

# How much are digital platforms based on open collaboration? An analysis of technological and knowledge practices and their implications for the platform governance of a sample of 100 cases of collaborative platforms in Barcelona

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## ABSTRACT

From the early cases of FLOSS and Wikipedia, the digital collaborative model of production and consumption has rapidly expanded to other spheres. This article explores how much this expansion has maintained the open character of the initial model, specifically the extent to which platform projects follow an open collaborative approach in their technological and knowledge policies and practices, and if this is also reflected in an open approach to governance. The empirical analysis is based on a sample of 100 cases in Barcelona. On the basis of this analysis, we conclude that open modalities of collaborative platforms are not prevalent. Around a third of the sample presented open modalities of the dimensions analyzed. Different areas—technological, knowledge, or governance— showed different levels of diffusion of open practices. The cases which tended to be open in one dimension also tended to be open in the other dimensions. That is, the analysis points to a correlation between technological, data, and knowledge policies and open and democratic collaborative economy models. These results suggest the importance of open technology and knowledge in realizing an open and democratic collaborative model.

## Author Keywords

Open tech; open knowledge; open collaboration; collaborative platforms.

## ACM Classification Keywords

INFORMATION SYSTEMS: Crowdsourcing

## INTRODUCTION

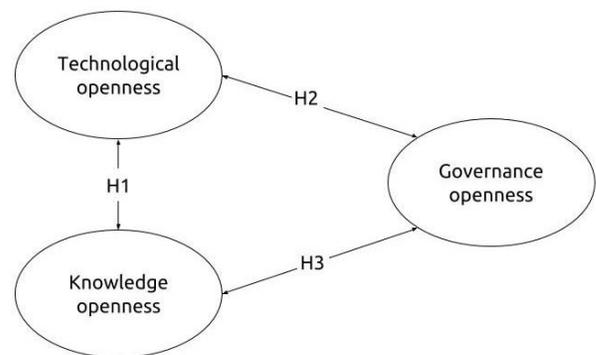
### The expansion of collaborative platforms and their open collaboration character

The collaborative consumption and production of capital and labor among distributed groups, supported by a digital platform, is growing rapidly [1]. From the early cases of FLOSS and Wikipedia, described by Benkler in the context

of common-based peer production [2], there has been an expansion of the collaborative model to other spheres [1], for instance, to platforms dealing with car sharing, house sharing, and apps exchanging specialized knowledge and notes among university students. However, more recent models based on collaborative production via a platform, such as Airbnb and Uber, have strayed far from the open collaboration logic described in the frame of common-based peer production [3].

This paper addresses the question of how much, since the expansion of the model, open collaboration is present in digital platforms now. Openness will be investigated regarding the technological and knowledge policies of digital platforms, and how these relate to openness in the governance model of the platform.

## Main goals and hypothesis of the paper



**Figure 1. Research model for studying the technological, knowledge, and governance openness of collaborative platforms.**

First, the paper addresses technological and knowledge practices in collaborative platforms, investigating the extent of the diffusion of open modalities in technological and knowledge policies. Second, the paper investigates the relationship between them—that is, how much open

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technological policies tend to coincide with open modalities in knowledge practices. Third, the paper investigates how much openness in technological and knowledge policies might favor more open models of community governance. See Figure 1 regarding the different relationships the paper will explore.

Our beginning hypothesis is that three dimensions of openness would tend to reinforce each other. These dimensions are:

**H1:** *Open technological and knowledge practices tend to reinforce each other.* That is, more technological openness is connected to knowledge openness in collaborative platforms.

**H2:** *Technological openness tends to favor more open governance of collaborative platforms.*

**H3:** *Knowledge openness tends to favor more open governance of collaborative platforms.*

The paper presents the following sections: first, we approach the construction of a conceptual framework for collaborative openness regarding technological, knowledge, and governance practices. Next, we explain the methods based on a sample of 100 cases in Barcelona, using data based on web collection and structured interviews. In the results section, we provide descriptive statistics of the openness of technological, knowledge, and governance practices at the platforms, and then test if they are correlated. Finally, we address conclusions and suggest further lines of research.

## **KEY DIMENSIONS: OPENNESS IN TECHNOLOGY, KNOWLEDGE, AND GOVERNANCE OF PLATFORM**

### **Technological openness**

Technological practices and policies openness refers to the adoption of software and technological architecture that favor freedom and openness.

We have adopted as indicator the type of license of the software code the platform uses. We have categorized the licenses depending on their degree of favorability to openness, or “freedom.” The licenses considered were (in descending order of freedom from most free to least): 1) Public Domain; 2) CC0 1.0, CC BY; 3) CC BY-SA; 4) CC BY-ND; 5) CC BY-NC; 6) CC BY-NC-SA; 7) CC BY-NC-ND; and 8) Copyright or No license.

Regarding technological architecture, two indicators have been adopted. First is the type of technological infrastructure on the platform. We categorized these, from more open to less, as: 1) Peer-to-peer (e.g., BitTorrent); 2) Centralized reproducible FLOSS, but not federated (e.g., Media wiki); 3) Federated (e.g., Kune); 4) Centralized in one entrance point (e.g., Wikia); and 5) Centralized but not reproducible because one node is exclusively provided by the platform owner and proprietary (e.g., Facebook). The other indicator used has been the interest (Yes/No) of use of blockchain so as to decentralize the platform’s technological architecture, considering that an interest in blockchain or other

decentralized technologies as an indicator of open orientation of the project.

### **Knowledge openness**

Regarding knowledge platform policies, we have adopted two types of elements content and data. The content element refers to the type of user-generated content license. The license used and their categorization from more open/free as to less were: 1) Public Domain; 2) CC0 1.0, 3) CC BY, 4) CC BY-SA, 5) CC BY-ND, 6) CC BY-NC, 7) CC BY-NC-SA, 8) CC BY-NC-ND, 9) Copyright or No license.

Regarding data policies, the indicator adopted is the ability to access data generated by users. The options considered were (from more open to less): 1) API without restrictions; 2) Full data export (data dump); 3) Freely downloadable as a whole; 4) API with some restrictions; 5) Freely downloadable in part; and 6) Not possible to export, copy, or access any API.

### **Governance openness**

Regarding platform governance, we have considered several dimensions of governance and the extent to which they adopted an open modality:

1) The openness of the management of contributors. We have considered: 1.1) the ways users can contribute to the platform content, if it is possible to create new ways of generating content, and whether it is possible to create content or (only) offer/demand/rate products or services; 1.2) the policy of platform participation: whether participation is open without filters, moderated before publication, or moderated after publication; 1.3) the possibility of user interaction: if users can communicate among themselves or create groups; and 1.4) if the platform considers different types of user accounts or a single type open to any user.

2) The openness of the election of administrators. We considered: if the users can self-appoint themselves as administrators; if administrators gain privileges automatically through participation; and if administrators are elected from among the general community, by other administrators, or by the infrastructure provided.

3) Decision-making with regard to community interactions, including whether or not there are formal or informal systems for community decision-making and if the definitions of the formal rules and platform policies are open to user contributions.

4) The type of legal entity and the options for community members to engage with each type of legal entity. We have considered: public administration, university, foundation, association, cooperative, business company, or without legal format.

5) Finally, governance linked to economic management. We considered: 5.1) economic transparency (if the economic balance is accessible to the community or if it is provided publicly); and 5.2) openness in deciding the destination of project benefits (if only project owners or the whole

community have channels to be informed of and manage the benefits).

**METHODOLOGY**

The methodology is based on the statistical analysis of a sample of 100 cases present in the city of Barcelona.

To create the **sample**, the use of a probability or random sample has several advantages. The most important benefit is the ability to make inferences about the population with a certain degree of confidence. Randomization increases the likelihood that a large sample will reflect the characteristics of the underlying population by avoiding assignment or selection based on the value of the variables of interest. However, randomization does not guarantee a representative sample per se. In addition, random selection involves the risk of “missing relevant cases.” Finally, there are limitations (such as uncertainty regarding representativeness) to applying randomness to a highly diverse population with unknown size and boundaries. *In other words, using probability samples requires knowledge of the population* — for instance, a list or census of the population, or at least a partial list (at some level) of the population. This is not the case for collaborative platforms, which are diverse and whose “universe” is unknown.

Given the lack of adequate conditions and the unsuitability of developing a probability sample of diverse collaborative platform experiences, as well as the absence of a comparability goal, we used *non-proportional quota sampling* to build the sample of 100 cases out of the initial 1,000 case sample, based on the P2Pvalue directory [4]. We ensured the inclusion of a mix of platform experiences to reflect the heterogeneity of the collaborative platforms. From the initial list of around 1,000 cases identified, we used different “matching” criteria to ensure the diversity of the sample. Additionally, in order to improve the robustness of our sample, we ensured the systematization of the sampling. We selected 100 cases on the basis of: 1) Projects with activity in Barcelona; 2) Project based on or supported by a digital platform; 3) Projects based on collaborative production; and 4) Projects with a significant level of activity, not in a very preliminary stage. Some of the cases were well known and important, but there were also many experiences that were almost unknown.

Even if the universe is unknown, we are quite confident that we reached a large part of the experience in Barcelona with an initial mapping of 1,000 cases.

A “**codebook**” [5] for data collection—a set of indicators related to the analysis variables—was employed.

**Data collection** was based on two methods: web collection and a structured interview. Web collection was based on digital ethnography of the web platforms. It was performed in 100 cases. In addition, we performed a structured interview with 50 of these 100 cases. Finally, during data collection, “field notes” of general impressions were kept in

a field book in order to have detailed qualitative data about study cases.

A single researcher collected the data. To guarantee the reliability of the sample, two other researchers tested the indicators of the codebook with a set of cases, and verified the data collected for some cases by the main data collector. In this way, we controlled the quality of our data.

To develop the analysis, we generated descriptive statistics of defined variables and correlation analysis in order to study the relation between open technology, knowledge openness variables, and open governance.

For the **statistical analysis** of the data, we applied different non-parametric tests. We were aware that non-parametric methods are not as powerful as parametric ones. However, because non-parametric methods make fewer assumptions, they are more flexible, robust, and applicable to non-quantitative (categorical/nominal) variables. Some of the tests that we applied to our dataset were bivariate non-parametric correlations calculated using Spearman’s correlation [6].

**RESULTS: OPEN COLLABORATION AT PLATFORMS**

**Technological openness**

Focusing on software openness (See Table 1), 33.66% of the platforms were based on copyrighted software while 19.80% used software without any type of license. At the other end of the scale, 2.97% of them took advantage of software with a public domain license while 36.63% adopted one of the different grades of free licenses.

Type of license	Percentage of use
Public domain	2.97%
Open Source License	3.96%
MIT license	4.95%
AGPL	3.96%
CC BY-SA 3.0	3.96%
GNU Lesser General	4.95%
GNU v2	10.89%
GNU v3	3.96%
Copyright	33.66%
No license	19.80%
N/A	6.93%

**Table 1. Software openness (n=100)**

With regard to technological infrastructure architecture openness (Table 2), 35.64% of platforms were open to reproducibility. Of these, 10.89% had a peer-to-peer architecture, 18.8% used centralized reproducible FLOSS,

and 5.94% used centralized FLOSS. 44.55% of the collaborative platforms studied were not open to being reproduced.

Type of architecture	Percentage of use
Peer-to-peer	10.89%
Centralized reproducible (FLOSS)	18.81%
Centralized FLOSS	5.94%
Not reproducible	44.55%
N/A	19.80%

**Table 2. Technological architecture openness (n=100)**

Additionally, 38% of projects showed interest in adopting blockchain as a way to decentralize power and control of the platform technology, while 44% were not interested and 18% did not answer the question.

In sum, 39.6% of the projects were based on a free license software, 35.64% were based on an open architecture, and 38% of projects had interest in exploring other forms of decentralized technologies. The openness of technological practices in the three modalities investigated was not used by the majority of cases. However, it constituted more than a third of the cases.

Finally, the technological openness correlation analysis (Table 3) shows a relationship between the platform's software and the type of infrastructure architecture. While with less significance, there is also a correlation between the openness of platform code and interest in blockchain technology. In other words, different types of openness in technological practices tend to reinforce each other.

Technological openness	Open. platform software	Openness tech. architecture	Block. interest
Openness platform software	1.00		
Openness technological architecture	0.93**	1.00	
Blockchain interest	0.52*	0.56	1.00

**Table 3. Technological openness correlations (n=50)**

\*\* . Correlation is significant at the 0.01 level (2-tailed)

\* . Correlation is significant at the 0.05 level (2-tailed)

### Knowledge openness

When it comes to user-generated content (Table 4), the majority of collaborative platforms analyzed had a private

copyright license (36.63%) or dismissed any type of license (23.76), while 2.97% had a public domain license and 32.67% had a Creative Commons license.

Type of license	Percentage of use
Public domain	2.97%
CC BY	7.92%
CC BY-SA	11.88%
CC BY-NC	7.92%
CC BY-ND	1.98%
CC BY-NC-SA	2.97%
Copyright	36.63%
No license	23.76%
N/A	3.96%

**Table 4. Knowledge content openness (n=100)**

Only 20.79% of the platforms studied had an option to export part or all of the data generated by their users (Table 5).

Type of data exportation	Percentage of use
API without restrictions	5.94%
Free downloadable in whole	10.89%
API with some restrictions	1.98%
Free downloadable in part	1.98%
Not possible to export, copy or API access	53.47%
N/A	25.74%

**Table 5. Data export openness (n=100)**

An internal correlation analysis of knowledge policies (Table 6) highlights a relationship between user-generated content licenses and how the data is exported or how copying of the complete resource is technically facilitated.

Knowledge openness	Content license	Data export
Content license	1.00	
Data export	0.74**	1.00

**Table 6. Knowledge openness correlations (n=50)**

\*\* . Correlation is significant at the 0.01 level (2-tailed)

\* . Correlation is significant at the 0.05 level (2-tailed)

### Governance openness

Regarding the management of contributors (Table 7), there was almost a balance between platforms where users create new ways of adding or generating content with others (39.6%) and the ones which focused on offering, demanding, or rating products or services (42.6%). At the same time, the majority of collaborative platforms did not constrain user participation.

In 35.6%, members published without filters, and in only 25.7% was content moderated prior to publishing. 57.4% of platforms allowed participants to be part of groups or communicate among themselves. In spite of that, the

majority of projects analyzed (60%) had different types of user accounts, and the administrators were chosen by the founders or platform providers.

Management of contributors	Type of form	Percentage
G1. Openness to contribution on the digital platform (n=100)	Creating new ways of adding content	7.9%
	Creating contents with others	31.7%
	Offering, demanding, rating products or services	42.6%
	N/A	17.8%
G2. Policy of platform participation (n=100)	Publication without filters	35.6%
	Moderated previous publishing	25.7%
	Moderated after publishing	2.0%
	N/A	36.6%
G3. Users can be part of groups and/or communicate among them (n=100)	Yes	57.4%
	No	24.8%
	N/A	17.8%
G4. Different types of account with diverse levels of permission (n=50)	No	28%
	Yes	60%
	N/A	12%
G5. Administrators election (n=50)	Self-appointed	28%
	Privileges gained automatically by participation	2%
	Elections among general community	2%
	By other administrators	4%
	Selected by infrastructure provider with mechanisms of community representation	2%
	Selected by the infrastructure provider	30%
	Historical role (star)	2%
	Selected by founders/leaders/board	12%
	N/A	18%

**Table 7. Management of contributors' openness**

	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11
G1	1.00										
G2	-1.00	1.00									
G3	0.45*	0.39	1.00								
G4	-1.00	0.28	-0.11	1.00							
G5	1.00	-1.00	0.34	0.23	1.00						
G6	0.31	-1.00	0.53	-0.04	0.41	1.00					
G7	0.33	-1.00	-0.11	-0.04	0.76**	0.60*	1.00				
G8	0.74**	1.00	0.27	-0.03	0.70	0.58	0.55	1.00			
G9	0.16	-0.07	0.35	-0.18	0.63*	0.59*	0.66**	0.73**	1.00		
G10	0.27	-1.00	-1.00	0.11	1.00	0.46	0.71*	0.61*	0.61*	1.00	
G11	1.00	-0.02	0.11	-0.18	0.60*	0.29	0.55*	1.00**	0.56*	0.60*	1.00

**Table 10. Governance openness correlations (n=50)**

\*\* . Correlation is significant at the 0.01 level (2-tailed); \* . Correlation is significant at the 0.05 level (2-tailed)

Regarding the decision-making process for community interactions (Table 8), 56% of platforms have formally or informally defined systems to involve the community in the decision-making process. On 54% of the projects, users can participate in the definition of formal rules and policies.

<b>Decision-making with regard to community interactions</b>	Type of form	Percentage
G6. Decision-making systems in place for the community	Yes, formally defined	50.0%
	Yes, informally defined	6.0%
	No	40.0%
	N/A	4.0%
G7. Users can participate in the definition of formal rules and policies	Yes	54.0%
	No	34.0%
	N/A	12.0%

**Table 8. Decision-making with regard to community interactions (n=50)**

Regarding the legal entity (G8), 44.6% of the platforms

studied belonged legally to a business structure (I.e. SL, SA, SCP etc.), while 4% came from the Public Administration, 2% from the university, 17.8% from non-profit associations, 5% from foundations, and 12.9% from cooperatives, while 13.9% did not have a defined legal format.

<b>Governance linked to economic management</b>	Type of form	Percentage
G9. Decision of the platform's economic benefits	The whole members	40.0%
	Platform owners	50.0%
	N/A	10.0%
G10. Economic balance accessible to the members of the legal entity	Yes	76.0%
	No	16.0%
	N/A	8.0%
G11. Economic balance being provided publicly	Yes	38.0%
	No	46.0%
	N/A	16.08%

**Table 9. Governance linked to the economic management (n=50)**

Regarding the connection between platform governance and economic management (Table 9), in 76% of cases the economic balance was accessible by members of the project's legal entity and in 38% this information was publicly available. In half of the instances (50%), the owners of the platform decided the destination of the economic benefits.

Governance openness correlations (Table 10) highlight some strong connections between the variables studied. First, a connection appears between the openness to users contributing to the digital platform (G1) and the type of legal entity (G8). Second, a connection appears between the way a user can participate in the definition of the rules and policies (G7), how the platform administrators are chosen (G5), and who controls decision regarding economic benefits (G9). Finally, a connection appears between the type of the legal entity behind the platform and its economic management, in terms of who decides the destination of economic benefits (G9) and the transparency of economic balance (G11).

#### Relation between technological, knowledge, and governance openness

The analysis points to a correlation between the three dimensions considered in this investigation: technological, knowledge, and governance openness (Table 11).

Openness dimensions	Technological	Knowledge content & data export	Governance
Technological	1.00		
Knowledge content & data export	0.46**	1.00	
Governance	0.36**	0.38**	1.00

**Table 11. Technological, knowledge, and governance openness correlations (n=50)**

\*\* . Correlation is significant at the 0.01 level (2-tailed)

\* . Correlation is significant at the 0.05 level (2-tailed)

The results confirm our general hypothesis that openness principles are reinforced by the different dimensions in which it is applied. The results also confirm the three specific hypotheses.

The most relevant correlation from the analysis is that between the dimensions of knowledge and technological openness (0.46\*\*). This suggests that the adoption of open technology and open knowledge policies by a collaborative platform are related. The double correlation, with similar values, of technological openness with open governance (0.36\*\*) and knowledge openness with governance openness (0.38\*\*), suggest the importance of knowledge and technological policy openness in favoring open governance.

## DISCUSSION AND CONCLUSION

Based on our analysis of a sample of 100 cases of collaborative platforms in Barcelona, we could conclude that open modes of collaborative platforms are not prevalent. The diffusion of open practices varies depending on the area analyzed —technological, knowledge, or governance openness.

The area with the greatest presence of openness is that of knowledge practices in concrete user-generated content, as open practices are present in 35.64 % of the sample. In knowledge practices relating to data openness, however, it goes down to 20.79% of the sample.

Openness of technological practices in the three modalities investigated was not practiced by the majority, but open options constituted more than a third of the cases (39.6% of the projects are based on a free software license, 35.64% are based on open architecture, and 38% of the projects have interest in exploring other forms of decentralized technology).

Two factors may explain this result. The first of these is the desire to restrict use of the website's software to the platform owners. The second is the low level of attention to software, content license, and open data exportation in the growing platform cooperativism model.

Regarding governance, the most prevalent points of openness are seen in the policies of publication without filters or moderated only before publishing (61.3%), the ability to create groups or communicate with other users (57.4%), and internal transparency (76%). The least-used openness policies regard the administrators' election (only 38% of platforms had a democratic or meritocratic process to elect administrators) and who decides the destination of the economic platform's benefits (only 40% were decided by whole community). Therefore, when we look into the core of governance —platform or economic administration— the grade of openness is lower than when we study openness to the member participation. Still, overall open governance of the platforms was adopted by 38% to 61.3% (depending on the specific governance indicator), which constituted a higher diffusion of openness in terms of platform governance, than technological or knowledge practices.

We could conclude on the basis of the data that openness collaboration in platforms is not irrelevant, but it is not prevalent. It is seen in around one third of the sample. Furthermore, the cases which tended to be open in one dimension also tended to be open in the other dimensions. This suggest that a segment of the overall platform ecosystem could be characterized as more open, while a larger segment is not based on any of the methods of openness considered.

We have shown a connection between the indicators that define knowledge and technology policies, which, at the same time, are intertwined with governance. In that sense,

our investigation suggests that openness in technology and data areas tends to also be reflected in other areas like governance. In spite of the relevance of the sample, however, the limited number of cases requires caution in analyzing its results and conclusions.

In platform governance, we observe the active role of members in some key aspects of the democracy of the platform: defining the rules, involvement in the decision-making process, and internal transparency of the economic balance. We observed better open behavior in the realm of open governance than in the realms of technological, knowledge, and data openness. In spite of that, the correlation analysis shows that openness in participation, knowledge, and technology are also connected to the governance of the project. To sum up, the results of this investigation suggest a better proliferation of governance openness models than open technological, knowledge, and data ones. The results also suggest the interrelated strength of these three dimensions in the promotion of the open collaborative ecosystem.

Regarding the city of Barcelona, in the current context of the expansion of the social solidarity economy movement [7], and taking into account the social and economic sustainability qualities of Social and Solidarity Economic organizations, with open governance models based on a tradition of cooperativism [8,9], we can expect new strengths in the growth of cooperatives and more sustainable alternatives for expansion in collaborative platforms [10]. The digital domain opens up new possibilities for the cooperative tradition [11], adopting platform forms such as opencoops [12] or platform coops [13] based on technological, knowledge, and data openness [14]. This leads us to suggest that an expansion of the more open models of platforms maybe seen in coming years, connected to the growth of cooperativism in the digital sector. This is a question worthy of further investigation.

**Acknowledgments:** This research is part of the work carried out by the Dimmons research group in the framework of the DECODE project (funded by the European Union's Horizon 2020 Programme, under grant agreement number 732546). We would like to thank E. Senabre, E. Rosello, M. Rocas, G. Smorto, B. Carballa, P. Imperatore, M. Rebordosa, and N. Andrea for their contribution to the data collection, and Claudia Malpica for her help in data analysis.

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