techsoup

Studies of FOSS Adoption:

An Annotated Bibliography

This document is a compilation of the documents and annotations that have informed some insights that are relevant to TechSoup's work on the Filecoin Foundation for the Decentralized Web (FFDW) grant and its associated research initiative. The annotations are grouped by theme and insight.

Glossary

These terms are used in this document.

Adoption: The act of acquiring and implementing new technology platforms towards business or program operations.

OSS/OS/FLOSS/FOSS: Abbreviations associated with "open-source software" "free/libre open-source software" or variations thereof. The variation in abbreviations in this document is a product of matching the abbreviation used in the article in many cases. There are some philosophical differences between these terms, but for the purpose of this research, we use all of these terms relatively interchangeably to refer to technology that has been developed via an open-source methodology, or whose code is "open," meaning available for review and modification by anyone who wishes to, with the expectation that modifications and improvement are shared back to the larger community towards an iterative design process.

Sector: There are three main sectors of concern in this document:

- The *private sector*, which refers to privately held organizations; businesses
- The *public sector*, which refers to publicly owned organizations, such as universities, state organizations; the governmental sector.
- The *civil sector*, which refers to formal civil society, such as charities, nonprofits, and nongovernmental organizations, as well as other proximate organizations, such as fiscally sponsored projects and mutual aid networks

techsoup

Technical Professionals as Champions of New Technology

Sánchez, V. R., Ayuso, P. N., Galindo, J. A., & Benavides, D. (2020). Open Source Adoption Factors — A Systematic Literature Review. *IEEE Access*, *8*. https://doi.org/10.1109/ACCESS.2020.2993248.

Abstract: Nowadays Free/Libre/Open Source Software (FLOSS) is becoming a strategic option for many organizations in the public and the private sector. The lack of well-defined guidelines for IT managers may jeopardize the FLOSS adoption process. FLOSS adoption procedures are developed ad hoc in every organization, hence, leading to potential wheel reinvention situations. Identifying factors that influence and determine adoption is crucial. In this article, we survey existing literature through systematic review methodologies to make visible the technical, organizational and economic factors that must be evaluated in the adoption process. We also provide hints for researchers on publications and the type of research that already covered this topic in the past. We studied almost 500 papers from which we selected a final set of 54 primary studies directly related to FLOSS adoption. We found 22 different adoption factors categorized as technical, organizational and economic. This article aims to provide the basic building blocks to step into the creation of a guide for the FLOSS adoption. All the data we use in the study is available at this online repository: https://githhub.com/jagalindo/rea.victor.19-foss.

Summary: This article explores the factors influencing the adoption of open source software. The authors conduct a systematic literature review to analyze existing research on this topic. The study investigates various aspects, including software, systematics, organizations, databases, economics, data mining, guidelines, and other factors related to FOSS adoption. The goal is to provide insights into the key factors that contribute to the adoption of open source solutions, offering a comprehensive overview of the existing knowledge in this domain at the time of publication..

Insights: This paper is very valuable in looking at factors related to technology adoption, especially FLOSS adoption related to technical, organizational, and economic factors related to onboarding or adopting new technologies. The paper posits that one of the most important factors related to FLOSS adoption is support in both internal and external applications. The paper also posits that in general IT managers are not using any tools or procedures to evaluate FLOSS solutions. As a result, the paper is motivating researchers to create and publicize guidelines for adopting FLOSS to feature research in the application of FLOSS and new domains and guide the correct selection of FLOSS technology by IT managers.

Kochhar, P. S., Kalliamvakou, E. Nagappan, N, Zimmermann,T., & Bird, C. (2019). Moving from closed to open source: observations from six transitioned projects to GitHub. *IEEE Transactions on Software Engineering*, 1–1.

Abstract: Open source software systems have gained a lot of attention in the past few years. With the emergence of open source platforms like GitHub, developers can contribute, store, and manage their projects with ease. Large organizations like Microsoft, Google, and Facebook are open sourcing their in-house technologies in an effort to more broadly involve the community in the development of software systems. Although closed source and open source systems have been studied extensively, there has been little research on the transition from closed source to open source systems. Through this study we aim to: a) provide guidance and insights for other teams planning to open source their projects and b) to

help them avoid pitfalls during the transition process. We studied six different Microsoft systems, which were recently open-sourced i.e., CoreFX, CoreCLR, Roslyn, Entity Framework, MVC, and Orleans. This paper presents the transition from the viewpoints of both Microsoft and the open source community based on interviews with eleven Microsoft developers, five Microsoft senior managers involved in the decision to open source, and eleven open-source developers. From Microsoft's perspective we discuss the reasons for the transition, experiences of developers involved, and the transition's outcomes and challenges. Our results show that building a vibrant community, prompt answers, developing an open source culture, security regulations and business opportunities are the factors which persuade companies to open source their products. We also discuss the transition outcomes on processes such as code reviews, version control systems, continuous integration as well as developers' perception of these changes. From the open source community's perspective, we illustrate the response to the open-sourcing initiative through contributions and interactions with the internal developers and provide guidelines for other projects planning to go open source.

Summary: Reasons to transition included the vibrant community, early external evaluation, exposure to creative approaches, an open-source culture, access to an employee pool, expanded resources, business opportunities, and the opportunity to build trust with governments and other organizations. It identifies nine factors for successful transition, seven perceived advantages by developers, the pros and cons of GitHub, and seven benefits to the community. It then recommends clear goals, uniform processes, the right hosting platform, and a holistic transition early in the project. In leading this transition, the authors recommend a collaborative culture, harmonious attitudes, extensive documentation, and decoupled parts housed in a single repository. Finally, the paper concludes with four best practices involving who to engage and agile processes, and it recommends further research into this process's generalizability.

Insights: The energy of the OS developer community inspires large organizations to consider transitioning to OS. This energy is still present as late as 2019, when this publication came out. OS is still exciting.

Silic, M., & Back, A. (2016). The influence of risk factors in decision-making process for open source software adoption. *International Journal of Information Technology & Decision Making* 15 (01): 151–85.

Abstract: "Nobody ever got fired for buying IBM," was a widely used cliché in the 1970s in the corporate IT (information technology) world. Since then, the traditional process of purchasing software has dramatically changed, challenged by the advent of open source software (OSS). Since its inception in the 1980s, OSS has matured, grown, and become one of the important driving forces of the enterprise ecosystem. However, it has also brought important IT security risks that are impacting the OSS IT adoption decision-making process. The recent Heartbleed bug demonstrated the grandeur of the issue. While much of the noise relates to the amplification of perceived risks by the popular mass media coverage, the effect is that many enterprises, mainly for risk reasons, have still chosen not to adopt OSS. We investigated "how do information security related characteristics of OSS affect the risk perception and adoption decision of OSS" by conducting an online survey of 188 IT decision-makers. The proposed Open Source Risk Adoption Model offers novel insights on the importance of the perceived risk antecedents. Our research brings new theoretical contributions, such as understanding the perceived IT security risk relationship with adoption intention in the OSS context, for researchers and important insights for IT information professionals. We have found that IT security risk has a significant role in OSS

adoption intention. Our results offer possible future research directions and extend existing theoretical understanding of OSS adoption.

Summary: Through the lens of the Theory of Reasoned Action, which aims to understand the relationship between attitudes and behaviors within human action, this research explores perceptions of risk and their impact on OSS adoption. Through a 24 percent response rate, the study collected 188 successful surveys and applied structural equation modeling (SEM) techniques, which revealed that confidentiality and integrity impact negative perceptions of IT security risks while availability, and information/structural assurance impact positive perceptions of IT security risks. The authors suggest institutional trust through safeguards such as encryption or authentication and legal and compliance structures decrease perceived risk. Ultimately, perceived IT security risk constitutes 63 percent of adoption variance. Better testing, checks, verifications, data privacy and integrity, and safeguards will improve trust and increase OSS adoption.

Insights: Potential users are most concerned about IT security risks, but a very present concern pertains to the manner in which blockchain preserves information in perpetuity. While this function is very valuable in many contexts it is also a point of concern to some populations.

Governmental Adoption of FOSS as a Legitimizing Force

Zuiderwijk, A., Shinde, R., & Jeng, W. (2020). What drives and inhibits researchers to share and use open research data? A systematic literature review to analyze factors influencing open research data adoption. *PloS One* 15 (9): e0239283.

Abstract: Both sharing and using open research data have the revolutionary potentials for forwarding scientific advancement. Although previous research gives insight into researchers' drivers and inhibitors for sharing and using open research data, both these drivers and inhibitors have not yet been integrated via a thematic analysis, and a theoretical argument is lacking. This study's purpose is to systematically review the literature on individual researchers' drivers and inhibitors for sharing and using open research data. This study systematically analyzed 32 open data studies (published between 2004 and 2019 inclusively) and elicited drivers plus inhibitors for both open research data sharing and use in eleven categories total that are: "the researcher's background," "requirements and formal obligations," "personal drivers and intrinsic motivations," facilitating conditions," "trust," "expected performance," "social influence and affiliation," "effort," "the researcher's experience and skills," "legislation and regulation," and "data characteristics." This study extensively discusses these categories, along with argues how such categories and factors are connected using a thematic analysis. Also, this study discusses several opportunities for altogether applying, extending, using, and testing theories in open research data studies. With such discussions, an overview of identified categories and factors can be further applied to examine both researchers' drivers and inhibitors in different research disciplines, such as those with low rates of data sharing and use versus disciplines with high rates of data sharing plus use. What's more, this study serves as a first vital step towards developing effective incentives for both open data sharing and use behavior.

Summary: This systematic literature review of 32 articles explores researchers' drivers and inhibitors in sharing and using open research data alongside individual drivers and organizational contexts to answer eight research questions surrounding three themes: existing knowledge, methodology and application,

and drivers and inhibitors of sharing and using open data. Very generally, primary inhibitors include distrust (of technology, other researchers' quality, and data quality), organizational/local/discipline culture and practices, and cost (time, money, training), while regulation and oversight, funding, publishing requirements, infrastructure availability, and personal beliefs drive them to use open research data. The article noted that technical fluency influences adoption with better technical fluency; potential adoptees are better able to understand new technologies and are not immediately put off. The authors recommend further research into conditions that affect researchers' sharing of data, infrastructure needs for this type of data repository, and the effectiveness of incentives and policies.

Insights: Governments can potentially optimize adoption by recognizing their role in funding, requiring publishing code, building infrastructure, and enacting regulation in new technologies such as DWeb.

Kochhar, P. S., Kalliamvakou, E. Nagappan, N, Zimmermann,T., & Bird, C. (2019). Moving from closed to open source: observations from six transitioned projects to GitHub. *IEEE Transactions on Software Engineering*, 1–1.

Annotation appears in the previous section. This article applies to this theme as well.

Yaseen, M.G, Abd, S.A, & Adeb, I. (n.d.). Critical factors affecting the adoption of open source software in public organizations. *Iraqi Journal for Computer Science and Mathematics*. https://journal.esj.edu.iq/index.php/IJCM/article/view/49/24

Abstract: *Context:* The way public organizations produce, acquire, use, and commercialize software is changing as a result of open source software (OSS). Because of the numerous benefits provided by open source software, public organizations began to use it to meet their demands. As a result, governments implement various measures to encourage and facilitate OSS use. A variety of factors continue to influence the choice to implement OSS, which can have a positive or negative impact on the adoption process. *Objective:* The study's purpose is to explore the most critical factors that may influence the open source software adoption process, which are drawn from chosen case studies from various domains in public organizations. Based on their findings, the authors produced a guideline to tell prospective adopters about the most crucial factors that they may confront during the adoption process. *Method:* Authors chose a handful of publications that address three public domains: healthcare, municipal government, and higher learning institutions. We looked for articles based on various criteria, beginning with their relevance to open source software adoption in general and, more specifically, in the public sector. We also screened the papers based on whether they were written in simple English or if they were written in another language. *Results:* According to the findings, government and top management support, reliability, security, availability, and cost ownership are the most influential elements that contributed to the adoption process's success. Lacking of in-house development, connectivity, quality, computing resources, and expertise were identified as barriers to the adoption of open source software in specific sectors.

Summary: This literature review explores the factors that facilitate OSS adoption which are: little cost, reliability, customizability, licensing, greater choice and control for end users, and support from major companies. It explores the OSS movement in the public sector spaces around the world — including governments, schools, and hospitals — and the process involved in the decision to employ OSS through the lenses of needs, availability, features of hospitals, intervening conditions (such as HIPAA, legislation, type of system being integrated with, and scalability), and results. It concludes recognizing the

importance of governments creating a national framework for successful adoption and the impact of cost savings.

Insights: The factors impacting adoption of OSS generalize across various technologies. The role of governments in developing a national framework to encourage the OSS space is fundamental to nonprofit sector adoption.

A Note on a Literature Gap

There are rather few publications on FOSS adoption in the civil sector compared to FOSS adoption in the public sector and the private sector. This is likely due to a number of overlapping reasons. Chief is the difference in means — NGOs simply have less money to operate with than governments and much less freedom to use this money as they see fit than the private sector. Additionally, the government has invested a great deal of time, money, and effort in the cost-saving potential of FOSS (per Hana Schank and Tara Dawson McGuinness in *Power to the Public*). This investment was very well documented. Other reasons that might account for this include the general lag in technology adoption in the civil sector, and the emphasis on mission-centric work in the civil sector.