

A Review of Ethical Discussions on Platforms and Ecosystems

Hyrnsalmi Sami ¹[0000-0002-5073-3750], Koskinen Jani ²[0000-0001-8325-9277], and Hyrnsalmi Sonja M. ³[0000-0002-1715-6250]

¹Pervasive Computing, Tampere University of Technology, Pori, Finland and Lappeenranta–Lahti University of Technology, Lahti, Finland

²Turku School of Economics, University of Turku, Turku, Finland

³Department of Future Technologies, University of Turku, Turku, Finland
sami.hyrnsalmi@tuni.fi

Abstract. Since the breakthrough of Apple’s iOS platform and AppStore marketplace a decade ago, different kinds of ecosystems and platforms have conquered the world. In the ecosystem-based business model, a platform owner offers a technological solution (e.g., Apple, Google) for end-users (e.g., smart phone users) and producers (e.g., application and content developers). The platform owner benefits, either directly or indirectly, from the transactions between end-users and producers taking place in the platform. As the ecosystem-based model has gained popularity and de facto status in the industry, also critical voices in ethical problems and questions for the new model has raised. This paper reviews recent literature (n=20) on ethical discussion on platforms and ecosystems in order to summarise the current development and suggest some future avenues. The review show that several disciplines, from law to technology ethics and sociology, are addressing the same phenomena from different viewpoints. However, further studies are requested to support the building of a comprehensive view on complex concerns.

Keywords: Ecosystem ethics, targeted review, literature study, platform, ethics, ecosystem

1 Introduction

Software platforms and ecosystems have become a de facto way of working in the software industry. Driven by the popularity and success of Apple's iOS platform and its store, abundance of different companies, such as SAP and Microsoft, have started to offer their products as a platform for external developers (Hyrnsalmi, 2014).

However, the new approach has also gained critique and, for example, Bergvall-Kåreborn and Howcroft (2013) describe Apple’s new approach as a way to “[...] harness creative labour at little or no cost while minimising risk”. The new approach centralises the power to the platform owner, strengthen barriers to entry and makes the entry of newcomers harder. Therefore there are and has been different projects that are aiming

Copyright © 2019 for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

to create alternative data ecosystems as alternative choices (see Decode, 2019; Mesinfos, 2019; Sitra, 2019). Likewise, European commission has started to aim more open solutions in data economy ecosystems that includes free flow of data, but also protects people rights considering their personal information (EU 2017).

In addition, it is worth to note that Stallman (2010) have criticised the use of the term ‘ecosystem’ to describe a software or a human community. According to him, ecosystems imply the lack of intention and ethics. Stallman (2010) points out that software is a results of both of these, and thus the term is misleading.

Thus, there are various critiques and raised ethical concerns towards platforms and ecosystems. The prior work is scattered and there is a lack of comprehensive picture. This paper aims to fill this gap. The objective of this paper is to map recent discussion on ethical aspects related to the software platforms and ecosystems. The study uses a targeted (or non-systematic) literature review approach (Huelin, Iheanacho, Payne, & Sandman, 2015).

By using a set of four papers as a seed, a total of 20 primary studies are selected with snowballing technique. The primary studies are analysed and ethical concerns are mapped. The results show that ethical concerns related to freedom of expression are widely discussed in various disciplines, but also that the ethical discussion is lacking depth both in presented arguments as well as in different relationships between the ecosystem actors.

The remaining of this study is structured as follow. Section 2 defines the key concept for this review. The research process is discussed in Section 3 and the results are given in Section 4. Key findings and limitations are discussed in Section 5 and Section 6 concludes the study.

2 Key concepts

Since the seminal work by Moore (1993, 1996) seminal work on defining a *business ecosystem*, a series of different kinds of ecosystem have been presented (c.f. Seppänen, Hyrynsalmi, Manikas, & Suominen, 2017). To put Moore’s (1996) view simply, a business ecosystem is a loose network of organisations including suppliers, customers and competitors involved in delivery of goods or services are connected. The network evolves gradually and the participants of the ecosystems are affected by the other players in the ecosystem as well as by the competing ecosystems. However, as pointed out by Gueguen and Isckia (2011), borders of an ecosystem are unclear.

In the software industry, a software platform is often in the centre of an ecosystem (Jansen, Finkelstein, & Brinkkemper, 2009). A platform is either a partial or a full software product or a service, for which third-party suppliers can develop their complementing products and services, named as complementaries. For example, a gaming console (i.e., hardware and operating system) is a platform that allows game producers and software developers (i.e., third-party vendors) to offer their games and software applications (i.e., complementaries) to the end-users.

The platform creates a *software ecosystem* around it, which consists of the platform owner—also named as ecosystem orchestrator—as well as consumers and independent

software producers (Manikas & Hansen, 2013). A software ecosystem is, according to Jansen et al. (2009), “*a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artefacts.*”

Likewise the data may be the core that creates the ecosystem. According to Oliveira and Lóscio (2018) a data ecosystem is:

“...a set of networks composed by autonomous actors that directly or indirectly consume, produce or provide data and other related resources (e.g., software, services and infrastructure). Each actor performs one or more roles and is connected to other actors through relationships, in such a way that actors collaboration and competition promotes data ecosystem self-regulation.”

Koskinen, Knaapi-Junnila, and Rantanen (2019) has combined the definitions of business ecosystem and data ecosystems and come up with term data economy ecosystem defined as:

“Data economy ecosystem is a network, that is formed by different actors of ecosystem, that are using data as a main source or instance for business. Different actors and stakeholders are connected directly or indirectly within network and it’s value chains. Data economy ecosystem also incorporates the rules (official or unofficial), that direct action allowed in network.”

The relationship between actors in an ecosystem can be complex and involve several layers (Yu, Ramaswamy, & Bush, 2008). For example, some actors in an ecosystem can be direct competitors against each other with their offering, but still doing cooperation in order to support the whole ecosystem Brandenburger and Nalebuff (1997). The reason is that the fate of both firms is depending on the fate of the ecosystem and its success (Iansiti & Levien, 2004).

Ecosystem ethics, by following the usage by Koskinen, Rantanen, Kimppa, and Hyrynsalmi (2017), refers to discussion on ethical concerns related to ecosystems and their management. For example, previously there has been discussion whether a platform owner, who often have monopoly and ultimate power in the ecosystem, should allow all producers to publish whatever they wish in the platform, or should the platform owner have a control over what is offered in its marketplace (Koskinen et al., 2017).

Finally, it is worth to note that the concept of ‘ecosystem’ has also been criticised. For example, Oh, Phillips, Park, and Lee (2016) questioned whether the addition of the ‘eco-’ prefix into ‘innovation system’ has bring any value. Furthermore, Hyrynsalmi and Hyrynsalmi (2019) argues that the overuse of the ‘ecosystem’ term has caused that the concept is starting losing its content and becoming a zombie term, just a empty buzz word. They requested that the term should be carefully defined in the further use in order to maintain its content. To follow their recommendations, we rely on the denitions given above.

3 Research process

This paper uses a literature review as a tool to recapitulate the current discussion on platform and ecosystem ethics. The main objective is to map the discourse, offer a summary as well as point avenues for future work.

Literature studies can be roughly divided into two main categories (Kitchen-ham & Charters, 2007): systematic literature studies and non-systematic studies. Systematic studies aim to systematically and objectively find and summarise all available evidence. Non-systematic studies, instead, aim to offer informative, but not all-encompassing review on the issue at hand (Huelin et al., 2015).

This study utilises non-systematic review in order to gather relevant primary studies. This paper is a targeted literature review where in-depth and pre-defined protocol, but not systematic. As the field is underdeveloped due to scattering in different publication fora and vocabulary is not standardised, traditional systematic literature gathering methods—electronics searches with keywords to selected databases or manual searching through selected publication fora—would not have been useful. Thus, to offer a starting point for the future studies, this paper follows snowballing technique, as defined by Wohlin (2014), for gathering primary studies.

For this study, we used the process described as follow. We selected a small set of primary studies (four papers) known to address the area. For those papers, we did backward and forward snowballing—i.e., we studied the references that the primary study is using as well as we studied papers which are referring to the primary study. We repeated this iteratively until no new papers were anymore added. We included studies that were discussing any ethical issues related to software platforms or ecosystems. We excluded studies written with other languages than English as well as clearly non-peer reviewed content (e.g., blogs, Master's theses, news articles). The studies were first evaluated by title and abstract. The searches were done in mid-August 2019.

After the searches had terminated, all selected papers were read through and analysed by the authors. The frequent themes appearing in the primary studies were identified and categorised into major groups.

4 Results

4.1 Frequent themes

The primary studied selected to this literature review are shown in Table 1. Studies that were used as a seed for the backward and forward snowballing are marked with asterisk in the table. In the following, frequently appearing themes are presented alongside with short summaries of primary studies.

Freedom of expression, right to install.

Wolk (2010) and Lee and Soon (2017) study jailbreaking, i.e., a process of exploiting vulnerabilities in order to install software that would not otherwise be available in the

product. Wolk (2010) addresses the legal point of view, but note that that a device could be better if there would be no installation restrictions.

Hestres (2013) discusses on ‘app neutrality’; e.g., consumers’ and producers’ freedom of expression to install and publish what they want for smart devices. Daly (2011) discusses on the same issue: Apple has completely power over applications available in the store as well as preventing users to install content that the platform owner do not wish to see. DeNardis and Hackl (2015), on the other, discusses on consumer’s right to freedom of expression on social media platforms.

Tonner (2013) and Curwin (2015) addresses tethering applications and their blocking in a mobile application store. Whereas the discussion focuses solely on this area, Tonner notes how blocking hinders innovations in the mobile application space. Gillespie (2017) takes a broad view and discuss how platforms of any kind—from social media to application ecosystems—structure and dictate the content and speech in their areas of business.

Table 1. Primary studies selected for this review.

#	Paper
1	Wolk (2010)
2	Daly (2011)
3	Castree III (2012)
4	Mejia (2013)
5	Síthigh (2013)
6	Tonner (2013)
7	Hestres (2013)
8	Clelland (2014)
9	Curwin (2015)
10	DeNardis and Hackl (2015)
11	Lee and Soon (2017)
12	Koskinen et al. (2017)*
13	Gillespie (2017)
14	Kimppa, Hyrynsalmi, Rantanen, and Järvi (2018)
15	Rantanen, Koskinen, and Hyrynsalmi (2019)*
16	Rantanen, Hyrynsalmi, and Hyrynsalmi (2019)
17	Härkönen, Naskali, and Kimppa (2019)*
18	Ververis, Isaakidis, Weber, and Fabian (2019)
19	Koskinen et al. (2019)*
20	Royakkers, Kool, and van Est (2018)

* denotes studies used a seed in this review

Koskinen et al. (2017) continues this theme by defining ecosystem ruling dilemma as a question whether a platform owner can restrict one’s right to freedom of expression against the owner’s right to dictate the content in their avenue.

Ethical governance

Castree III (2012) addresses cyber-plagiarism among producers in the digital media stores. While the focus of the article is on legislation improvements, it also addresses, e.g., relationships between developers in an ecosystem. Mejia (2013) continues the theme with focus being on mobile games.

Kimppa et al. (2018), on the other hand, discuss on ethical issues regarding platform owners', often representing industrialised countries, relationships to and business ventures with software producers from developing countries. They emphasise points for (e.g., developing country software developers gain access to a developed market with the platform owner) and against (e.g., platform owners can exploit underdeveloped markets) this kind of collaborations.

Rantanen, Koskinen, and Hyrynsalmi (2019) define a new concept of e- government ecosystem as a vehicle to explain e-government systems and point ethical governance as a part of it. Rantanen, Hyrynsalmi, and Hyrynsalmi (2019) present a systematic literature study on ethical management of data ecosystems.

Koskinen et al. (2019) proposed the new people-centric approach for data economy ecosystems as fair basis for governance model in Habermasian spirit. They derive main ideas of people-centricity and informed consent from medical field that has been forerunner of those issues a long time. Koskinen et al. (2019) demand more human approach for data economy ecosystems to balance field ecosystems of dominated by few central player — as individuals have no real possibilities way to influence the ecosystem in current situation.

Legislation, censorship and value creation

Clelland (2014) discuss on iOS ecosystem's bright and dark value creation. He pinpoints that the monopoly position of the ecosystem core company allows it exploit third party workers. Whereas the paper focus on migrant workers in the component production and assembly, the observations can be, to some extent, to be generalised to software producers.

Ververis et al. (2019) study application censorship in different countries. They note that, for some reason or another, certain applications are not available in certain countries. However, different kinds of circumvention tools have been prevented.

Finally, S' thigh (2013) ponders legislation in the case of application markets. As one of the area addressed in the paper, he notes the relationship between the platform owner (i.e., Apple) and the mobile developers. In addition, he addresses also consumers' rights in the marketplace. Härkönen et al. (2019) discuss on ethicality and social responsibility of platform economy giants. They point that the platform giants have almost unlimited power and little competition in their businesses.

It is worth to note that there are plethora of work done in domain of platforms and antitrust. For example, Khan (2017) discusses on Amazon and its unchallenged position in platform markets and Sharma (2019) points out that restricting access to APIs might promote anticompetitive practices. Khan argues that Amazon's business strategy has concerns against the spirit of anticompetitive laws. However, these are restricted from our survey as their focus has been on legislative, not ethical, issues. Nevertheless, also these aspects should be studied further in future work.

4.2 Relationship analysis

As pointed out by Jansen et al. (2009), software ecosystems are about relationships between different kinds of actors. For this review, we studied what relationships between actors have been addressed in the literature. We identified four main stakeholder groups: Platform owner, Consumer, Producer and Government. The three first are often discussed in literature (cf. Hyrynsalmi, 2014), whereas the last one appeared frequently in primary studies.

Figure 1 illustrates the observed ethical discussion on relationships in the primary studies. In the figure, the relationships are directed according to whose concerns are addressed. For example, governmental censorship against certain applications in the marketplace is denoted with the edge *Government* \rightarrow *Platform owner*. The amount of concerns raised per relationship is not illustrated.

As the figure reveals, the discussion has been concentrated to ethical concerns between the platform owner and consumer as well as platform owner and producer. As the platforms allow transaction of goods and services between two different side of a market (Rochet & Tirole, 2003), this is not a surprise. However, the lack of discussion on ethical concerns between other parties might indicate that the literature is overtly focused on these relationships.

Finally, from Figure 1 one can also deduce areas missing ethical discussions. For example, in the review, we could not find, for example, discussion raised regarding the *Consumer* \rightarrow *Consumer relationship*. Nevertheless, it is worth to note that not all relationships might be worth of discussion in the ecosystem ethics context. For example, this context might not offer new insights into the *Consumer* \leftrightarrow *Government* relationships.

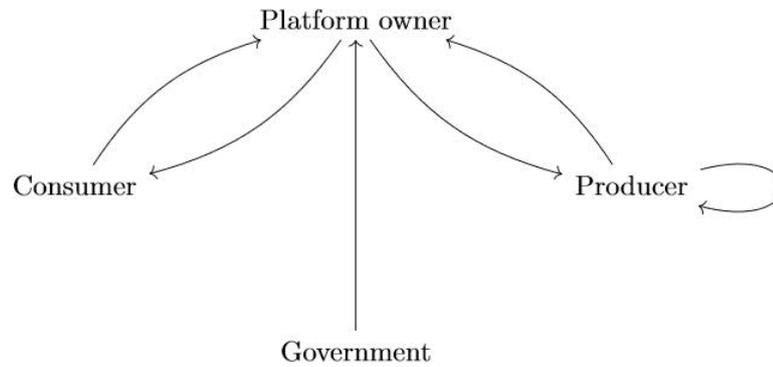


Fig. 1. Directed relationship of ethical concerns between different actors in an ecosystem.

5 Discussion

5.1 Key findings

We summarise our key findings into the following three points:

First, despite that the literature on ethical aspects of platforms and ecosystems is diverse, there are a few clear and shared focal points. Frequently appearing theme is the question of freedom of expression, both from producers' and consumers' point-of-view. While most of this discussion seems to focus on Apple and its ecosystem, there are also more general observations presented (e.g. Gillespie, 2017; Koskinen et al., 2017).

Fruitfully, this question has been discussed from multitude of approaches ranging from legislation to information ethics. Nevertheless, more work are needed to summarize recent developments in this question as well as to generalise more usable guidelines for all kinds of platforms and ecosystems.

Second, the relationship analysis of ethical concerns show that the studied literature has focused on the concerns between platform owner and consumers as well as between platform owner and producers. Other concerns are infrequently, if at all, addressed.

Third, while we were able to find 20 primary studies, this review show also that the platform and ecosystem ethics is underdeveloped area. Some of the analysed concerns relied on anecdotal evidence and discussion on single cases. Only a few of the primary studies presented empirical material.

5.2 Limitations

Naturally, this study has certain limitations. First and foremost, the study is based on targeted literature review method and most likely not all available primary studies have been gathered. This certainly limits the result only the studied papers.

Second, due to the snowballing method, the selected primary studies might be biased towards certain areas. Therefore, the selection of the seed papers is crucial. For this

study, we selected a set of recent studies representing a few different kinds of ecosystems. Yet, a more systematic gathering of primary studies would draw more comprehensive picture of the issue at hand.

Third, it is worth to note that the used research process (i.e., seed articles and snowballing) might cause that only articles inside a certain academic school of thought –i.e., articles referring to each others – is identified. Thus, there is a risk that another research 'cluster' is not included as there are no references between the cluster that we found and the others.

6 Conclusions

It seems that the research of ethics of ecosystems and platforms it still at infancy and there founds only a handful of papers about topic. However, the included studies of review has shown that there are different ethical issues to consider even the larger picture is still blurred and taking a shape. This papers main contribution is that it shows the lack of ethical research of ecosystems. Our analysis brings forward the need for research, so we could see the issues that should be dealt with ecosystems and platforms from ethical perspective and ensure the good for the society. Thus, there is need for research focusing on specific ethical issues likewise there exists demand for research with wide scale analyse of challenges that arise in this ecosystem context.

References

1. Bergvall-Kåreborn, B., & Howcroft, D. (2013, December). The Apple business model: Crowdsourcing mobile applications. *Accounting Forum*, 37(4), 280–289. (The Apple Business Model: Value Capture and Dysfunctional Economic and Social Consequences — special issue) doi: 10.1016/j.accfor.2013.06.001
2. Brandenburger, A. M., & Nalebuff, B. J. (1997). *Co-opetition* (1st ed.). New York, NY, USA: Currency Doubleday.
3. Castree III, S. (2012, September). Cyberplagiarism for sale!: The growing problem of blatant copyright infringement in online digital media stores. *Texas Review of Entertainment & Sports Law*, 14(1), 25–45.
4. Clelland, D. (2014). The core of the apple: Degrees of monopoly and dark value in global commodity chains. *Journal of World-Systems Research*, 20(1), 82–111. doi: 10.5195/jwsr.2014.564
5. Curwin, R. (2015). Unlimited data, but a limited net: How zero-rated partnerships between mobile service providers and music-streaming apps violate net neutrality. *Columbia Science and Technology Law Review*, 17, 204–245.
6. Daly, A. (2011, May). Recent issues for competition on the internet: Google's search and advertising, the Apple App Store, and the AOL Huffington Post merger (Working papers series). Swinburne University of Technology. doi: 10.2139/ssrn.1838346
7. Decode. (2019). Decode project. Retrieved 2019-04-16, from <https://decodeproject.eu/what-decode>
8. DeNardis, L., & Hackl, A. (2015). Internet governance by social media platforms. *Telecommunications Policy*, 39(9), 761–770.

9. European commission. (2017). Building an european data economy. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2017:9:FIN>
10. Gillespie, T. (2017). Regulation of and by platforms. In J. Burgess, A. Marwick, & T. Poell (Eds.), *The sage handbook of social media* (p. 254-278). London: SAGE Publications Ltd.
11. Gueguen, G., & Isckia, T. (2011, February). The borders of mobile handset ecosystems: Is cooperation inevitable? *Telematics and Informatics*, 28(1), 5–11.
12. Härkönen, H., Naskali, J., & Kimppa, K. (2019). Hub companies shaping the future: The ethicality and corporate social responsibility of platform economy giants. In *Proceedings of the 2nd acm sigsoft international workshop on software-intensive business: Start-ups, platforms, and ecosystems* (pp. 48–53). New York, NY, USA
13. Hestres, L. E. (2013, June). App neutrality: Apple's App Store and free- dom of expression online. *International Journal of Communication*, 7(0), 1265–1280. Retrieved from <http://ijoc.org/index.php/ijoc/article/view/1904>
14. Huelin, R., Iheanacho, I., Payne, K., & Sandman, K. (2015). What's in a name? systematic and non-systematic literature reviews, and why the distinction matters. *The evidence forum*, 34–37. Retrieved from <https://www.evidera.com/wp-content/uploads/2017/10/The-Evidence-Forum-2015-May.pdf>
15. Hyrynsalmi, S. (2014). *Letters from the war of ecosystems — an analysis of independent software vendors in mobile application marketplaces* (Doctoral dissertation, University of Turku, Turku, Finland). (TUCS Dissertations No 188) doi: 10.13140/2.1.4076.4484
16. Hyrynsalmi, S., & Hyrynsalmi, S. M. (2019). Ecosystem: A zombie category? In *2019 IEEE international conference on engineering, technology and innovation (ICE/ITMC)*. IEEE. doi: 10.1109/ice.2019.8792658
17. Iansiti, M., & Levien, R. (2004, March). Strategy as ecology. *Harvard Business Review*, 82(3), 68–78.
18. Jansen, S., Finkelstein, A., & Brinkkemper, S. (2009). A sense of community: A research agenda for software ecosystems. In *31st international conference on software engineering — companion volume, icse-companion 2009* (pp. 187–190). IEEE. doi: 10.1109/ICSE-COMPANION.2009.5070978
19. Khan, L. M. (2017). Amazon's antitrust paradox. *The Yale Law Journal*, 126, 564–907.
20. Kimppa, K., Hyrynsalmi, S., Rantanen, M. M., & Järvi, A. (2018). The return of evil companies: Is it okay to profit with the poor at software platforms? In *Proceedings of ethicomp 2018* (pp. 433–443).
21. Kitchenham, B. A., & Charters, S. (2007). *Guidelines for performing systematic literature reviews in software engineering. version 2.3*. (EBSE Technical Report No. EBSE-2007-01). Keele, Staffs, United Kingdom: Keele University.
22. Koskinen, J., Knaapi-Junnila, S., & Rantanen, M. M. (2019). What if we had fair – people-centred – data economy ecosystems? In *Proceedings of IEEE Smart World Conference 2019*.
23. Koskinen, J., Rantanen, M. M., Kimppa, K. K., & Hyrynsalmi, S. (2017). Ecosystem ethics: An ethical analysis of orchestrators' ultimate power and the dilemma of ecosystem ruling. In S. Hyrynsalmi, A. Suominen, C. Jud, & J. Bosch (Eds.), *Proceedings of the 9th international workshop on software ecosystems* (Vol. 2053, pp. 43–54). Aachen, Germany: CEUR-WS. Retrieved from <http://ceur-ws.org/Vol-2053/paper04.pdf>
24. Lee, M. S., & Soon, I. (2017). Taking a bite out of apple: Jailbreaking and the confluence of brand loyalty, consumer resistance and the co-creation of value. *Journal of Product & Brand Management*, 26(4), 351–364.
25. Manikas, K., & Hansen, K. M. (2013, May). Software ecosystems — A systematic literature review. *Journal of Systems and Software*, 86(5), 1294–1306.

26. Mejjia, S. (2013). Game on: Building an analytic framework for addressing copyright and trademark issues in mobile gaming. Available at SSRN: <http://dx.doi.org/10.2139/ssrn.2319096>.
27. Mesinfos. (2019). Mesinfos project. Retrieved 2019-04-16, from <http://mesinfos.fing.org/english/>
28. Moore, J. F. (1993, May-June). Predators and prey: A new ecology of competition. *Harvard Business Review*, 71(3), 75–86.
29. Moore, J. F. (1996). *The death of competition: Leadership and strategy in the age of business ecosystems*. New York, NY, USA: Harper Business.
30. Oh, D.-S., Phillips, F., Park, S., & Lee, E. (2016, August). Innovation ecosystems: A critical examination. *Technovation*, 54, 1–6.
31. Oliveira, M. I. S., & Lóscio, B. F. (2018). What is a data ecosystem? In *Proceedings of the 19th annual international conference on digital government research: Governance in the data age* (pp. 74:1–74:9). New York, NY, USA: ACM. Retrieved from <http://doi.acm.org/10.1145/3209281.3209335>
32. Rantanen, M. M., Hyrynsalmi, S., & Hyrynsalmi, S. M. (2019). Towards ethical data ecosystems: A literature study. In *2019 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*. IEEE.
33. Rantanen, M. M., Koskinen, J., & Hyrynsalmi, S. (2019). E-government ecosystem: A new view to explain complex phenomenon. In *2019 42nd international convention on information and communication technology, electronics and microelectronics (mipro)* (p. 1408-1413). IEEE. Rochet, J. C., & Tirole, J. (2003, June). Platform competition in two-sided markets. *Journal of the European Economic Association*, 1(4), 990–1029.
34. Royakkers, T. J., Lambèr, Kool, L., & van Est, R. (2018). Societal and ethical issues of digitization. *Ethics and Information Technology*, 20, 127-142.
35. Seppänen, M., Hyrynsalmi, S., Manikas, K., & Suominen, A. (2017). Yet another ecosystem literature review: 10 + 1 research communities. In *2017 IEEE European technology and engineering management summit (E-TEMS)* (pp. 1–8). IEEE
36. Sharma, C. (2019, June 7). Concentrated digital markets, restrictive APIs, and the fight for internet interoperability. Available at SSRN: <https://ssrn.com/abstract=3400980>.
37. S' thigh, D. M. (2013, Summer). App law within: rights and regulation in the smartphone age. *International Journal of Law and Information Technology*, 21(2), 154–186.
38. Sitra. (2019). Fair data economy project. Retrieved 2019-04-16, from <https://www.sitra.fi/en/topics/fair-data-economy/>
39. Stallman, R. M. (2010). *Free software, free society: Selected essays of Richard M. Stallman* (Second ed.). Boston, MA, USA: Free Software Foundation, Inc.
40. Tonner, M. (2013). Tethering applications and open internet rules for the mobile broadband: Lessons from the FCC-Verizon settlement. *Hastings Communications and Entertainment Law Journal*, 35(3), 471–492.
41. Ververis, V., Isaakidis, M., Weber, V., & Fabian, B. (2019). Shedding light on mobile app store censorship. In *Adjunct publication of the 27th conference on user modeling, adaptation and personalization* (pp. 193–198). New York, NY, USA
42. Wohlin, C. (2014). Guidelines for snowballing in systematic literature studies and a replication in software engineering. In *Proceedings of the 18th international conference on evaluation and assessment in software engineering* (pp. 38:1–38:10). New York, NY, USA
43. Wolk, M. H. (2010). The iPhone jailbreaking exemption and the issue of openness. *Cornell Journal of Law and Public Policy*, 19. (Article 8)
44. Yu, L., Ramaswamy, S., & Bush, J. (2008, July/August). Symbiosis and software evolvability. *IT Professional*, 10(4), 56–62.