FLOSS and digital inclusion in Brazil: a literature review

Flávio Gomes da Silva Lisboa
UTPFR
Curitiba, Brazil
https://orcid.org/0000-0002-9396-7944

***Abstract*—This article is the first part of a broad research on digital inclusion policies in Brazil. In particular, this research aims to find out how free and open source software (FLOSS) has been used in digital inclusion actions. To support this work, we conducted a literature review, with no starting date limit, searching for scientific production that relates digital inclusion with the concepts of free software or open source software. We found 66 works, published between 2003 and 2022, which include journal articles, conference papers, bachelor, specialist and master dissertations, doctoral theses and books. These papers were produced by authors from 37 different research institutions, within 28 programs or courses. It was possible to highlight some categories in this preliminary analysis, such as accessibility, policies, and "telecentros" (community technological centers), but a deeper analysis is needed to better understand the contributions of this scientific production.**

***Keywords*—bibliographic review; digital inclusion; free software; open source software; social inclusion.**

I. INTRODUCTION

In 2003, Sérgio Amadeu [1] stated that a digital inclusion policy and free software movement were "a key link in the chain of initiatives for [Brazilian] sustainable development" (our translation). In the previous year, the Brazilian e-Government Executive Committee defined several guidelines for Brazilian e-government policy [2]. One of these guidelines stated that digital inclusion was inseparable from e-government and that "digital inclusion must be treated as a constituent element of e-government policy if it is to be configured as a universal policy" (our translation).

"*Digital inclusion is a first step towards the appropriation of technologies by socially excluded populations in order to break the reproduction of misery. The sharing of software and other products of collective intelligence is decisive for the democratization of technological benefits and needs to be encouraged*" (our translation) [1].

In this paper we investigate the results of almost two decades of e-government policies in Brazil regarding digital inclusion with the use of free software.

To this end, we carried out a literature review, searching for articles, dissertations, theses, and books that presented results of research on the use of free software for digital inclusion in Brazil.

This article is the first part of a wider investigation about relationship between digital inclusion and free and open source software in Brazilian territory.

Before presenting the methodology used for the literature review, it is important to introduce the concepts of digital inclusion and free software.

A. Digital Inclusion

According to Mori [3], "Understandings of 'digital inclusion' can be grouped into three strands: a) 'digital inclusion' as access; b) 'digital inclusion' as 'digital literacy'; and c) 'digital inclusion' as appropriation of technologies" (our translation).

Sérgio Amadeu [1] defends digital inclusion as appropriation of technologies. He believes in digital inclusion as a condition which a people dominates:

- World Wide Web (Internet);
- Internet content;
- electronic mailbox and information storage modes;
- basic languages and tools for using the network;
- content production techniques;
- construction of community-oriented tools and systems.

Sérgio Amadeu believes that is impossible to have a complete appropriation of digital technologies without use of free software. In the next subsection we will define what is free software and which is its relationship with technology appropriation.

B. Free Software

According to Free Software Foundation – FSF [4], a computer program is a free software if it give to users four essential freedoms: to run the program as they wish; to study how the program works and change it; to redistribute copies of the program; to distribute copies of modified version of the program. For a program ensures these freedoms, it needs to have a open source code and a license which says that the program is a free software.

The possibility to study and change computer programs allows that users appropriate software technology. A free software is not only a software to be used. It can be modified and adjusted to needs of their users. Of course, the users

needs to know how to change the software and, therefore, the appropriation possibility of free software depends on education.

Free software is a problematic term in English because it can be understood as a software which you don't need pay for. The "free" in free software is about freedom, as Richard Stallman, FSF founder, always remembers.

A movement was organized around free software idea and reunited users and programmers worried about the freedom to use softwares. However, other movement were organized, more worried about the technical advantages to share software source code: the open source movement. This other movement reunited around the Open Source Initiative – OSI [5] and it is more focused on business.

Stallman [6] does not agree with the emphasis which OSI gives to practical benefits of open source programs, but he recognizes that both of movements share common technical aspects and he accepts the term FLOSS (Free\Libre and Open Source Software) as a common name for two movements, ignoring the political views.

So, although the Brazilian e-government policy mentions exactly "free software", we also have searched for works with the term "open source software", thinking that authors could have used both of terms.

II. METHODOLOGY

We were looking for works about digital inclusion in Brazil mediated by free software or open source software. So, we have searched for scientific works with two groups of keywords (translated when this was necessary):

1. "free software", "digital inclusion", "Brazil"
2. "open source software", "digital inclusion", "Brazil"

We used as scientific database the following repositories:

- ACM Digital Library (https://dl.acm.org);
- OASIS (https://oasisbr.ibict.br/vufind);
- Scielo (https://scielo.org)

These three repositories has open access to find papers, but ACM has some articles with fee-based access to read the content. ACM and Scielo index papers and other works in English, so we have searched in these databases with English keywords. In OASIS, however, we have searched for Portuguese translations for the keywords – except "Brazil', because this repository index works in Portuguese.

We did the searches in September 2022, for all fields and without limiting the date of publication.

From the found works, we made a quantitative analysis aided by spreadsheets, built with LibreOffice Calc. We reunited the records collected from the three mentioned databases, creating a table with the columns author, title, year, type (of work), university and program/course. We sorted this table according to data we wanted to find and extracted other tables, which will be showed in next section.

III. RESULTS

In this section we present the general data collected from literature review. Table I shows the amount of found works for each one of the combinations of keywords.

TABLE I
RESULTS FOUND IN EVERY DATABASE

Database	Free software	Open source software
ACM Digital Library	10	13
Oasis	74	7
Scielo	0	0
Total	**84**	**20**

From Table I, it is possible to notice that most of the works were found in Oasis database. In other hand, no work was found in Scielo.

After sorting the works by title and authors, we discarded the replicated occurrences. We also discarded editorals, because they are not research works, but only summaries. We have found 66 scientific works published between 2003 and 2022. The Figure 1 shows the amount of works by publication year.

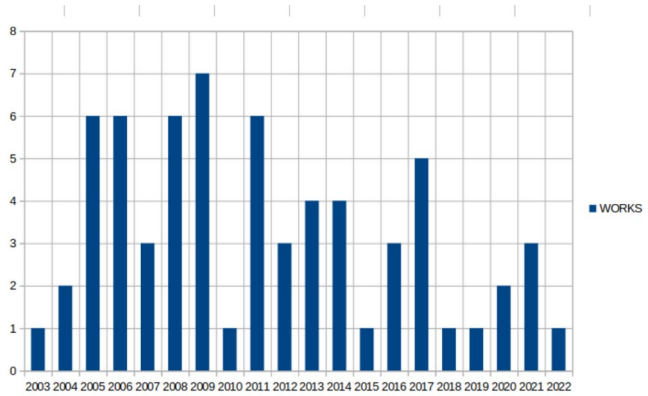

Fig. 1. Scientific works found by publication date

The older complete work is "O uso do Software Livre na redução da exclusão digital", a journal paper by Liane Baqueiro dos Santos, published in 2003 [7]. This year was the second one after the definition of guidelines for Brazilian e-government policy by Brazilian e-Government Executive Committee. The journal which published the article, "Revista Eletrônica de Sistemas de Informação", is from the area of Information Systems.

The newer complete works are "TICS na formação dos agentes comunitários de saúde", a master dissertation by Donizete Moreira de Oliveira [8], and "O Plano de Aula para

Educação On-line na Pandemia de Covid-19", a journal paper by Telma Britto Rocha, both of them published in 2021 [9]. Table II shows the found works grouped by production type.

TABLE II
WORKS GROUPED BY TYPE

Type	Amount
conference paper	16
journal paper	11
bachelor dissertation	6
specialist dissertation	4
master dissertation	22
doctoral thesis	4
book	2
extended abstracts	1
Total	**66**

We have identified 37 different publishers for all works, except the extended abstracts of Conference on Human Factors in Computing Systems 2021. It was not possible to read the extended abstracts due to a continuous timeout fail in ACM Digital Libray system, then we don't know what was published in this event.

12 research institutions have produced more than 1 work, as we can see in Table IV. Most of them has produced only one work.

TABLE IV
WORKS BY PUBLISHER (WITH MORE THAN ONE)

Publisher	Amount
UFBA	7
UNICAMP	6
UFRGS	5
UnB	5
UFMG	3
UFSC	3
USP	3
UEPB	2
UFPE	2
UFPR	2
UFU	2
UTFPR	2

Most of the biggest publisher institutions listed in Table IV are federal universities, except UEPB, which is a state university. But all of them are institutions with free learning (the students don't need to pay the course). These 12 institutions belongs to four of five big regions of Brazil: northeast (UFBA, UEPB and UFPE), center-west (UnB), southest (UNICAMP, UFMG, USP, UFU) and south (UFRGS, UFSC, UFPR and UTFPR).

Most of publishers are Brazilian institutions, with 17 federal universities, 6 state universities, 7 private universities, 2 foundations, 1 research institute, and a 1 private college. Among the private universities, there are 5 managed by catholic organizations. 4 publishers are non Brazilian universities, 1 from Portugal (Universidade Técnica de Lisboa) and 3 from Spain (Universitat de Barcelona, University of Almeria, and University of Salamanca).

We have identified 28 different programs or courses for the found works (Table V). We can see that almost one third of works are related to Education, in general or with a specialization (Social Sciences, Mathematics and Technology, Media and Pedagogy). The three other areas with more works are Biblioteconomy (5), Information Science (5) and Social Sciences (4). These three areas have almost 20% of all the works.

TABLE V
WORKS BY PROGRAM/COURSE

Course/Program	Amount
Archictecture	2
Biblioteconomy	5
Business	2
Collective Health	1
Communication	2
Computer Science	3
Computing	2
Computing in Education	1
Design	1
Education	16
Education and Social Science	1
Enginnering	3
Geography	1
Information Science	5
IT Project Management	1
Interdisciplinar	1
Language	2
Law	1
Local Development	1
Mathematical and Technological Education	2
Media in Education	1
Multimedia	1
Pedagogy	1
Physical Education	1
Social Sciences	4
Technology and Free Software	1
Theology	1
Web Development	1

From Table V, it is possible to see something interesting: a program about technology and free software. It is the only program with "free software" term in the title. When we searched for more information about this program, we discovered that it had a short live. It was a specialization course which produced 6 dissertations, all of them published in 2017. This program were managed by Electronics Department of Universidade Tecnológica Federal do Paraná (UTFPR), in the city of Curitiba, state of Parana.

There with 4 authors with more than one published work:

- Débora Abdalla, with 2 conference papers, in 2008 and 2018 [10][11];
- Jorge Ferreira Franco and Roseli de Deus Lopes, with 2 conference papers, in 2006 and 2009 [12] [13];
- Luísa Xavier de Oliveira, with 1 conference paper in 2006 [14] and 1 master dissertation in 2008[15].

In next section we will discuss some findings from these works.

IV. HIGHLIGHTS

We have identified some categories from work titles. Inside the theme of social inclusion, there is the question of including people with disabilities. This worry also exists for digital inclusion, because information technology devices require some abilities. There are 2 works with the word "accessibility" in Portuguese translation: the master dissertation by Daniel Domingos Alves, published in 2011 [16], and the specialist dissertation by Bruna Amanda Bochnia, published in 2013 [17]. The first work, "Acessibilidade no Desenvolvimento de Software Livre", explores the development of software for people with disabilities in general. The second work, "Acessibilidade no âmbito do ensino a distância: uma análise da plataforma Moodle de ensino nos cursos do ensino superior" , is focused on software for e-learning adapted to people with disabilities, more specifically Moodle, a FLOSS course management system (https://moodle.org). Moodle also appears in other master dissertation, by Glaucia Medianeira Coelho Pereira, published in 2017 [18], but she focus on virtual learning for politechnical high school education.

There is another work about people with disabilities, but without the word "acessibility" in title: "O Software Livre como Alternativa para a Inclusão Digital do Deficiente Visual" (2006), a master dissertation by Samer Eberlin [19], about use of free software for helping people visually impaired.

Mori [3] talks about one specific space for social inclusion in Brazil promoted by governments, the "telecentros", or Community Technology Centers, according to Nemer [20]. We have found 2 works with "telecentros" in title: the bachelor dissertation by Fabiana Alves Coelho, published in 2004 [21], and the conference paper by Marta Pinheiro Aun and Mauro Araújo Câmara, published in 2005 [22]. The first work, "Qualificação de monitores de telecentros Porto Alegre : uma análise da experiência realizada pela FABICO/UFRGS", approaches the training of monitors for "telecentros" in the city of Porto Alegre, in south of Brazil. The second work, "Telecentros como instrumento de inclusão digital : perspectiva comparada em Minas Gerais" , approaches experiences with these Community Technology Centers in the state of Minas Gerais, in southest of Brazil.

In the introduction of this article we have talked about a government policy of digital inclusion. We have found 5 works with Portuguese translation for word "policy".

- "Software livre : por uma política pública de formação e inclusão digital" (2006), conference paper, by Luisa Xavier de Oliveira [14];
- "Política de Formação de Professores e Inclusão Digital : o Uso do Software Livre" (2008), master dissertation, by Luisa Xavier de Oliveira [15];
- "Inclusão Digital nas Políticas Públicas para Formação de Professores em Pernambuco" (2012), master dissertation, by Dagmar Heil Pocrifka [23];
- "A guerra pelo monopólio do conhecimento: o Movimento do Software Livre, as políticas culturais e o debate em torno dos direitos autorais" (2014), doctoral thesis, by Wilken David Sanches [24];
- "Políticas públicas para o software livre na Educação Superior : o uso do programa Scribus no curso de Jornalismo da Universidade Federal de Uberlândia" (2015), by Ricardo Ferreira de Carvalho [25].

V. CONCLUSION

The literature review has showed that education seems to be the main focus of scientific works related to the intersection between digital inclusion and FLOSS. A superficial reading of the titles already to allow finding some categories, as "accessibility", "policies" and "community technological centers". It is a fact that there are studies about digital inclusion in Brazil involving FLOSS, most of them produced by public universities.

We discovered a specific specialization program about FLOSS, but this program had a short live and it was an exception. It seems that FLOSS does not works as an independent theme for most of cases.

It is necessary to make a deeper analysis for finding other categories and to understand better how FLOSS were used for digital inclusion. A next step is to choose a content analysis tool for identifying patterns in titles and abstracts and then to build one or more category frameworks.

It is also necessary to build a framework with the research questions, for understanding which were the generating issues for these works and how they are aligned to public policies for digital inclusion.

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