms[5], FOSS' four freedoms have the potential to provide the EU with a unique opportunity to accelerate Digital Transformation by empowering anyone to inspect / study / iterate upon FOSS code. This creates an environment in which

---

[4]Nagle, 'Government Technology Policy, Social Value, and National Competitiveness', 18, 21.
[5]Free movement of goods, free movement of capital, freedom to establish and provide services and free movement of persons

large or small enterprises, governments, universities and individuals can collaborate across Europe to deliver cutting-edge solutions to many of the challenges that society faces.

As such, FOSS holds the potential to turn fragmentation into strength, by networking the many European Digital SMEs in innovative ecosystems. This can unlock potential when delivering the Digital Single Market and digitisation of European industry. Openness, be it Open Science, Open Data, FOSS, Open Standards or Open Innovation in general, is how European network effects can be harnessed to enhance innovation.

Research indicates strongly that adopting FOSS has benefits for a range of business metrics, including cost savings, freed-up capital, increased productivity, increased innovativeness and higher return on investment. Most of theses aspects are especially important to SMEs.[6] This is based on the open and collaborative development model, which research has shown favours small and medium size enterprises (SMEs) in particular. SMEs often miss the resources, whether in capital or the workforce, to make investments which go further than what is necessary just to keep the existing business running. The collaborative working method embodied by FOSS allows for pooling of resources and gives SMEs the chance to work more strategically.[7]

European innovation will come from connecting research and business through the European ecosystem of universities, individual developers, the public sector, start-ups, SMEs and larger industrial companies. FOSS is an important part of that connection. Especially valuable is the fact that FOSS gives SMEs the opportunity to participate, from the outset, in larger projects involving technologies that would otherwise be available only after larger players start to introduce the technology to the market.

The European Commission defines the "'smart use of ICT' [as] ... the ability of companies in a supply chain to exchange data electronically and seamlessly, thus avoiding (or at least reducing significantly) paper-based, manual data processing".[8] Readers familiar with FOSS will immediately see why FOSS is the key enabling technology for the "smart use of ICT". Only interfaces which are collaboratively developed and available under a FOSS licence will offer a level playing field for small businesses. Proprietary technologies controlled by one vendor can be used to exclude competition, favour certain companies, extort usage fees, unfairly favour own services, exert pressure on users – the list goes on.

FOSS is neither a new nor an untested innovation model. Some of the biggest internet and mobile and Cloud computing platforms are built upon it. In fact, European companies of all sizes and in all sectors, such as pharmaceuticals, telecoms, shipping, banking and

---

[6]Capra, Francalanci, and Merlo, 'The Economics of Community Open Source Software Projects'; Colombo et al., 'Open Business Models and Venture Capital Finance'; Colombo, Croce, and Grilli, 'ICT Services and Small Businesses' Productivity Gains'; Nagle, 'Open Source Software and Firm Productivity'; Nagle, 'Government Technology Policy, Social Value, and National Competitiveness'.

[7]Lambrechts et al., 'Exploring Open Innovation in Entrepreneurial Private Family Firms in Low- and Medium-Technology Industries'; Lorenzi and Rossi, 'Innovativeness of Free/Open Source Solutions'; Vanhaverbeke et al., *Researching Open Innovation In SMEs*; Vanhaverbeke et al.

[8]European Commission, 'Fostering SMEs Growth through Digital Transformation: Guidebook for Regional and National Authorities'.

manufacturing rely heavily on Open Source software to increase their pace of innovation in order to compete globally, with an estimated economic impact of €116 billion per year for European companies, according to a 2012 study, as a result of sharing R&D costs. Today, FOSS provides most of our operating systems, development tools (programming languages/compilers, IDEs, etc), databases, middleware and is at the core of the Web.[9]

For example, every single one of the top 500 supercomputers in the world runs Linux. Linux is also pervasive throughout the Internet of Things and cloud computing. Linux's global market share of the mobile sector is 75%. The Internet runs on FOSS, using software such as BIND, Apache, nginx, Sendmail, etc. In short, apart from the desktop of PCs, FOSS can be viewed as the foundation of modern computing operating systems.[10]

Importantly, Europe's future innovation and digitisation should not lead to more users and industries being locked-in to proprietary solutions. Lock-in leads to the situation that once an organisation has selected a software provider, either it cannot move to another provider or it will incur a substantial cost in doing so, either because the economic or technical offer has become inadequate, or because the vendor has ceased operations. The German government has pointed out that FOSS offers potential to reduce such lock-in, reducing dependence on any one supplier company or country, writing that: "Open-source software guarantees transparency, while open interfaces ensure interoperability and standardisation. This can prevent market-dominant platforms from further consolidating their market power".[11]

Another benefit of the collaborative development method of FOSS is that the freedoms to use, study, share and improve empower citizens, businesses and the public sector fully to understand what the programs they use actually do, i.e., what data is generated and where this data is sent to. This is a very important aspect of technology sovereignty in the digital age.

in the groundbreaking Tallinn Ministerial Declaration on eGovernment [12], the European Commission and Member States have acknowledged the strategic nature of FOSS as a driver of innovation and as a driver of their own public sector digitisation.

Today, the FOSS market is in a phase of broad consolidation, monetisation and industrialisation. Europe, with its robust role in FOSS, should be taking steps to facilitate a European presence in this phase. European companies are well-placed to lead the way and foster the champions of FOSS. Europe could be the base of the FOSS innovators, monetisers and business leaders.

---

[9] Carlo Daffara, 'Carlo Daffara - Economic Impact of Free Open Source Software for Euro…'.
[10] statcounter, 'Mobile Operating System Market Share Worldwide'; Top500.org, 'TOP500 Supercomputer Sites'.
[11] Permanent Representation Germany to the European Union, 'Written Statement by Germany on the Adoption of the Copyright in the Digital Single Market Directive'.
[12] European Commission, 'Tallinn Declaration on EGovernment'.
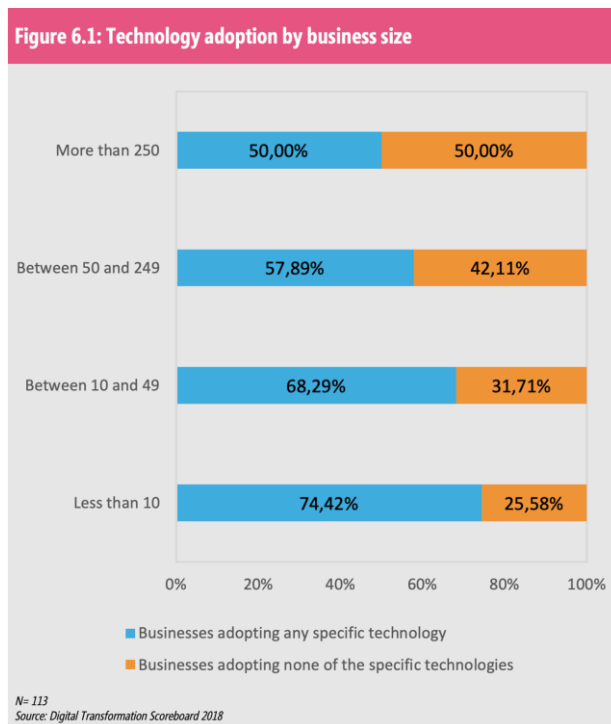
Figure 2: Technology adoption by business size. Source: Digital Transformation Scoreboard 2018

2.2 FOSS and SMEs

Digitisation is prevalent in everyday private and professional life. It affects consumers and businesses alike, and few can really make the choice not to digitise at all. A business without a computer is almost unimaginable. A person without a mobile phone the same.
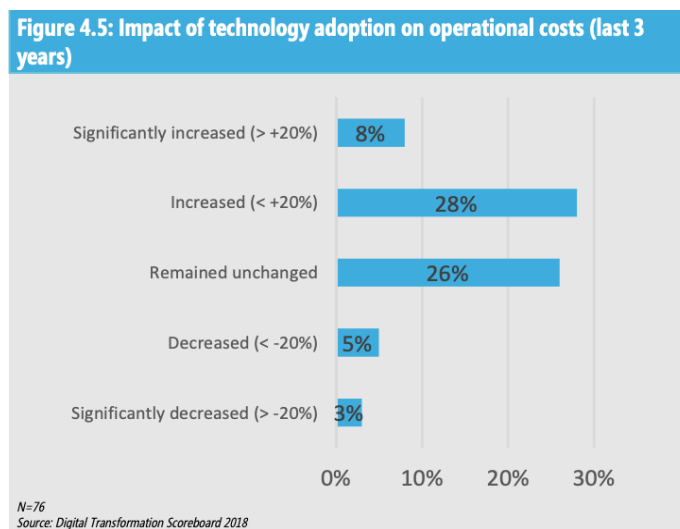
Figure 1: Impact of technology adoption on operational costs. Source: Digital Transformation Scoreboard 2018

The potential target market for FOSS is therefore huge. Almost all SMEs will have some need for IT equipment or services. SMEs especially are often in a position where they have to monitor expenses closely, due to a low financial buffer. Employing FOSS. which can have significantly lower costs, can free uesources up for investments, raising revenue and growing the business.

We expect to see SMEs which have adopted FOSS to see a cost reduction through a variety of factors. We evaluate this through a total cost of ownership approach, which includes costs such as migration.

According to the European Commission's Digital Transformation Scoreboard, digitising a business in general tends to increase operating expenses. While 36% of companies report that technology adoption increased operational expenses, only 8% reported a decrease in operational expenses. 26% said that expenses did not change.[13]

On the other hand, data from PwC indicates that the pursuit of cost reduction is not the reason why businesses digitise; rather, the aim is to increase revenue. A significant majority (73%) of CEOs say that revenue growth is the top benefit of digital initiatives. Only 40% of CEOs see reduced costs as the top benefit.[14]

Data from the European Commission's Digital Transformation Scoreboard shows that the smaller the size of the company, the more likely the company is to adopt digital technologies. Almost 75% of companies with fewer than 10 employees have adopted digital technologies, while only half of companies with more than 250 employees have done the same.[15]

The same data suggest that the adoption of digital technologies has very beneficial effects on businesses (of all sizes), with almost 90% reporting that digital technologies have generated positive outcomes for the business, especially entering new markets and gaining new clients.[16]

---

[13]European Commission, 'Digital Transformation Scoreboard 2018: EU Businesses Go Digital:
    Opportunities, Outcomes and Uptake', 20.
[14]PwC, '2017 Global Digital IQ Survey', 9.
[15]European Commission, 'Digital Transformation Scoreboard 2018: EU Businesses Go Digital:
    Opportunities, Outcomes and Uptake', 32.
[16]European Commission, 39.

Table 14: Sectoral share of SME value added in selected Member States, 2015

Sector	BE	DE	ES	FR	IT	NL	UK
Mining and quarrying	0%	0%	0%	0%	0%	1%	1%
Manufacturing	16%	20%	20%	17%	31%	17%	14%
Electricity, gas, steam and air conditioning supply	2%	1%	2%	1%	2%	1%	1%
Water supply, sewerage, waste management and remediation activities	1%	2%	1%	1%	2%	1%	1%
Construction	11%	10%	10%	12%	10%	9%	13%
Wholesale and retail trade	25%	22%	24%	22%	21%	27%	17%
Transportation and storage	7%	6%	9%	5%	6%	7%	5%
Accommodation and food services	4%	4%	8%	5%	6%	4%	4%
Information and communication	6%	6%	4%	6%	4%	7%	9%
Real estate activities	5%	7%	5%	6%	4%	6%	5%
Professional, scientific and technical services	15%	14%	11%	14%	11%	14%	19%
Administrative and support service activities	7%	7%	5%	9%	4%	7%	11%
Total	100%	100%	100%	100%	100%	100%	100%

Source: Eurostat

Figure 3: Sectoral Share of SME value added in selected Member States, 2015. Source: Eurostat

Digital skills are tightly connected with the performance of digital technology integration. The European Commission data suggest that those who have the highest level of digital skills also have the most successful integration of digital technology. Around 20% of new value created by SMEs (non-startups) is created within the "information and communication" as well as the "professional, scientific and technical services" sectors.[17]

2.3   Tangible benefits for SMEs

2.3.1   FOSS impact on business costs

Some see the cost angle as becoming less and less important, yet many SMEs struggle to stay alive and competitive in the marketplace. Unlike large enterprises, SME decision makers often feel that they only have the resources to focus on the immediate business, with little ability to invest resources into long-term goals or development. This is an issue that affects not only the digitisation of SMEs, but also many other areas of strategic importance to the business in general.[18]

There have been a number of case studies of organisations that moved away from proprietary software to FOSS to reduce cost; examples are the French Gendarmerie, the Estonian government, and CERN. A wide range of possible savings is attached to these moves, from 20% of up to 95%. It is therefore difficult to make a general statement, and we are taking a more nuanced approach.[19]

---

[17]European Commission, 'SME Annual Report 2017-2018', 54.

[18]Vanhaverbeke et al., *Researching Open Innovation In SMEs*.

[19]Dumond, 'Linux on Desktop: A Success Story'; Hillenius, 'UK: "Government's Use of Open Source Could Save Millions"'; Merilo, 'OpenOffice.Org in the Estonian Ministry of Environment'; RedHat, 'The Government of the Canary Islands Migrates Telecommunications and New Technologies Platform

Cloud-based Software as a Service (SaaS) offerings have become mainstream and partly do not operate on the traditional desktop software paradigm. These offerings operate on a recurring subscription model, where most of the computing and data is offloaded to third-party hosting services provider. Yet whether these models result in higher or lower cost for organisations over the life-span of a product turns out to be very dependent on the individual product. Even though upfront cost might be lower, total cost of ownership can be higher, due to recurring subscription costs. Some research points toward self-deployed FOSS cloud solutions on a third-party cloud-based IaaS (Infrastructure as a Service) offering to be associated with a lower total cost of ownership, even before taking into account the lower exit costs.[20]

These developments can mean significantly different results when calculating cost, and so can influence the economic performance of an SME. Hardware costs might be lower, yet licence costs might be higher. This should be taken into account when performing cost calculations.

Consulting & customisation costs

Businesses often require help to ensure the seamless integration of new software into their existing business processes, either through adjusting the business processes, through adjusting the software, or usually both. When implementing a new business process with new software, such software might have to be adjusted to fit the new process.

With proprietary software, the adjustments will usually have to be performed by the developer of the software, as proprietary licences regularly forbid changes by the licensee or by third parties. This means there can be no competition around these services and thus the developer can set the price for such adjustments more independently.

In contrast to this, the open nature of FOSS ensures that anyone with the necessary competence can not only make adjustments to the software in order perfectly to tailor it to the required business process; further, it may even be the case that such adjustments have already been made, and are freely available.

Similarly, independent consulting work is difficult if intimate knowledge of the software is restricted, either to first party personnel or to authorised third party personnel. Not only does such a restriction reduce competition, it also can mean reduced independence of the consultant, and thereby reduce perceived reliability of, and/or trust in, the consultant.

Exit costs

Exit costs are likely to be incurred when moving away from a specific product or solution. In most situations, it will be desirable to move existing data across to any new or

---

to Red Hat Enterprise Virtualization'; The Linux Foundation, '6 Reasons Why Open Source Software Lowers Development Costs'.

[20]Bibi, Katsaros, and Bozanis, 'Business Application Acquisition'.

replacement product. With proprietary solutions, such cost can be significantly higher than with FOSS.

Without knowledge of the inner workings of the software, or without adherence to open standards, which allow an understanding of how the data is processed, it can be next to impossible to migrate data without the support of the vendor. This is likely to incur extra and high costs.

FOSS can be inspected, and often adheres to open standards for its input/output functions. This makes the exchange of data easier and even if exchange of data is not straightforward, i.e., if not based on an open standard or documented, the open nature of FOSS makes it possible for professionals to understand how the software processes data and so build software which helps with the migration.

Hardware costs

The term "hardware costs" refers to charges related to necessary hardware purchases to support the software in use at the company in question.

In general, proprietary software might have higher hardware requirements or might set specific requirements for features present in the hardware. One example is the hardware requirements for the Microsoft Windows 10 desktop operating system, which includes 2 GB RAM and an arbitrary requirement for a WDDM 1.0-compatible graphics card.

FOSS often has simple or low hardware requirements, and seldom relies on arbitrary hardware requirements. While this is not guaranteed, it is not unusual for forks to exist with still lower hardware requirements or for still older versions with lower hardware requirements still to be available. As an example, mainstream operating system distributions based on GNU/Linux (which work with 512 MB RAM and which are regularly updated), are available. The open nature of these FOSS projects means that anyone can adapt the software and might therefore be able to lower system requirements.

Licence costs

The term "licence costs" refers to charges directly related to the purchase of a licence to use the software.

FOSS generally does not incur licence costs directly from the software itself, as FOSS licences grant the four freedoms to use, study, share and improve the software. This being said, there are a number of situations where similar costs can occur; examples are third party components, purchase of compiled versions of software or tested versions of software.

Companies distributing proprietary software usually rely on licence (or subscription) sales for a majority of their income, and as such these sales tend to be a core part of the proprietary software business model.

Support costs

The term "support costs" refers to costs relating to the maintenance and running of activities. Typical in a business environment are support contracts for specific products, guaranteeing a stated minimum level of availability for the product, by use of a service level agreement (SLA).

The availability of code without obscurity means that there can be an open market for support services, delivered either ad-hoc or based on a running contract. Often, with proprietary products, the producer only allows support services to be provided directly by it and so can set the prices without needing to be concerned about competition. An open market allows for competition and therefore for the possibility of lower prices.

In addition, since the source code is open, anyone, i.e., an in-house IT team, or the community for the project, can provide support, possibly at no dedicated cost.

It is also possible that reduced licence costs associated with FOSS might to some degree be transferred over to support costs, and that proprietary vendors provide support at lower costs, financed through licence sales.

Training costs

The term "training costs" relates to the costs of training activities, either through direct charges (e.g., for courses) or the opportunity costs incurred by the removal of an employee from revenue-producing activity.

Principally, we do not see major differences in how training employees for new software would work between FOSS or proprietary software. In some cases, proprietary software may have more expansive training content, or training content provided as part of the sale of the licence. In a business environment, consulting and support contracts are quite typical, and so this may not be relevant in all situations.

It is possible that retraining due to a switch to FOSS from proprietary software is necessary, or that productivity is lower in the beginning following such a switch. It should be noted though that this would usually be the case with any software switch. If a business adopts new software in a business process where no software was used before, or a new business process, such new software would in all likelihood also incur training costs.

2.3.2   FOSS impact on business revenue

Moving on from the potential to reduce costs, we posit that migrating to FOSS can also help an SME to become more innovative and increase sales.

A major issue for SMEs is the factual and perceived lack of resources to go beyond the current existing business model or product palette, in order to become more competitive. The previously mentioned cost savings are an important step in improving the

competitiveness of SMEs, by freeing funds up from supporting resources to be used on productive activities.

In the case of SMEs operating in the area of software development, FOSS offers even more potential benefits. The open and collaborative FOSS development process means that SMEs can profit from the work of others by linking efforts, either technically or organisationally. Research has concluded that reusing components whilst also contributing back leads to a 100% return on investment. In one study, software developed through FOSS methods showed itself to be more innovative than proprietary software. Through this, resources can be diverted to the development of differentiated features and therefore to increase competitiveness.[21]

Software development costs

The term "software development costs" relates to costs directly incurred through the development of software. These are staff, overhead, software and hardware costs.

Embracing FOSS in software development can mean that companies start to integrate existing FOSS libraries into their own software. Such libraries provide base level functionality, readily integrable into other software. SMEs can avoid a high amount of otherwise necessary own development activity by relying on FOSS libraries, which are well-tested and of high quality. As such, SMEs can concentrate on developing features that truly distinguish their own software from the competition's, without having to rebuild the infrastructure, which consists of non-differentiating aspects of the final product, from scratch.

SMEs can also make "forks" of existing projects – this means an existing project is duplicated and developed in a different direction (one thinks of a "fork in the road"). By doing this, SMEs can customise and enhance these projects and provide services around the resulting new product. This way, SMEs can save incurring significant amounts of software development cost, while still providing a unique and differentiated product.

Community engagement is another important part of the FOSS model. If a FOSS project is successful in building a community, the community becomes an invaluable resource for any company working with that project. The community can undertake quality assurance and testing, flag bugs, provide solutions, make suggestions for market needs, maintain a product, evangelise the product and be a partner in the development. As the software is freely available, all involved parties profit from this exchange. A company can help provide a level professional development to the project.

---

[21]Lamastra, 'Software Innovativeness. A Comparison between Proprietary and Free/Open Source Solutions Offered by Italian SMEs'; Lorenzi and Rossi, 'Innovativeness of Free/Open Source Solutions'.

Sales

"Sales" refer to revenue, relating to either existing or new business processes, which in some way are dependent on software.

As we have argued, employing FOSS methods allows SMEs to re-focus on differentiating aspects of a product with a reduced need to develop the non-differentiated part of the product, i.e., the infrastructure. By doing this, SMEs can end up with products that are more innovative, which can lead to higher sales and revenue.

In addition, the open nature of FOSS means that multiple SMEs can work together to improve an existing product and generate revenue from different aspects of the software, or provide a suite of software that is interoperable, which does not necessarily all need to come from the same vendor. This can especially help SMEs compete with companies that are bigger and provide their own broad software suites.

Lastly, an SME can provide support, customisation & consultation services for software that the SME did not itself develop, whether primarily or at all. FOSS code can be inspected by anyone and improved. SMEs can provide consultancy services to companies on how to integrate software into their system, or make customised versions; SMEs can also offer support services if something goes wrong. They can contribute code back and by doing this improve the software. SMEs can join the FOSS ecosystem and generate revenue through supporting the ecosystem.

In conclusion, there is much potential for an SME which incorporates FOSS into its business. Taking this approach can offer reduced costs, through a reduction of lock-in (exit) costs, consulting & customisation costs, licence costs and hardware costs. Cash-strapped SMEs can reinvest these savings into becoming more competitive and innovative. SMEs involved in software development can profit twice by adopting FOSS, as we expect that this approach has the potential to help an SME both to reduce its software development costs and to increase its sales.

2.4   Project results in VET

As part of the project, the consortium considers the feasibility of different options to achieve the long-term sustainability and up-scaling of the project results, including the development of other applications in vocational education and training (VET) based on FOSS4SMEs results.

The purpose of this section is to first outline the consortium's analysis of the current context and situation. Secondly, an analysis will be presented to evaluate the different aspects that will need to be considered for this analysis. Among the aspects considered are technical feasibility, economic/resource feasibility, operational/management feasibility and social desirability/marketing feasibility. Lastly, the consortium will make a number of recommendations to enhance the feasibility of the project results.

2.4.1   Situation analysis

In this section we describe strategies to support the projects impact and the dissemination of the course, the FOSS Business User Profile in the context of VET and this Policy Recommendation Report. In this, the FOSS4SMEs consortium is relying on the unique strengths of the members of the consortium. Yet, it is important to consider the most promising avenues to ensure the widest impact possible for the public deliverables of the project.

For these, the project is considering different avenues, yet a combination is promising to be the most feasible way forward to have the most amount of impact for the project results and to enable the re-use of the same.

In line with the open ethos of the FOSS4SMEs project, it should be considered that for the success of the FOSS4SMEs course, the usage of the course itself is only the first step. The FOSS4SMEs consortium is committed to supporting the course for usage by third parties, for example, European SMEs, ECVET institutions and other interested parties. Yet, it should be noted that going further than the singular usage of this course, it could have a much larger impact by being adapted for future use by others.

With time, the content of the course will undoubtedly and unavoidably become outdated and not in line with the development of the educational, policy and technical realities in Europe and the world. As such it is important to consider how the project results can feasibly be re-used to still be fit-for-purpose.

The FOSS4SMEs consortium therefore consider the open license defined in the annex of this document to be imperative to its continued success. Others, such as VET providers, can take the course, re-use parts, update them and therefore save own resources while building on a well-researched, well-reviewed basis.

2.4.2   Evaluation

Technical Feasibility

In this, the consortium evaluates the feasibility of the long-term sustainable development and up-scaling of project results based on technical criteria. From this perspective, few barriers appear to exist for such a feasible up-scaling.

The consortium has chosen the Moodle platform as the technical basis for the course, thereby relying on a standard and popular MOOC platform that is Free and Open Source Software and based on open standards. As such, the code of the platform is inspectable and everyone interested can survey the code and its contents. The license also technically encourages re-use and therefore supports the technical feasibility.

Additionally, the consortium has developed different roll-out options that can be used for the re-use of the course. Available are a Docker-image for the course, which means that the course can be easily locally installed and run and such can be re-used in a number of different contexts.

Besides this, the course is available in a much simpler, open format in a PDF/A-1 file. As such, the content can easily be extracted even if the technical skills of the extractor are limited.

Lastly, the course is also available in the standard version as a hosted course and can through this be easily inspected and copied without the need for prior registration and/or providing personal data.

Besides the up-scaling of the course, the FOSS Business User competence can also be inspected easily as it is available in a standard file formats and case easily be extracted and integrated into a possible new file and through his a curriculum by for example and institution in the area of ECVET.

Economic/resource Feasibility

In this, the consortium evaluates the feasibility of the long-term sustainable development and up-scaling of project results based on economical and resource criteria. From this perspective, few barriers appear to exist for such a feasible up-scaling.

The strength of the project results are in their adherence to standard formats and systems. As such, not only is their creation less economically or resource intensive, their up-scaling is also less economically or resource intensive.

Very few resources should be required to support the up-scaling of the project results. All files are available in simple layouts and can easily be extracted. This applies to both the course content and the FOSS Business User Competence.

A new course can easily implement content from the FOSS4SMEs course also due to its licensing, as no resource-intensive approval process is necessary for the re-use. A new course for the same reason be easily and quickly be created on top of the newly created FOSS Business User Competence and take advantage of the work done by the FOSS4SMEs consortium.

An implementer can also use the course in a for-profit capacity, as the license does not preclude such an option. As such, it would even be possible to use the course and the FOSS4SMEs Business User competence in a revenue-generating situation and should therefore be economically positive.

Possibly most important is the positive impact of digital skills on the European economy and in this we see a possible role for the course to be an important tool to promote digital skills. As we have argued before, FOSS competence should teach independent usage of technology and therefore can be an important tool to improve digital skills.

Operational/management Feasibility

In this, the consortium evaluates the feasibility of the long-term sustainable development and up-scaling of project results based on operational and management criteria. From this perspective, few barriers appear to exist for such a feasible up-scaling.

The type of delivery of the project results of the FOSS4SMEs project should pose very little to no issues when it comes to the aspects of operations and management, for the reasons that have been referred to before.

Social desirability/marketing Feasibility

In this, the consortium evaluates the feasibility of the long-term sustainable development and up-scaling of project results based on social and marketing criteria. From this perspective, some barriers appear to exist for such a feasible up-scaling.

From a perspective of social desirability, the up-scaling of the project results can be seen positively. Beside the benefits for society through digital education, FOSS education specifically teaches open thinking.

Yet, from a marketing perspective, it might be possible that possible organisations that would be interested to re-use the course and the FOSS Business User competence, such as ECVET institutions, would want to develop own materials to emphasise the own competence existing in such institutions and being the core competence of such institutions. While the re-use of previously created content should be seen as something to encourage, as it is cheaper, easier and can increase the quality of an outcome. Yet, often the value of the ideation of something new and "own" is considered important to indicate a high value of a specific outcome.

2.4.3　　Recommendations

There are a number of different actors that could be interested in being involved in this measure, yet it can be considered that will be most fruitful to, as is being demonstrated by the FOSS community, attempt to build a community around the project that will sustain and widen the project results in their own interest.

As such, for the long term sustainability and up-scaling of the project results it is suggested to consider a combination of the following actions:

- Approach VET providers, specifically academic institutions and business schools employing the European Credit system for Vocational Education and Training (ECVET) should be considered as especially well placed to adopt and further develop the FOSS Business User Profile.

- The FOSS Business User Profile was already developed with the ECVET system in mind and should therefore to be easy to adopt to the needs of these institutions. With the need for digital skills ever increasing, VET providers could build a

course/curriculum around the FOSS Business User profile without having to develop the course from the ground up.

- Through this, the tangible upscaling and further development of the project results could be achieved. It would therefore save development resources and ensure the FOSS Business User profile's impact. In addition, the usage of the ECVET system would allow the easy inter(national) mobility of learners of the course.

- Contact databases, listings and similar offerings to have the course be listed among on their platforms. This should increase the visibility not only for potential users of the course, but also for organisations, such as ECVET institutions, that could be interested in re-using the course by retooling into their curriculum. An example of such a listing is the Digital Skills & Jobs Coalition initiatives repository[22]

- Reach out to the existing European and national Free and Open Source business associations. These associations have the necessary knowledge, funding and interest to sustain and widen the projects. The business associations could use the course as training material for a number of different stakeholders and adjust the content to their need. In addition, they have the ability to reach system integrators that are interested in teaching customers.

- Reach out to accounting practices, as SMEs will usually rely on third-party accountants. Yet, accounting practices are also under pressure to provide more services than "just the books". As such, they could be seen as a conduit to support SMEs vision through consultation and provide valuable knowledge on how to grow. Naturally, the most important avenue today to grow is to digitise and FOSS knowledge and competences could be the perfect tool for this. They could adapt the course according to their needs.

- Reach out to academic institutions and specifically business schools. These institutions will be very important to change the way young graduates think about how a tech business can work. As such it will imperative to teach about the value of open innovation and FOSS. Academic institutions and business schools already know how to create online training courses, but the basis of the FOSS4SMEs course can significantly reduce the effort required to create a course perfectly suited for their needs.

- Reach out to financial institutions. These institutions have have an interest that their customers have value and a prosperous future. With the ongoing digitisation, digital skills are imperative and financial institutions could use the course to introduce digital skills into their customers.

- Reach out to existing MOOC platforms which host open courses. The FOSS4SMEs course would provide new content at no cost to the MOOC platform

---

[22]https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition-initiatives

provider. The increased discoverability would also increase the impact the course would have in the real world.

-

3 Policy recommendations

3.1 Vocational Education and Training (VET) policy

3.1.1 SME training support

Issue: Our own survey among SMEs and studies has shown that typical SMEs don't see themselves as possessing the resources, whether financial or personnel, to devote to training. SMEs say they are focused on delivering on their own products, and find it difficult to invest the resources to expand their business.[23]

> **Rec 01:** The European institutions should consider supporting a structured, no-cost online platform which organises training resources for businesses. Such an online platform could provide consulting services and increase the discoverability of training opportunities. This platform should be strategically managed, so as to increase education in the critical areas of digital skills, encompassing FOSS competences.

> **Rec 02**: Training support, such as refunding training costs, and providing funding to recover time spent by employees on training duties by covering trainees' wages, should be evaluated and tailored for SMEs' digital transformation employing FOSS, so that they can invest the resources to achieve their vision.

3.1.2 Diversity

Issue: As is the case for the general technology sector, the FOSS ecosystem is not sufficiently diverse. In a 2017 survey of FOSS projects on GitHub, 95% of the 5,500 respondents were men, with only 3% of the respondents being women and a small representation of non-binary people. According to the same survey, women were also significantly more likely to have experienced abusive or stereotyping language and unwelcome sexual advances. This makes these workplaces less attractive for a diverse set of people. FOSS is about openness and should be open to all.[24]

> **Rec 03**: Continue and strengthen existing programs to support the diversity in technology education and jobs, to increase awareness about opportunities for a diverse set of people. Support a change from the inside.

---

[23]European Commission, 'Guide for Training in SMEs'; Lyons and Mattare, 'How Can Very Small SMEs Make the Time for Training and Development'; OECD, *Skills Development and Training in SMEs*.
[24]GitHub, Inc., 'Open Source Survey'.

Rec 04: Support universities in teaching diversity in computer science and technology education. Making FOSS businesses more inclusive makes them more attractive workplaces and therefore supports their competitiveness.

3.1.3 Digital sovereignty

<u>Issue</u>: FOSS, be it developed in Europe or not, supports digital sovereignty. Due to its architecture, FOSS is resilient to disruption, resilient to geographic and national capture and resilient to blocking. For example, access to FOSS projects cannot be restricted through trade restrictions, as has been shown in the recent Huawei trade dispute, when access to the FOSS mobile operating system Android continued for the Chinese company, while its access to Google's proprietary Play Services was restricted. If one entity is taking a project in an undesirable direction, the project can be forked and development can be continued independently. FOSS therefore is perfectly in line with the European Union's approach to build a sovereign, open and global approach.

Rec 05: European policymakers should strive to leverage the value of FOSS for Europe's digital sovereignty and embrace it. As such: (i) supporting FOSS throughout public procurement and within the European ecosystem will support Europe's digital sovereignty; and (ii) FOSS, open standards etc. are strategic tools to achieve digital sovereignty.

Rec 06: When teaching digital competences, it is important to not fall back on simply teaching specific product knowledge of the incumbent product – this increases lock-in and inflexibility. True digital competences equip a learner to apply their know-how to a broad set of tools, and enable them easily to switch between products, thus giving them transferable skills.

3.2 Business policy

3.2.1 Scale and growth

<u>Issue</u>: SMEs employing FOSS, open innovation and open collaboration are not being sufficiently considered in support programmes. As such, their growth potential remains under-developed. The legal framework is not sufficiently adapted to take into account the specific challenges faced by SMEs employing FOSS.

Rec 07: The European institutions are supporting efforts to foster more venture capital in the European small business ecosystem. This effort needs to reflect the open nature of many growing ICT SMEs, which critically rely on FOSS to innovate.

Rec 08: Many SMEs employing FOSS have leaders who are specialised in product development, yet not in business development. Significant efforts are being made to support SME growth. Efforts need to be maintained and increased to support leaders with little background in business. Measures such as (mini)-MBAs, accelerators and networking need to be shaped to embrace open innovation.

Rec 09: The European institutions should continue efforts under the European Innovation Council.[25] In the diverse set of measures, it should be ensured that a modern and current understanding of innovation is fostered and that no unnecessary intellectual property restrictions are recreated, which harm open collaboration.

Rec 10: The discoverability of FOSS solutions should be increased, so that SMEs can be supported in adopting FOSS. The European institutions should consider supporting directories for FOSS solutions so that European SMEs, especially less technically adept ones, can more easily pick up solutions well suited for their needs.

Rec 11: The European institutions should strive to support the FOSS business community through improving the legal environment for the governance of FOSS projects and their uptake by software providers and integrators as well as users. A study should be considered on what business and legal risks and challenges exist for procuring FOSS, either as a private or public organisation, and to provide recommendations as to how the environment can be improved. Consider examples such as Apperta[26] as cases where stewardship can mean positive outcomes for the public good.

3.2.2   Public procurement

<u>Issue</u>: Public procurement makes up 14% of European GDP and therefore has a huge impact on the European economy. Public procurement rules therefore have a tremendous impact on the business environment, including which businesses succeed and which fail. Public procurement is still built upon outdated principles, and favours proprietary software as well as big suppliers.[27]

Rec 12: Public procurement is not sufficiently open to SMEs. The European institutions should study the needs of FOSS SMEs in public procurement so that they can take part in public procurement on a level playing field. The rules under the public procurement directive should be reviewed.

Rec 13: Public procurement does not sufficiently consider open innovation and open collaboration as business models. The European institutions should study how these business models can be better included into the public procurement process. One possibility is to study a custodian model, where one company acts as a conduit for a number of interlinked suppliers collaborating openly - this could enable SMEs to compete on a level playing field with bigger competitors.

Rec 14: Public procurement needs take into account the whole life cycle cost when procuring software as the total cost of ownership. As such exit costs need to be

---

[25]European Commission, 'Enhanced European Innovation Council (EIC) Pilot'.
[26]https://apperta.org/
[27]European Commission, 'DG GROW: Public Procurement'.

considered as a natural part of project. The potential of FOSS and open standards to reduce such costs should be clarified.

Rec 15: Public procurement should consider the benefits of procuring FOSS for the adaptability of software. With the code being open to re-use and modification, existing products can be adjusted at little cost to present needs, future projects in the same or other organisations can save significant resources by re-using existing project results and adjusting it again. This means FOSS can provide significant value beyond the existing project.

3.2.3   Intellectual property & innovation

<u>Issue</u>: SMEs by and large do not file patents, and the current emphasis on patents therefore disadvantages SMEs. Further, FOSS, open innovation and open collaboration have little need for patents, as the existence of patents can be a serious detractor to collaboration. The role of patents needs to be reconsidered. FOSS has been shown to be hugely innovative. Whenever innovation policy in the digital space is discussed, FOSS needs to be considered.[28]

Rec 16: The European institutions should review alternative ways to measure innovation, rather than continuing with today's status quo. Innovation measurements should move away from quantifying the number of patents filed by a given company. This method is outdated and not aligned with modern ways of innovating openly, or the practices of SMEs which by and large do not file patents.

Rec 17: Public procurement rules should embrace openness. In public procurement, there should be no requirement to protect intellectual property or demonstrate how intellectual property will be shielded from re-use. By default, results of public procurement should be available under a licence allowing re-use.

Rec 18: The European institutions should commission research evaluating and assessing the specific impact and consequences of the current national and European intellectual property regimes on open innovation, open collaboration and FOSS, with a special emphasis on SMEs, and examining whether changes would support European digital transformation and competitiveness.

Rec 19: As SMEs typically have neither the staff nor other resources dedicated to evaluating the possible existence of patents related to software development, the European institutions should: (i) make sure that SMEs are not unduly disadvantaged; and (ii) strive to maintain and enforce the non-patentability of software under the European Patent Convention.

---

[28]Frietsch and Neuhäusler, 'SME Patenting – An Empirical Analysis in Nine Countries'.

3.2.4   Openness policy

<u>Issue</u>: Openness is still not the default in European digital public policy, FOSS is not sufficiently taken into account. Yet, FOSS has become ubiquitous in the digital business world. FOSS powers 100% of the supercomputer operating system market, 82% of the smartphone market, 90% of mainframe customers, 90% of the public cloud, and 62% of embedded systems.[29] Europe needs to become open-first in order to harness this.

> **Rec 20:** The European institutions should systematically recognise the potential for a positive impact that openness in all its permutations can have on society, and support this in all their policy-making.

> **Rec 21**: The European institutions should take a broad view of the need for openness in their digital policy. Openness, be it FOSS, open standards, open science, open access is becoming the standard, and is the option benefiting everyone.

> **Rec 22**: The European institutions should consider incentivising the public welfare gain that FOSS can offer through its open nature. If released under a FOSS licence, everyone can potentially benefit.

3.3   EU Institutions policy

3.3.1   Research

<u>Issue</u>: There exists already a wealth of research on FOSS, much of which has been funded by EU research grants and by the Commission. However, gaps exist for which the European Commission is best placed to produce much-needed research.

> **Rec 23**: The European Commission should strategically research what its own role in supporting FOSS sustainability and communities could be.

> **Rec 24**: The European institutions should continue and strengthen their support for openness and open data when funding research. Existing rules to make results and data of such research available under an open licence and as FOSS software by default need to be rigorously enforced.

> **Rec 25**: The European Commission should continually update FOSS market research into its economic and social impact with an EU-wide scope, as it does for other sectors of strategic importance to Europe.

> **Rec 26**: The European Commission should research how to co-develop and build communities around its software solutions to take advantage of the immense help the community can offer when engaged.

---

[29]Thomas Claburn, 'Open Source Community Crams Itself into Big Tent'.

3.3.2 EU institutional capacity

Issue: It is necessary to take a holistic approach to digital policy. The Commission is already active in several programmes which support FOSS, e.g., ISA² in DIGIT, EU FOSSA 2, the Open Source Observatory (OSOR), JoinUp, and the EU Open Source Strategy. But measures are currently fragmented and lack an overarching common purpose which can both guide and pool resources to accelerate EU and its Member States' digital transformation journey whilst creating more European jobs and digital leaders. There were unintended consequences for FOSS businesses which stemmed from legislation under the Digital Single Market. A broader view requires all Commission services to be aware, and to act towards enabling European FOSS businesses to succeed. There are fragmented responsibilities regarding digital policy. There is still potential to improve the coordination of digital lawmaking, as it is a horizontal policy area, impacting most or all policy areas today.

Rec 27: The European Commission should explore the creation of a unit responsible for open technologies or create a cross-DG, cross cabinet coordinator for open technologies. It should provide the necessary legislative competences and resources from all involved departments.

Rec 28: The European institutions should rely on the well-documented wealth of knowledge available in FOSS and openness communities when making policy decisions, so as to minimise unintended consequences.

Rec 29: The European institutions should reach out to the FOSS and openness communities when preparing policy decisions, to extend their interaction from the technical to the policy level, and to minimise the risk of unintended consequences.

Rec 30: The European Parliament should reinvigorate the European Parliament Free Software User Group to connect and network Members of the European Parliament on relevant topics and work with like-minded organisations in the EU and globally.

Rec 31: The European Commission should place an adviser on open technologies in the Think Tank of the President of the European Commission (the European Political Strategy Centre (EPSC)), and thus recognise and aim to leverage the strategic importance of openness.

Rec 32: The European Council should consider the needs of businesses relying on FOSS when discussing innovation on all levels, such as Council working parties. As such, policy impacting such businesses, including SMEs should not unduly disadvantage them.

3.3.3 Follow through on openness commitments

Issue: The European institutions and Member States have made great commitments to openness. These commitments need to be fulfilled to reap their benefits. The European institutions face a challenge when it comes to recognising the importance of FOSS within their broader digital strategies and for SMEs. Most current digital strategies of public

administrations do not reflect how FOSS fits within the European growth in Cloud computing, its relevance to SME-led innovation, Open Science, Industry 4.0, within cybersecurity and Artificial Intelligence.

Rec 33: The European Commission should follow through on its commitments through the Tallinn Declaration, and proactively take its role in supporting and monitoring the implementation of the Tallinn Declaration in Member States. These openness commitments help SMEs to compete fairly with bigger companies.

Rec 34: The European institutions and Member States should begin considerations for a follow-up to the Tallinn Declaration, and discuss the next Ministerial Declaration on eGovernment.

Rec 35: When developing software, the European Commission needs to follow its commitment and develop software under a FOSS licence and Develop In the Open (DITO). As such, SMEs can compete with bigger companies on a level playing field for support contracts, or take advantage of software development and build a business on top of these for other public administrations.

3.3.4 Safeguarding European FOSS

Issue: FOSS has today a very positive image so that some vendors attempt to profit from the advantages from the affiliation without actually offering true FOSS by respecting the freedoms assigned to it.

Rec 36: The European institutions should endorse accepted definitions of Free and Open Source Software, such as the definitions of the Free Software Foundation (FSF)[30] and the Open Source Initiative (OSI)[31], as other governments have done when strategically supporting FOSS. This will protect the ecosystem and thus support SMEs relying on FOSS.

Rec 37: The European institutions should consider creating a platform to archive all software under a FOSS license, or support an existing platform which abides by openness principles. SMEs relying on FOSS can then take advantage of this wealth of software and use it for their business.

4 Conclusion

Usage of Free and Open Source Software today is ubiquitous in many ICT companies and many other companies are using software that is FOSS without even being aware. FOSS is the basis for a vast majority of mobile devices, it runs almost all websites in the world and each and every one of the fastest 500 supercomputers would not be possible without FOSS. No company working with ICT can avoid FOSS, its economic impact is vast and it shows the potential of the open and collaborative model.

---

[30]https://www.gnu.org/philosophy/free-sw.en.html
[31]https://opensource.org/osd

Yet, many European SMEs do not take advantage of this potential. The European Commission has funded the FOSS4SMEs project to enable harnessing FOSS to increase SMEs digital skills by means of a free digital course. At the same time, developing and implementing FOSS can help SMEs take advantage of the digital transformation, as its open model lets anyone inspect, customise and repackage software for the needs of the organisation. Studies have shown FOSS to be innovative, free of lock-in, in support of digital sovereignty and cost-efficient and have identified the specific advantages FOSS has for SMEs, which often tend to cash-strapped. The strategic value of FOSS can be immense.

With the course, the FOSS4SMEs consortium aims to support SMEs to take advantage of FOSS, yet with this Policy Recommendation Report, the consortium provides policymakers with a road map to create the right policy environment for SMEs that have adopted FOSS to flourish.

The FOSS4SMEs consortium has suggested action in three areas: Vocational Education and Training (VET), business policy and EU institutions policy. Our recommendations focus on creating a level playing field for SMEs employing FOSS, a business model that is not sufficiently taken into account by the current policy environment. With this, SMEs employing FOSS should be able to compete fairly and Europe could realise the strategic value that FOSS can have.

In VET, SMEs need to be supported in training activities, diversity needs to be improved and the role of FOSS in digital sovereignty needs to be realised.

When it comes to business policy, SMEs employing FOSS have specific needs and their scaling and growth needs to be supported in a considered way. In addition, public procurement rules and intellectual property regulations should be adapted to both the needs of SMEs and the open innovation and collaboration models.

Lastly, the European institutions themselves have started laudable initiatives to embrace openness, yet these initiatives are not sufficiently coordinated and therefore don't realise the full impact. The institutions should improve internal coordination when it comes to policymaking, research funding and the made commitments.

5 Bibliography

Bibi, S., D. Katsaros, and P. Bozanis. 'Business Application Acquisition: On-Premise or SaaS-Based Solutions?' *IEEE Software* 29, no. 3 (May 2012): 86–93. https://doi.org/10.1109/MS.2011.119.

Capra, Eugenio, Chiara Francalanci, and Francesco Merlo. 'The Economics of Community Open Source Software Projects: An Empirical Analysis of Maintenance Effort'. Research article. Advances in Software Engineering, 2010. https://doi.org/10.1155/2010/685950.

Carlo Daffara. 'Carlo Daffara - Economic Impact of Free Open Source Software for Euro…'. 2012. https://www.slideshare.net/SFScon/04-carlo-daffarasfscon.

Colombo, Massimo, D Cumming, A Mohammadi, Cristina Rossi-Lamastra, and Anu Wadhwa. 'Open Business Models and Venture Capital Finance' 25 (1 April 2016): 353–70. https://doi.org/10.1093/icc/dtw001.

Colombo, Massimo G., Annalisa Croce, and Luca Grilli. 'ICT Services and Small Businesses' Productivity Gains: An Analysis of the Adoption of Broadband Internet Technology'. *Information Economics and Policy*, ICT and Innovation, 25, no. 3 (1 September 2013): 171–89. https://doi.org/10.1016/j.infoecopol.2012.11.001.

Dumond, Stéphane. 'Linux on Desktop: A Success Story'. 2013. https://joinup.ec.europa.eu/sites/default/files/news/attachment/11-apresentacao-stephanedumond.pdf.

European Commission. 'A New Skills Agenda for Europe'. Brussels: European Commission, 2016. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016DC0381&from=EN.

European Commission. 'About EU-FOSSA 2', 2019. https://joinup.ec.europa.eu/collection/eu-fossa-2/about.

European Commission. 'DG GROW: Public Procurement'. Text. Internal Market, Industry, Entrepreneurship and SMEs - European Commission, 2019. https://ec.europa.eu/growth/single-market/public-procurement_en.

European Commission. 'Digital Transformation Scoreboard 2018: EU Businesses Go Digital: Opportunities, Outcomes and Uptake'. European Commission, 2018. https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/Digital%20Transformation%20Scoreboard%202018_0.pdf.

European Commission. 'Enhanced European Innovation Council (EIC) Pilot', 2019. https://ec.europa.eu/research/eic/index.cfm.

European Commission. 'EU Budget: Commission Proposes €9.2 Billion Investment in First Ever Digital Programme', 2018. https://europa.eu/rapid/press-release_IP-18-4043_en.htm.

European Commission. 'Fostering SMEs Growth through Digital Transformation: Guidebook for Regional and National Authorities'. European Commission, 4 November 2016.

European Commission. 'Guide for Training in SMEs', June 2009.

European Commission. 'SME Annual Report 2017-2018'. European Commission, 20 November 2018.

European Commission. 'Tallinn Declaration on EGovernment'. European Commission, 6 October 2017. https://ec.europa.eu/digital-single-market/en/news/ministerial-declaration-egovernment-tallinn-declaration.

Frietsch, Rainer, and Peter Neuhäusler. 'SME Patenting – An Empirical Analysis in Nine Countries', 2013, 30.

GitHub, Inc. 'Open Source Survey', 2017. https://opensourcesurvey.org/2017/.

Hillenius, Gijs. 'UK: "Government's Use of Open Source Could Save Millions"', 13 March 2007. https://joinup.ec.europa.eu/news/uk-governments-use-open.

Lamastra, Cristina Rossi. 'Software Innovativeness. A Comparison between Proprietary and Free/Open Source Solutions Offered by Italian SMEs'. *R&D Management* 39, no. 2 (March 2009): 153–69. https://doi.org/10.1111/j.1467-9310.2009.00547.x.

Lambrechts, Frank, Wim Voordeckers, Nadine Roijakkers, and Wim Vanhaverbeke. 'Exploring Open Innovation in Entrepreneurial Private Family Firms in Low- and Medium-Technology

Industries'. *Organizational Dynamics* 46, no. 4 (October 2017): 244–61. https://doi.org/10.1016/j.orgdyn.2017.05.001.

Lorenzi, Dario, and Cristina Rossi. 'Innovativeness of Free/Open Source Solutions: Evidence from an Alternative Methodology'. *SSRN Electronic Journal*, 2007. https://doi.org/10.2139/ssrn.1077107.

Lyons, Paul, and Marty Mattare. 'How Can Very Small SMEs Make the Time for Training and Development: Skill Charting as an Example of Taking a Scenistic Approach'. *Development and Learning in Organizations: An International Journal* 25, no. 4 (28 June 2011): 15–19. https://doi.org/10.1108/14777281111147053.

Merilo, Meelis. 'OpenOffice.Org in the Estonian Ministry of Environment', 11 January 2011. http://lata.org.lv/wp-content/conf/2011/LATA_EM_Estonia.pdf.

Nagle, Frank. 'Government Technology Policy, Social Value, and National Competitiveness'. SSRN Scholarly Paper. Rochester, NY: Social Science Research Network, 3 March 2019. https://papers.ssrn.com/abstract=3355486.

Nagle, Frank. 'Open Source Software and Firm Productivity'. *Management Science* 65, no. 3 (March 2019): 1191–1215. https://doi.org/10.1287/mnsc.2017.2977.

OECD. *Skills Development and Training in SMEs*. OECD Skills Studies. OECD, 2013. https://doi.org/10.1787/9789264169425-en.

Permanent Representation Germany to the European Union. 'Written Statement by Germany on the Adoption of the Copyright in the Digital Single Market Directive'. General Secretariat of the Council of the European Union, 15 April 2019. https://data.consilium.europa.eu/doc/document/ST-7986-2019-ADD-1-REV-2/en/pdf.

PwC. '2017 Global Digital IQ Survey', 2017.

RedHat. 'The Government of the Canary Islands Migrates Telecommunications and New Technologies Platform to Red Hat Enterprise Virtualization'. Accessed 16 April 2019. https://www.redhat.com/en/about/press-releases/the-government-of-the-canary-islands-migrates.

statcounter. 'Mobile Operating System Market Share Worldwide'. StatCounter Global Stats, June 2019. http://gs.statcounter.com/os-market-share/mobile/worldwide.

The Linux Foundation. '6 Reasons Why Open Source Software Lowers Development Costs'. *The Linux Foundation* (blog), 28 February 2017. https://www.linuxfoundation.org/blog/2017/02/6-reasons-why-open-source-software-lowers-development-costs/.

Thomas Claburn. 'Open Source Community Crams Itself into Big Tent'. The Register, 6 March 2018. https://www.theregister.co.uk/2018/03/06/open_source_community_crams_itself_into_big_tent/.

Top500.org. 'TOP500 Supercomputer Sites', 2019. https://www.top500.org/statistics/sublist/.

Vanhaverbeke, Wim, Federico Frattini, Nadine Roijakkers, and Muhammad Usman. *Researching Open Innovation In SMEs*. New Jersey: World Scientific, 2018. http://ludwig.lub.lu.se/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1724132&site=eds-live&scope=site.