

Abstract: *Chinese Free and Open-Source Software has become a structural component of the Chinese Internet in recent years. Despite FOSS's cultural importance as a value-laden IT practice, the topic has received little attention from the social sciences. This article contributes to filling this gap by using as a lens a local association of FOSS enthusiasts located in one major Chinese city, c. 10 years after the 1st observation (Tarantino 2011), focussing on FOSS practitioners' imaginaries and motivations.*

Introduction

A sociological approach to Free and Open-Source Software (henceforth FOSS) in China is worthwhile at least for two reasons. The first reason lies in its importance as a structural factor within the Chinese IT sector. From the perspective of *adoption*, FOSS has become a core infrastructural component of the Chinese Internet, with most of the largest IT companies adopting FOSS for critical system operations.¹ From the perspective of *production*, China has become the second contributor (after the USA) to the FOSS projects hosted on the largest global aggregator GitHub,² with the above-mentioned subsidizing dedicated teams to work on FOSS projects. On the *policy* side, FOSS is currently (once more, as will see in the next section) an important component of Chinese technological endeavours, in particular driving the current attempt of the PRC to attain software and hardware independence from foreign suppliers - most notably from the USA.³ One example is the FOSS project Unity Operating System,⁴ released first in 2019 and designed to be fully compatible with Chinese-designed microprocessors such as those of the Zhaoxin (兆芯) and Loongson (*longxin* 龙芯) families.

The second reason is more theoretical. The ideas underpinning the FOSS movement emerged at the intersection between two very specific milieus in 1960s and 1970s North America. The first was the academic

culture, with its preoccupations with experimentation, peer-review and public-domain knowledge. The second was the one driven by counter-cultural movements, with their concerns with non-hierarchical organizations, common good, independence and overall opposition to mainstream culture.⁵ From the perspective of the social sciences, it appears therefore of considerable scholarly interest to observe the processes of circulation of such a value-laden concept, its imaginary and the corresponding modes of production and distribution, outside of its context of origin. Yet this remains a relatively underdeveloped strand of the social sciences, even within the specific field of Software Studies.⁶ National approaches to FOSS have been largely interrogated alternatively as (a) subsumed by the global FOSS movement (of which any national approach would replicate values, concepts and imaginaries, possibly conflicting with national mainstream cultures);⁷ (b) focussing on individual developers' psychological motivating factors;⁸ (c) disregarding the cultural component and considering FOSS primarily in terms of its features as a mode of production.⁹

This article intends to contribute to filling the abovementioned gap by investigating the adaptation of Free and Open-Source Software (FOSS) philosophy and movement to the Chinese context by using as a lens a local association of FOSS enthusiasts located in one major Chinese city. The same association was studied between 2007 and 2008 by one of the authors, in a project which investigated imaginaries, motivations and practices of FOSS practitioners through an ethnographic approach.¹⁰ This article presents the first exploratory results of this revisitation. It is structured as follows: the first part will define FOSS and reconstruct its relationship with China. The second part will present the results of our new fieldwork. We will then conclude with some considerations on the future of FOSS in China.

While its origins date back to the dawning of mass computing in the 1950s, and its formalization into a ‘movement’ dates to 1983, Free and Open-Source Software (FOSS) has been attracting a growing amount of scholarly attention since the mid-1990s. The definition expands that of “Open-Source Software” – that is, software released under a license allowing public access and modification of its source code – to include “Free Software”. Free software has been defined by Richard Stallman, founder of the Free Software Foundation, as software released under licenses which enable the “Four Freedoms”: “to run the program as you wish, for any purpose”, “to study how the program works, and change it so it does your computing as you wish”, “to redistribute copies so you can help your neighbor” and “to distribute copies of your modified versions to others”.¹¹ In evolving the concept, a cornerstone similitude linked ‘free software’ with ‘free speech.’ – or, as Stallman writes, “to understand the concept, you should think of “free” as in ‘free speech,’ not as in ‘free beer’”.¹² Stallman himself, and sizable part of the movement, thinks that ‘Libre’ would therefore be a more appropriate label than ‘Free’.¹³

The FOSS movement frames software as a public good, access to which must be universal (albeit it does not forbid to resell the software for a price, if a user so decides). To this end it is released under specific licenses (such as the GNU or Berkeley licenses) which legally force derivative works to be FOSS as well. Thus, a company cannot legally appropriate FOSS code to include in commercial software. The efficacy of such licenses rest upon the overall degree to which IP laws are enforced in a particular country: to this end, Patel speaks of “inversion of copyright”, as FOSS licenses “use this protection to advance policy goals contrary to traditional copyright”.¹⁴ Adherents

to FOSS tend to consider immoral commercial software licenses insofar as they limit individuals’ possible uses, access to source code and circulation of copies.¹⁵

Successful FOSS projects include the Firefox web browser, the Apache web server, and the Linux operating system. While integration with commercial software enterprises is overall on the rise, a large part of FOSS software still emerges, or originates, from community development coordinated through the Internet, sometimes participated by companies who use or benefit from FOSS.¹⁶ Those communities perform collectively unpaid coding through a system of peer-reviewed voluntary contributions. FOSS therefore rests upon an ensemble of intrinsic and external motivations for developers to work on their projects.¹⁷ To the former belong rewards coming from the individual itself, such as pleasure and enjoyment found in coding, sense of contribution to the common good (or “altruism”), and technical learning. To the latter belong rewards coming from external sources, such as prestige, career boosts, or economic incentives.

To improve the strength of those motivations, FOSS is accompanied by an action of promotion known as ‘evangelism’, aimed at increasing its penetration in society. Through public speaking and online discourse, evangelists work to convince developers to contribute to FOSS projects, individuals and organisations to adopt it; they also help with the technical difficulties which may emerge in the project. FOSS adoption can be troublesome, especially for inexperienced users, because of increased complexity and lack of full-time tech support. At the local level, users and developers of FOSS congregate in a variety of spontaneous associations performing evangelism: one of the most diffused are Linux User Groups or LUGs. LUGs are defined as “geocentric gatherings of Linux enthusiasts who meet face-to-face as well as online on a regular


basis to engage in a variety of individual and joint activities”.¹⁸ Those activities include assistance to new users, collective coding events, hackathons, charity events, technical troubleshooting and so on. LUGs essentially work as local bases for FOSS evangelism.

In China, FOSS (*zìyóu jí kāifàng yuándaimǎ ruǎnjiàn* 自由及开放源代码软件) has had a slower penetration rate than in other contexts. Literature offers multiple reasons for this. The country has long featured rampant software piracy due to weak IP enforcing measures, with estimates of pirated software being as high as 92%.¹⁹ This not only removed one of FOSS main pull factors, by driving the cost of commercial software close to zero; the weak IP protection enforcing schemes also complicated the enforcement of FOSS licenses themselves.²⁰ Overall, China has followed the trend of other developing countries in adopting FOSS as an alternative to commercial software in vital areas such as operating systems and productivity tools.²¹ However, government support has been unsteady, alternating between strong and weak support. For instance, the Red Flag (*bōngqí* 红旗) Linux distribution, originated by the Chinese Academy of Sciences and later managed by the spinoff Red Flag Software, was reportedly imposed as a replacement of the Microsoft Windows operating systems for all government computers in January 2000,²² subsequently reverting on this decision after Microsoft agreed to some modifications.

LUGs (Linux *yonghuzǔ* 用户组) and other similar associations started to form in China in the late 1990s in Shanghai (1997), then in Beijing (2002) and Guangzhou (2003). All were founded by Western expatriates working in the Chinese IT industry. The national variable was very prominent in our first round of observations.²³ We outlined a gap in the strength of commitment to FOSS philosophical and ethical tenets between Western and Chinese members, with the former leaning towards the ‘evangelist’

(i.e. strongly committed and invested) pole and the latter towards what we called the ‘agnostic’ one. Chinese members who had been exposed to Western education also tended to lean more towards the former than their colleagues without comparable experience. The possibilities LUGs offered for networking and technical learning (in terms of both IT and English language skills) were much stronger motivations for membership. Moreover, direct contribution by Chinese developers to FOSS projects was very sparse. Subsequent studies appear to confirm this overall trend. While acknowledging a growing penetration of FOSS in the Chinese software industry, Cheng *et al.* remarked a low rate of contribution to FOSS projects.²⁴ Chen *et al.* surveyed over 400 FOSS developers in China, finding that technical education and career boost were the strongest motivators, confirming our previous ethnographic results.²⁵ In our original observations, we also hypothesised a cultural component to the struggles of FOSS in China, as the horizontal production model, based on peer-review, was described as ill-fit for the sensitivities of our Chinese informants, because of unclear hierarchies and lack of feedback. All these factors contributed to the slow progress of FOSS in China, compared with the early days of the movement in the West.

However, as we briefly summarized in the introduction, the situation seems to be again on the upswing. Since the time of our first observation, the contributions of Chinese developers to FOSS projects have increased steadily and considerably as indicated by the increased number of “commits” (changes to FOSS projects) on both Gitee and OSCHINA, both repositories for Chinese-led FOSS projects. There have been Chinese contributions to the Linux kernel, an important symbolic milestone. Several major Chinese IT companies such as Huawei are now directly paying employees to contribute to the Linux kernel (about 1% of total changes as of 2015). Govern-



ment support intensified as well: in December 2014, China's Ministry of Industry and Information Technology released a statement supporting recourse to OpenStack for SOEs.²⁶ Big IT companies like Baidu, Tencent and Alibaba all embraced Open Source; for instance, they contributed developers to the Open Daylight Foundation, which develops FOSS networking software. Finally, FOSS associations have proliferated also inside Chinese universities, especially polytechnical ones. Those elements seem to indicate a maturation of the overall FOSS scene in the country. Because of this, we set out to perform a revisit of our initial research, going back to the LUG we investigated in 2007-2008, asking ourselves: what has changed on the ground?


The COVID-19 global pandemic of 2020 impeded a planned second round of field ethnographic research. As a partial substitute, we performed participant observation in all the main communication channels of the LUG: website, chat, account on the social networking services, software repositories, channel on the group's instant messaging service (provided by an external company), collecting and analysing published materials and, when possible, interacting with members. To this, we added the analysis of blogs, social media accounts and online videos by prominent current or past members of the LUG. Moreover, we analysed 18 years of events (2002-2020) organised by the LUG, with some gaps in our database because of missing records. All materials – including the LUG location – have been anonymised to the largest possible extent.

Case study

LUG's composition has changed considerably in the 13 years that passed from our initial fieldwork. Overall membership has grown, as did the percentage of Chinese members (albeit we were not disclosed exact

member figures). The group underwent a deep crisis in 2010 – defined in some internal communication as a “bloodshed” – losing a high percentage of members, who left Beijing. Top positions (including the presidency) were transferred to Chinese – albeit some Westerners have covered management roles until 2017. LUG's social events are now held predominantly in Chinese, whereas they used to be held in English. Then and now, LUG's website was built around notions of inclusivity, friendship and collaboration, which were stated in every section. Content was delivered in both Chinese and English on the same page; however, LUG's internal communication channels (Instant Communication platforms) were now using Chinese as the main language (albeit occasional English exchanges were still performed with non-Chinese members), whereas in 2007-2008 English was the *lingua franca*. All these aspects pointed to a progressive Sinicisation of the LUG, intended as an increase of the Chinese presence in its structure and language. This Sinicisation is also visible in the public events sponsored by the LUG, whose percentage of Chinese speakers has increased: Chinese speakers' percentage, about 2-3% in 2004, reached 33% in 2018.²⁷ This Sinicisation can also be read as an emancipation from the Western historical roots of LUG, and possibly the development of an autonomous Chinese localisation of FOSS.

To better explore the forms of this Sinicisation we attempted to study the discourse circulating in the LUG. We used the internal channel of communication (ICC) as our main proxy: specifically, we collected ICC's messages between January and May 2020 (when ICC was disbanded) for a total of 4,036 messages by 51 users.²⁸ We complemented this analysis with that of other online spaces connected to the LUG (four software repositories, three social media accounts, two individual members' blogs and one video-sharing channel). On our main



corpus (proceeding from ICC) we performed a Latent Dirichlet Allocation analysis individuating three main topical cores, which we labelled “technological” (ca 45.5% of the messages), “political” and “social” (ca 27.3% each).

The “technological” topic, the largest in the sample, included discourse on strictly technical issues, particularly troubleshooting requests between members. The “social” topic included discussions on broader societal issues; in our window of observation, COVID-19 was the most present topic (others ranged from the price of oil to football). Such topics were sometimes discussed with reference to the ‘freedom’ component, particularly with reference to access to healthcare, medicine and medical patents. The “political” topic focused instead on discussions about power dynamics, ideology and geopolitics. Group members discussed about contemporary Soviet and Chinese history, liberal democracy, and freedom of information. Here we observed conflicting perspectives between pro-China voices and voices critical of the country’s policies regarding freedom. The latter mostly originated from users who presented themselves (or were identified by other members) as overseas Chinese. However, critical voices also came from self-identified mainlanders. The fact that such discussions were taking place in the internal communication channel of a software-centred subculture cannot be attributed to simple topical variety (and, as we will see below, is explicitly defended by senior members). Rather, we argue that their inclusion points to a larger, emergent process which our current empirical material allows us to see only the broad outlines of: the adaptation of FOSS philosophy to the Chinese context.

Debates around the compatibility between FOSS and some of the political tenets of contemporary China spread across various online spaces the LUG was connected to. For example, within a forum discussing

the Chinese translation of one of Stallman’s books we could observe a discussion about the relationship between communism and FOSS. The topic started from a paragraph in which Stallman equates Soviet communism with commercial software. One prominent LUG user discussed the advantages of capitalism (described as “obviously not a good thing either”, *dangran le zibenzhuyi ye bu shi sha hao dongxi* 当然了资本主义也不是啥好东西) over communism in terms of individual freedom and happiness; another asked “what superstructure can be built by the economic structure of Free Software after all?” (*ziyou ruanjian de jingji jigou jiu jing neng gouzao chu zenyang de shangcengjianzhu* 自由软件的经济结构究竟能构造出怎样的上层建筑); in yet another passage, Stallman’s reference to communism is explained as a by-product of his American culture and the relative stereotypes on the Soviet Union. Such exchanges can be seen as hints of an ongoing process of adaptation attempting to “fit” FOSS within the Chinese cultural and political context.

Explicit Chinese techno-nationalism (such as appraisal for China’s feats in the global IT industry) appeared under-represented in both public and internal communication. For instance, the group declares to intentionally avoid Chinese software company Tencent’s products, particularly the very popular QQ and WeChat platforms, in favour of FOSS alternatives (while still keeping a Facebook page and a Weibo account).

In reconciling these various pushes, one attitude we could observe from evangelists was strong reliance on the FOSS canon, and in particular on Stallman’s writings. The distinctions between ‘Free’ and ‘Libre’ are also discussed. An indicative episode in this sense happened in the summer of 2020, as we approached the LUG’s IRC asking for availabilities for interviews. One of the authors uploaded the interview request in the Microsoft Word format. This provoked a strong reaction by some of the users active

on the IRC channel, amongst which was a prominent Chinese member. This member stated that in order to interview them, we shouldn't "embarrass us by using Microsoft's trash formats" (*bie yong weiruan de laji geshi lai exin women* 别用微软的垃圾格式来恶心我们). Members hyperlinked writings of Stallman explaining why Word attachments should be declined.²⁹ In a separate conversation, asked to comment on whether FOSS could be separated from politics, one senior member remarked that Stallman made that link: "all that has to do with politics also has to do with (the movement of) free software" (*fan shi he zhengzhi youguan de dongxi ye he ziyou ruanjian (yundong) youguan* 凡是和政治有关的东西也和自由软件(运动)有关). Again, when on the ICC users complained about the overabundance of what we called 'social' and 'political' discourse (as opposed to 'technological' discourse), they were reminded that "someone said" (read, Stallman) that FOSS was "inherently political." Reference to Stallman in particular was very conspicuous in the LUG's public spaces, with pictures, quotes and even a downloadable Chinese translation of his most prominent book, *Free Software/Free Society (Ziyou ruanjian, ziyou shehui* 自由软件, 自由社会).

What's more interesting, it was Chinese users who appeared to make most of these references. If in our 2007 ethnography FOSS Evangelists were almost entirely westerners, the 2020 LUG featured several very active and highly invested Chinese FOSS evangelists. Aside from LUG events, these evangelists could be seen active on a variety of platforms such as personal blogs, Weibo, Facebook, GitHub and YouTube channels (some of which were hyperlinked to the LUG's spaces, whereas some other remained disconnected), prorating the cause of FOSS expansion in China.³⁰ Chinese FOSS evangelists had replaced Western ones in the control of the LUG's governance structures and spaces. However, it was impossible in this phase of the research to interview any

of the most prominent ones, as all declined our interview requests.

Conclusions

In revisiting the LUG 13 years later, we found a very different scenario. Our empirical materials indicate an ongoing process of progressive Sinicisation of the LUG's online and offline spaces, with a corresponding emancipation from its Western origins and the emergence of Chinese FOSS evangelists. This seems to be coherent with the overall maturation of the FOSS scene in China, in a situation of strong governmental support and the backing of the major IT companies of the country. At the same time, on the ground, this process of Sinicisation appeared to be intertwined with a discussion about how to adapt the notion of "Freedom" of Free Software to the Chinese context. The strong adherence to FOSS canon we observed in Chinese evangelists during our observations may be counterproductive, because the foundational analogy between 'free speech' and 'free software' appears to offer difficult obstacle to adaptation. Stallman's statement that China has "no free speech" and therefore "the concept [of FOSS] has been slower to catch on there"³¹ is hyperbolic and does not do justice to the reality of speech in contemporary China. However, it is true that part of FOSS' struggles in China are related to the failure of cultural mediations with its strong conceptual roots in American individualism. This may have contributed to keep FOSS in the category of exotic philosophies, impeding organic assimilation into the motivational structures of Chinese developers. Currently, this adaptation process appears to be accelerating, but is still unresolved; the strong top-down support FOSS is currently enjoying may be inflating through external incentives the global quota of Chinese contribution to FOSS projects without a real penetration of FOSS-driven motiva-

tions, which appear vital to keep the movement alive and can only be observed on the ground. However, more empirical research on a wider sample of organisations will be necessary to better understand the forms of this process as well as its facilitating factors. Next phases of this research project will entail such analyses, along with the forms of adaptation of FOSS emerging from official institutional discourses.

Main References

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Notes

¹ See for instance the presence of some of the largest Chinese IT players (such as Alibaba, JD.com, Baidu.com, Huawei and others) as members of the Cloud Native Foundation, which promotes the use of the FOSS projects such as cloud-computing cluster manager Kubernetes. <https://www.cncf.io/about/members/>, (accessed on 26th February 2021).

² According to a 2018 study, China had the second-highest number of projects active on Github.com, the world’s largest FOSS repository. See Mombach *et al.*, “Open source development around the world: A comparative study”, *ArXiv:1805.01342*, 2018.

³ On this attempt, see Rogier Cremens, “China’s Conception of Cyber Sovereignty: Rhetoric and Realization”, in D. Broegers and B. van der Berg (eds.), *Governing Cyberspace: Behavior, Power and Diplomacy* (Laham, Boulder, New York, Rowman & Littlefield, 2020), pp. 107-144, see also <https://www.ft.com/content/b55fc6ee-1787-11ea-8d73-6303645ac406>, (accessed on 2nd February 2021).

⁴ *Tongyi caozuo xitong* 统一操作系统, www.chinauos.com. (Accessed on 26th February 2021).

⁵ Johan Söderberg, *Hacking capitalism: The free and open source software movement* (London, Routledge, 2015). See also the second chapter of Manuel Castells, *The Internet galaxy: Reflections on the Internet, business, and society* (Oxford, Oxford University Press, 2002).

⁶ The label of “Software studies” has come to identify a host of approaches that see software, and particularly code, as a socio-technical artifact, and examines its relationship with culture and society. First advocated by Lev Manovich in his influential *The*

Language of New Media (MIT Press, 1999) the field has come to establish intersections with many disciplines. See in particular the Software Studies book series from MIT Press (<https://mitpress.mit.edu/books/series/software-studies>, accessed on 1st February 2021).

⁷ See for example the very interesting work done on Cuba and Turkey: Alexis Garcia-Perez, Amit Mitra and Alfredo Somoza-Moreno, “Imperatives of free and open source software in Cuban Development”, *Information Technologies & International Development* 3.1 (2006), pp. 1-17. Nihan Yildirim, Hacer Ansal, “Foresighting FLOSS (free/libre/open source software) from a developing country perspective: The case of Turkey”, *Technovation* 31.12 (2011), pp. 666-678.

⁸ Nilay Patel, “Open source and China: Inverting copyright”, *Wis. Int'l LJ* 23 (2005), pp. 781-790.

⁹ See for instance Shyamalendu Kandar, Sourav Mondal & Palash Ray, “A review of open source software and open source movement in developing countries”, *International Journal of Computer Science & Informatics* 1.1 (2011), pp. 89-93. Gilberto Camara and Federico Fonseca, “Information policies and open source software in developing countries”, *Journal of the American society for information science and technology* 58.1 (2007), pp. 121-132.

¹⁰ Matteo Tarantino, “In Search for Motivations: Exploring a Chinese Linux User Group”, in D. K. Herold and P. Marolt (eds.), *Online Society in China: Creating, Celebrating, and Instrumentalising the Online Carnival* (Abingdon, New York, Routledge, 2011), pp. 147-164.

¹¹ Richard M Stallman, “*What is Free Software, Version 1.165*”, Url: <https://www.gnu.org/philosophy/free-sw.html.en>. (Accessed on 30th September 2020).

¹² *Ibid.*

¹³ <https://www.gnu.org/philosophy/floss-and-foss.html>. (Accessed on 26th Feb-

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¹⁴ Vedi nota 8.

¹⁵ Writes Stallman: “Proprietary software keeps the users divided and helpless: divided because everyone is forbidden to share with anybody else, and helpless because the users don’t have the source code, so they can’t change anything. They can’t even tell independently what the program is really doing to them”. See Richard M. Stallman, “*What is Free Software, Version 1.165*”. Url: <https://www.gnu.org/philosophy/free-sw.html.en>, (accessed on 30th September 2020).

¹⁶ Recent scholarship puts in the 10%-50% range the amount of paid contributions, depending on project Dirk Riehle, Philipp Riemer, Carsten Kolassa and Michael Schmidt, “Paid vs. volunteer work in open source”, *47th Hawaii International Conference on System Sciences*, (Waikoloa, HI, USA, 2014), pp. 3286-3295.

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¹⁸ Richard P. Bagozzi and Utpal M .Dholakia, “Open source software user communities: A study of participation in Linux user groups”, *Management science* 52.7 (2006), pp. 1099-1115.

¹⁹ Erin Swike, Sean Thompson and Christine Vasquez, “Piracy in China”, *Busi-*

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²⁰ For a review of the complexities in enforcing FOSS licenses in China see Chapter 5 of Ywein Van den Brande, Shane Coughlan and Till Jaeger, *The International Free and Open Source Software Law Book* (<http://ifosslawbook.org/>).

²¹ Shyamalendu Kandar, Sourav Mondal and Palash Ray, “A review of open source software and open source movement in developing countries”, *International Journal of Computer Science & Informatics* 1.1 (2011), pp. 89-93.

²² Nilay Patel, “Open source and China: Inverting copyright”, *Wis. Int'l LJ* 23 (2005), pp. 781-790.

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²⁴ Chen Weibing, Li Jingyue, Ma Jianqiang, Reidar Conradi, Ji Junzhong and Liu Chunnian, *A survey of software development with open source components in Chinese software industry* (Berlin, Springer, 2007); Chen Weibing, Li Jingyue, Ma Jianqiang, Reidar Conradi, Ji Junzhong and Liu Chunnian, “An empirical study on software development with open source components in the Chinese software industry”, *Software Process: Improvement and Practice*, 13.1 (2008), pp. 89-100.

²⁵ Chen Xiaohong, Zhou Yuan, David Probert and Su Jun, “Managing knowledge sharing in distributed innovation from

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²⁶ Wang Weixin, *Paid vs. Volunteer Job of Open Source in China* (Nuremberg, Friedrich-Alexander-Universität Erlangen-Nürnberg, 2018).

²⁷ This process could also be observed in other major LUGs in China of which we surveyed websites – for instance the Guangzhou LUG. See <https://gzlug.org>. (Accessed on 4th October 2020).

²⁸ 7.7% were published by then “deleted accounts”, making identification impossible.

²⁹ The document’s main thesis is that accepting Word documents perpetuates the need for Microsoft Word software, and must therefore be discouraged. Richard M. Stallman, *We Can Put an End to Word Attachments*. Url: <https://www.gnu.org/philosophy/no-word-attachments.en.html>. (Accessed on 30th September 2020).

³⁰ The materials we collected described familiar challenges including lack of IT education (and FOSS education) in Chinese schools, lack of critical thinking, lack of incentives and lack of understanding of FOSS principles.

³¹ Sam Williams, *Free as in Freedom: Richard Stallman’s Crusade for Free Software* (Newton, Massachusetts, O’Reilly Media, 2011). The passage is available here: <https://www.oreilly.com/openbook/freedom/ch05.html> (Accessed on October 7th, 2020).