Newspapers and alternative social networks in the Fediverse: a study of the presence of digital native and legacy media on Mastodon

Periódicos y redes sociales alternativas del Fediverso: estudio de la presencia de medios nativos digitales y matriciales en Mastodon

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ABSTRACT
Introduction: This study analyses the presence of newspapers on Mastodon, the most popular social platform in the Fediverse and an alternative to X (Twitter) in this ecosystem of decentralized and interoperable networks. **Methodology:** A subsample of newspapers (n=20) and accounts (n=28) on Mastodon was obtained from a sample (n=38) of digital native and legacy media in Spain. Official and

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unofficial, bots and non-automated, active and inactive accounts, instances where they are hosted, and links to Mastodon on media websites were identified. The date the accounts were created were also identified to check if they appeared before or after Elon Musk's purchase of Twitter, which boosted Mastodon's popularity. **Results:** A total of 13 official accounts (10 native and 3 legacy) were spotted. None of them worked on owned instances. Also, a total of 15 unofficial accounts (9 legacy and 6 native) were identified and they connected via RSS by Mastodon instances administrators. Legacy media show a higher proportion of active accounts than digital natives. The proportion of automated accounts is high for both categories. A 'Musk effect' is observed in the account's creation. Only *elDiario.es* and *El Salto* (digital natives) offer links on their websites. *El País* (legacy) has the oldest account, and *El Salto* is the one that shows the greatest commitment to Mastodon. **Discussion:** The analyzed media do not take advantage of the full potential of the technological sovereignty provided by Mastodon. **Conclusions:** The template used, and the results open up new lines for academic research on a social platform (Mastodon) and an ecosystem (Fediverse) barely explored in the journalistic field.

Keywords: Mastodon; Fediverse; alternative social networks; decentralization; Twitter; Elon Musk; news media.

RESUMEN
Introducción: Esta investigación analiza la presencia de periódicos en Mastodon, la plataforma social más popular del Fediverso y alternativa a X (Twitter) en este ecosistema de redes descentralizadas e interoperables. **Metodología:** De una muestra (n=38) de nativos digitales y matriciales de España se obtuvo una submuestra de periódicos (n=20) y cuentas (n=28) en Mastodon. Identificamos cuentas oficiales y no oficiales, *bots* y no automatizadas, activas e inactivas, instancias en las que se alojan y accesos directos en los sitios web de los medios. También se identificó la fecha de creación de las cuentas para comprobar si aparecieron antes o después de la compra de Twitter por parte de Elon Musk, operación que disparó la popularidad de Mastodon. **Resultados:** Localizamos 13 cuentas oficiales (10 nativos y 3 matriciales), ninguna en instancias propias, y 15 cuentas no oficiales (9 matriciales y 6 nativos) conectadas por RSS por administradores de instancias de Mastodon. Los matriciales muestran mayor proporción de cuentas activas que los nativos digitales. La proporción de cuentas automatizadas es alta para ambas categorías. Se observa un "efecto Musk" en la creación de cuentas. Solo *elDiario.es* y *El Salto* (nativos digitales) ofrecen accesos en sus sitios web. *El País* (matricial) tiene la cuenta más antigua y *El Salto* es el que mayor compromiso muestra con esta red. **Discusión:** Los medios analizados no aprovechan todo el potencial de la soberanía tecnológica que proporciona Mastodon. **Conclusiones:** La plantilla usada y los resultados abren vías de investigación sobre una plataforma social (Mastodon) y un ecosistema (Fediverso) poco explorados en el campo periodístico.

Palabras clave: Mastodon; Fediverso; redes sociales alternativas; descentralización; Twitter; Elon Musk; medios periodísticos.

1. INTRODUCTION

The progressive increase of digital native media, which is becoming more and more widespread in today's communication ecosystem (Salaverría, 2023), has contributed to the increase in the supply of information in a scenario marked by platformization and the role of social networks in the communicative processes of the network society. This rise of digital native journalistic media, in need of an identity that clearly differentiates their offer and allows them to gain the trust of users, is taking place at a time when a "plethora of experiments with decentralized social technologies" (Allen et al., 2023, p. 4) is emerging, forming the so-called Fediverse (an acronym for "federation" and "universe"). This new map of decentralized networks, which poses

alternatives to the current dominant model, appears as an interesting option for the latest generation of digital native media.

Bets on the decentralization of social networks and the Internet have made little progress in recent years due to the dissatisfaction of some users with the practices of the dominant platforms and their search for alternative models that escape the control of large technology companies. Federated, interoperable decentralized, free software and open source platforms - the main (n)ethical pillars of the Fediverse (Cabello et al., 2012; Gehl & Zulli, 2022; Mansoux & Roscam-Abbing, 2020) - emerge as an alternative in what appears to be an evolution or trend of the network society model built in the past years of the current millennium.

These networks guarantee their users that only they have control (and the possibility of monetization) over their content and data, which is also an incentive for digital native journalistic media with alternative approaches. These are decentralized online social networks (DOSN), whose most relevant platform is Mastodon (La Cava et al., 2021; 2023), and which are emerging as an alternative to centralized and commercial big tech networks (Sabo et al., 2024). Since the emergence of the so-called Web 3, through the decentralization capabilities of blockchain technology (De Filippi and Lavayssière, 2020; Kadena & Qose, 2022), or from open and decentralized network protocols for the interoperability of Fediverse platforms, mainly ActivityPub - a standard being recommended by the World Wide Web Consortium (Lemmer-Webber et al., 2018) -, there is an opportunity to explore with some success these alternative channels.

Although at the moment most interactions in social networks are done through centralized models, with users having a residual or no role in decision making, DOSNs offer a different kind of sociability and help to think "social" in networks in terms of topology, abstraction and scale (Zulli et al., 2020). While this new option gains strength and adds followers, in the current scenario marked by automation and artificial intelligence, in order to recover trust between users and centralized platforms, there is an emergence of the idea of the search for an effective algorithmic sovereignty, data sovereignty, technological sovereignty, or (self-)sovereign digital identity that mitigates some of the negative effects of the dominant model in social networks (Couture & Toupin, 2019; Giannopoulou & Wang, 2021; Hummel et al., 2021; Reviglio & Agosti, 2020). Such effective algorithmic sovereignty is, at least for the moment, a desideratum in corporate networks, but it does seem to materialize in the Fediverse:

Autonomous networks, unlike centralized social networking systems, promote independence without the need for centralized authority. Opposition to censorship, ownership of personal data, and greater control over user-generated material are all advantages (Kadena & Qose, 2022, p. 000112).

As opposed to the centralized model of corporate social networks, Mastodon and the Fediverse, as a whole, are characterized by reinforcing the rhizomatic structure of the Network and fostering a "form of spontaneous connectivity among users" and "the existence of densely connected small groups tailored to specific shared interests" (La Cava et al., 2022, p. 11).

The Fediverse is built through a set of open technologies and protocols that allow interconnecting a cluster of decentralized, free, autonomous and federated social networks and platforms, without a central authority dictating rules, without algorithms that condition or favor some users or publications over others, without integrated advertising and without a company that collects personal data and traffics with them. Moreover, the entire Fediverse runs on free and open source software (Quian, 2023). Thus, the Fediverse is placed under the umbrella of hacker ethics and culture in its original sense (Quian, 2022) and in opposition to the surveillance economy (Snowden, 2019; Véliz, 2021; Zuboff, 2020).

In short, the Fediverse is a set of interconnected projects (free and open source software on which the platforms are built) and instances (project servers that host communities). Although the servers are independent, they communicate with each other using open and decentralized protocols such as ActivityPub, which enable interoperability, and users of one instance can interact with those of another, but also with different platforms (a user of a Mastodon instance can interact with those of other instances of this project, but can also interact with other platforms with the same network protocol). This is not the case in corporate networks, where it is not possible to interact, for example, between users of Twitter, Instagram, YouTube and TikTok (Quian, 2023). In the Fediverse, Mastodon was created in 2016 and is the best known and most popular project, the federated alternative to Twitter (Abbing & Gehl, 2024; La Cava et al., 2023; Orihuela, 2023). However, there are many other platforms (Pleroma, PeerTube, Pixelfeld, Friendica, GNU Social, Lemmy, Funkwhale, Mobilizon, Diaspora, Misskey, Hubzilla, Matrix, etc.), each one designed for a purpose (photos, videos or audio, blogs or microblogs, discussion forums, event organization, instant messaging...), but all interconnected. On October 18, 2023, The Federation (https://the-federation.info/) - the reference site for Fediverse statistics - registered 150 projects on 17 protocols, 26,325 nodes (instances) and 13,411,721 users. Mastodon, with 12,073 instances and 9,698,494 users, was the most popular project.

The debates and trends on the present and future of social platforms are gaining momentum at a time when current digital communication technologies facilitate the collection, storage and rapid processing of data, with the corresponding consequences for subsequent interactions, which, for some experts, has generated a "dark turn" in communicative practices at the hand of state-of-the-art, high-tech machines (Cinque, 2021). Hence the interest aroused in certain sectors by the possibilities of alternative social networks as an option to the dominant model of corporate social networks (Gow, 2022a) and the expectations generated by the governance model of agreed federalism applied by these non-centralized platforms.

While these alternatives to the dominant model of networks emerge, the field of digital journalism is seeking ways to improve user confidence in their products, especially through transparency strategies, and to find alternative spaces to the corporate and centralized network model that, directly or indirectly, impose conditions that are unfavorable to the interests of small and medium-sized digital native journalism initiatives. Social networks have become in the last decade the main information gateway for young people, contributing to determine and shape their vision of the present, which is also conditioned by the exchange of news among users (Vázquez-Herrero et al., 2022). This explains the importance that decentralized networks can have for digital native media if they want to make an informative offer that is interesting for audiences that move in alternative virtual environments.

1.1. News media facing renewed challenges

Research on innovation in journalism has experienced a remarkable increase in recent years and has paid special attention to dissemination, management, organizational culture, professional profiles, business models, genres and content, tools and technology (García-Avilés, 2021), as evidenced by some of the key drivers of the change that is underway in journalistic environments. Innovation in journalism is an important determinant of the current and future course of the profession (de-Lima-Santos & Mesquita, 2021) in a context in which technological disruption and competition among media is increasing debates about the future of journalism and the media themselves (Westlund et al., 2021). Several researches highlight the potential benefits that can be generated by the link between technology and the media industry, as technology plays a traversal role for the industry (García-Avilés et al., 2019). Although the digitalization of the media has enabled changes, both in the production and consumption of news (Kramp & Loosen, 2018), it has been the social networks, which have expanded and multiplied the possibilities of participation of active audiences in journalism, that have led to the emergence of terms such as participatory journalism (Singer et al., 2011) or network journalism (Heinrich, 2011). These factors have generated a changing communicative relationship between journalists and

audiences in the digital environment, and a leading role for social platforms in the evolution of digital journalism (Nielsen & Ganter, 2022).

While social networks, which have changed people's lives (Graham & Dutton, 2014) and the way in which citizens consume information and build opinions (Smitch et al., 2017), take up central spaces in communication and business, legacy (matrix) digital media face important challenges to secure their future, in search of business models for the new digital scenario and strategies to ensure the loyalty of their audiences. In addition, digital natives seek their space and take advantage of the opportunities they have to confirm that they are part of a flourishing phenomenon that is expanding worldwide (Salaverría, 2020). Since the transition to digitalization, media business models have multiplied their problems, which threatened their economic feasibility. In the last decade, both old and new media face important challenges for journalism to remain relevant in society and to give continuity to their industries (Picard, 2014). The elements that make up media management in the digital era feature singularities due to their distinctiveness (von Rimscha, 2016) and pose important challenges in all players to ensure sustainable models (Ferrucci, 2017), while results of experiments are available showing proposals for redesigning the renaissance of digital journalistic media (Novak, 2018) in a context in which new horizons are announced for the virtual scenario, mainly due to the massive inclusion of artificial intelligence (AI) in the communicative processes as a disruptive and wide-ranging technology (Girasa, 2020).

The dramatic shifts taking place in the communication ecosystem, in a context referred to by some people as the fourth industrial revolution (Schwab, 2016), are having a major impact on the journalism sector. For years now, it has been known that disruptions (economic and technological) feed a favorable climate for reflection on the limits of journalism (Carlson & Lewis, 2015), with the participation of peripheral stakeholders who build products and position themselves with the profession (Holton & Belair-Gagnon, 2018) and with new media, understood as alternative media ecosystems to the traditional ones (Cabrera-Méndez et al., 2019). Also significant are the changes introduced in journalism by the emergence and massive popularization of social networks (Larsson, 2017), which are increasingly integrated into the journalistic workflows of the media (Vázquez-Herrero et al., 2019) and shape a new power (Hanna et al., 2011), changing the way in which people receive and experience news (Bergströ & Belfrage, 2018).

The new virtual social spaces have even led to the evolution of roles for the construction of new relationships between journalists and citizens (Xia et al., 2020), especially in alternative media seeking another kind of journalism.

In this context of change and transformation, in the shadow of the many debates triggered by the effects of this metamorphosis in journalism, the steps forward of decentralized networks open new horizons for the media, especially for digital natives who nurture the practice of other possible journalisms. Digital native media are transforming journalism (Salaverría & Martínez-Costa, 2021), but they need to explore all the territories that are opening up in the digital communication scenario. These native media, young, dynamic and diverse (Rey, 2022), seek an active participation in the innovation processes in the field of digital communication to find sustainable models that are specific to cyberspace. In this search the possibilities offered by decentralized networks appear for the viability of their projects and for creating their own communities of users.

Beyond technological determinism (García-Orosa et al., 2022), digital native media explore renewed fields for journalism and one of these fields can be found in the scenario created during the reinvention of social networks with healthy models (Dhawan et al., 2022), outside the platforms that currently monopolize the dominant, centralized and commercial model. It is in this context that the current initiatives that seek to regulate and combat the immense power of the major social networks must be placed, in addition to ensuring democratic oversight, to which there is a contribution to be made by the formula proposed and desired by

many, which is called algorithmic sovereignty. Digital native journalism is expanding and, finding itself in its territory (everything that characterizes the digital communicative ecosystem). It wants to make the most of it, despite the limited initiatives it has managed to implement in the alternative channels that have emerged in the face of the dominant model. Now, thanks to artificial intelligence and the progress of decentralized networks, it may have new opportunities.

1.2. Rise of studies on migrations from Twitter to Mastodon

The literature review shows that Fediverse platforms are understudied and require more scientific attention (Al-khateeb, 2022). Specifically, research on journalistic media in Mastodon and the Fediverse is lacking in empirical work.

Lázaro-Rodríguez (2024) finds that scientific publications on the Fediverse increased since 2022, concurrently with the arrival of Elon Musk on Twitter and the so-called migration waves from that social network to Mastodon, the platform that gathers the most academic attention, mostly conference papers and preprints. The focus of the papers is mainly on the nature of the Fediverse and on topics such as consumption, content and activism.

Sabo and Gesthuizen (2024) also note that, although practical research on Mastodon is scarce, there is greater academic interest in this social platform after the acquisition of Twitter by Musk and the migrations of users from the centralized to the decentralized network.

One of the most substantial contributions is that of La Cava et al. (2023), who consider that the mass exodus of Twitter users to Mastodon, following the purchase of the former platform by the tycoon, represents one of the largest digital migrations in the history of the social web and opens new possibilities for the study of collective behavior in social media. In their study, La Cava et al. (2023) describe the dynamics of migration, compatible with a phenomenon of social influence.

Jeong et al. (2023) explore migration patterns from Twitter to Mastodon and claim that dissatisfaction with Twitter's change in ownership and Musk's management is a major motivation for users to migrate to Mastodon, although migrants often use both platforms. He et al. (2023) analyze the migration of thousands of Twitter users to Mastodon after Musk's deal. Their results confirm that most migrants kept their accounts on the platform controlled by the tycoon. And Sabo et al. (2024) confirm a sustained growth of users on Mastodon, which was favored by Musk's acquisition of Twitter and his controversial decisions about this social network.

These migrations from Twitter to Mastodon are part of a set of multiple consequences of what some scholars and analysts call the "Musk effect" in the social media ecosystem (Beirne, 2022; 42matters, 2022; Hawkins & Pierce, 2022; Majid, 2023; Miller et al. 2023; Mo & Olivo, 2023; Sanderson & Tucker, 2022). The effect began in the spring of 2022, with the tycoon's stated intention to take control of Twitter, the purchase of which he materialized on October 27 of that year.

1.3. OBJECTIVES AND RESEARCH QUESTIONS

The review of the scientific literature shows that Fediverse platforms are little studied and require more attention from the scientific community (Al-khateeb, 2022). This research aims to provide, from the positivist and analytical empirical paradigm, a deeper knowledge about federated, open and free networks, especially about Mastodon and its potential for journalism.

The general objective ("GO") is to explore and describe for the first time the presence of digital native and legacy journalistic media in Mastodon in the Spanish press. The following specific objectives (SO) derive from the OG:

- SO1: To design and test a template that allows to accurately analyze the presence of journalistic media in Mastodon.
- SO2: To analyze the presence in Mastodon of digital native and legacy media through a comparative classification and description.
- SO3: To clarify how these media are present in Mastodon and what is their use.
- SO4: To develop a timeline of the appearance in Mastodon of accounts of the media under study and to analyze their evolution before and after the purchase of Twitter (now called X) by Elon Musk.

There is a general question (GQ) related to the GO and then there are specific questions (SQ) related to each of the SOs:

- GQ (OG): Are Spanish newspapers present in the information flows of the Mastodon network?
- Q1 (SO1): What are the basic parameters to characterize the journalistic media in Mastodon?
- Q2 (SO2): Do the analyzed parameters show differences between digital native and legacy media?
- Q3 (SO3): Are the media with a presence on Mastodon official accounts? Are they active accounts? Are they bots? On which servers are they hosted? Are there shortcuts on the websites of media with official accounts on Mastodon?
- Q4 (SO4): Were the accounts created before or during the "Musk effect"?

2. METHODOLOGY

The methodology used in this paper combines exploratory, descriptive and comparative approaches to analyze from a broad perspective the presence of digital native and legacy media in Mastodon. Digital native media or native cybermedia are "those designed and born for the Internet", while legacy, traditional or digital migrants "derive from pre-internet brands that migrated to that space" (Vázquez-Herrero et al., 2023, p. 3).

The sample is purposive, convenient and homogeneous, and the selected media (Table 1) share some similar traits or specific characteristics (Andrade, 2021; Battaglia, 2008; Etikan et al., 2016). This selection also corresponds to the singularities of the R&D&I project Digital native media in Spain: strategies, competences, social involvement and (re)definition of journalistic production and dissemination practices (PID2021-122534OB-C21), funded by the Ministry of Science and Innovation of the Government of Spain and the European Regional Development Fund (ERDF) "A way of building Europe".

The homogeneity criteria are as follows:

- The selected media had to be press.
- The selected media had to be generalist.
- The selected media had to be regional or state media.
- The sample had to include digital native and legacy media with online editions, in order to establish comparisons.

Table 1. *Sample of the study (n=38).*

Category	Media
Legacy	*20Minutos* *ABC* *El Correo* *El Mundo* *El País* *El Periódico* from Catalonia *La Razón* *La Vanguardia* *La Voz de Galicia* *Público*
Digital Native	*Andalucía Información* *Civio* *CTXT* *Diariocrítico* *Economía Digital* *El Confidencial* *El Español* *El Independiente* *El Orden Mundial* *El Plural* *El Salto* *elDiario.es* *ElNacional.cat* *Esdiario* *Estrella Digital* *Galicia Confidencial* *Hispanidad* *InfoLibre* *La Información* *Libertad Digital* *Nació Digital* *Naiz* *OkDiario* *Periodista Digital* *Praza Pública* *Valencia Plaza* *Vilaweb* *VozPópuli*

Source: Elaborated by the authors.

The sample (n=38) is composed of 28 digital native media and 10 legacy media (Figure 1).

Figure 1. *Sample of study.*
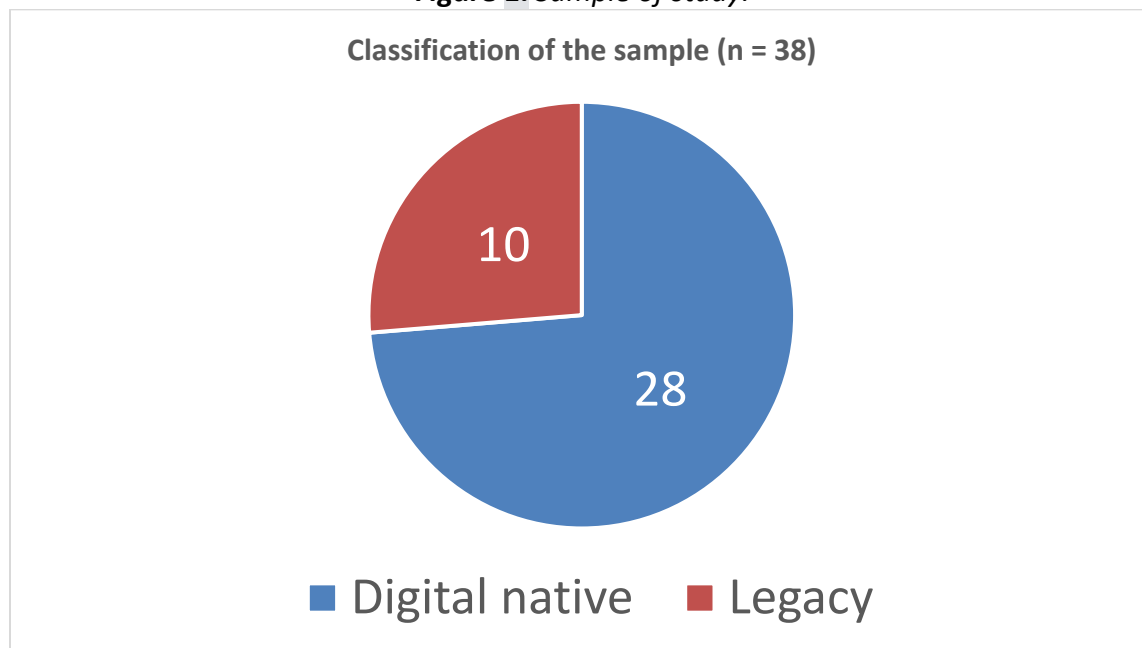
Source: Elaborated by the authors.

Once the sample was selected, a search for Mastodon accounts with the names of the media under study was carried out during the month of May 2023. Two ways were used to locate the selected media: 1) the search box of the most popular servers of the Mastodon network (in this federated network there is no centralized search, but searches against the database of each instance), where the literal names of the media and the user names they use on Twitter were entered (it was assumed that they could use the same identifiers) and 2) searches in Google using Boolean operators to perform combined searches of several terms ("mastodon" AND "name of the media").

Then, an Excel table was designed consisting of nine evaluation items answering the objectives and research questions. The different implementation variables were assigned to each item.

Table 2. *Items and variables of the study.*

	ITEMS	VARIABLES
V1	Media Category	Legacy / Digital native
V2	Mastodon Account	Yes/No
V3	Official account	Yes/No
V4	Bot	Yes/No
V5	Instances	Server on which it is hosted
V6	Proprietary Instance	Yes/No
V7	Active account	Yes/No
V8	Access from the website	Yes/No
V9	Account creation date	Did it happen before or after Elon Musk bought Twitter?

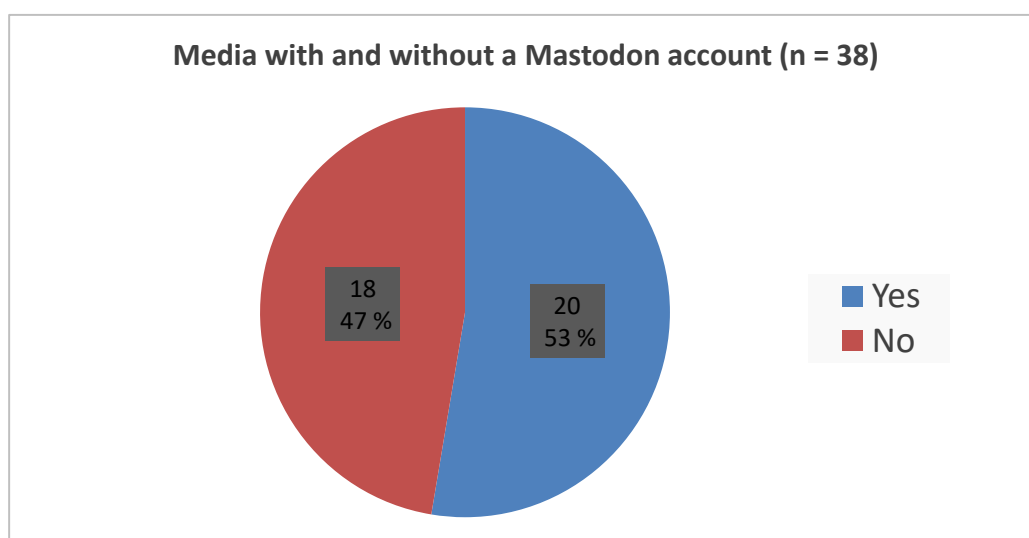**Source:** Elaborated by the authors.

- V1: The media categorization into legacy and digital natives is fundamental to establish comparisons with the other variables.
- V2: A screening was done to identify the media with and without accounts in Mastodon. Relationships with V1 were sought and a subsample was composed with the media with a presence in this federated network, which is used in the following phases of the research.
- V3: Official and unofficial accounts were identified and disaggregated and relationships with V1 were identified.
- V4: Automated accounts whose contents are published by bots and accounts where there is human publishing work were identified and disaggregated, and relationships with V1 and V3 were targeted.
- V5: The instances (servers) where all accounts (official and unofficial) are hosted were identified and described and relationships with V1, V3 and V4 were targeted.
- V6: The ownership of the instances where the accounts are hosted was specified (whether they are owned by the media or third party servers) and relationships with V1, V3 and V4 were identified.
- V7: Active and inactive accounts were identified. Given the nature of the sample (daily press), an account was considered inactive not only if no 'toot' (the name given to posts on Mastodon) had ever been published, but also if 'toots' had been published in the last month, at the time of the study. Here relationships were found with V1, V3, V4 and V5.
- V8: Among the media with official Mastodon accounts, the authors checked whether they had shortcuts to these on their websites and searched for relationships with V1, V4 and V7.
- V9: The creation date of all accounts (official and unofficial) was identified to check if they were created before or after the purchase of Twitter by Elon Musk and relationships with V1, V3 and V4 were identified.

3. RESULTS

3.1. Media in Mastodon

In the period under study, the Mastodon federated network included accounts from 20 of the 38 media that make up the sample (53%) (Figure 2).
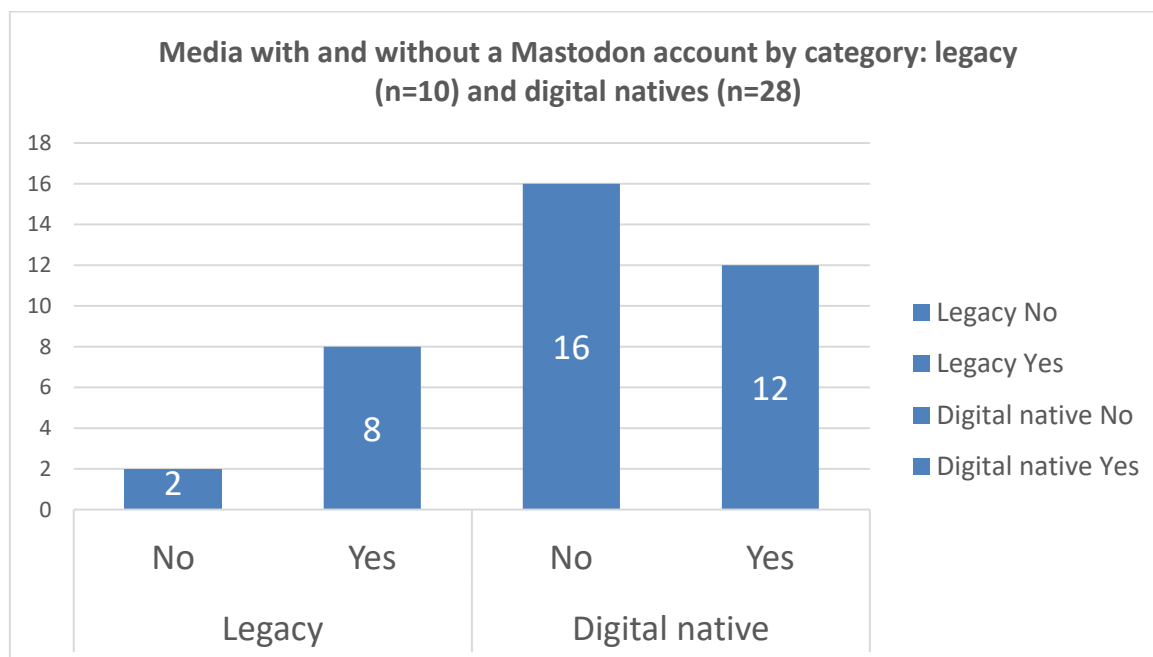
Figure 2. *How many of the media in the sample can be found in Mastodon?*

Source: Elaborated by the authors.

Out of the 10 legacy media, 8 (80%) have an account in Mastodon and out of the 28 digital natives, 12 (42.85%) have a presence in this federated network (Figure 3).

Figure 3. *Legacy media vs. digital natives.*
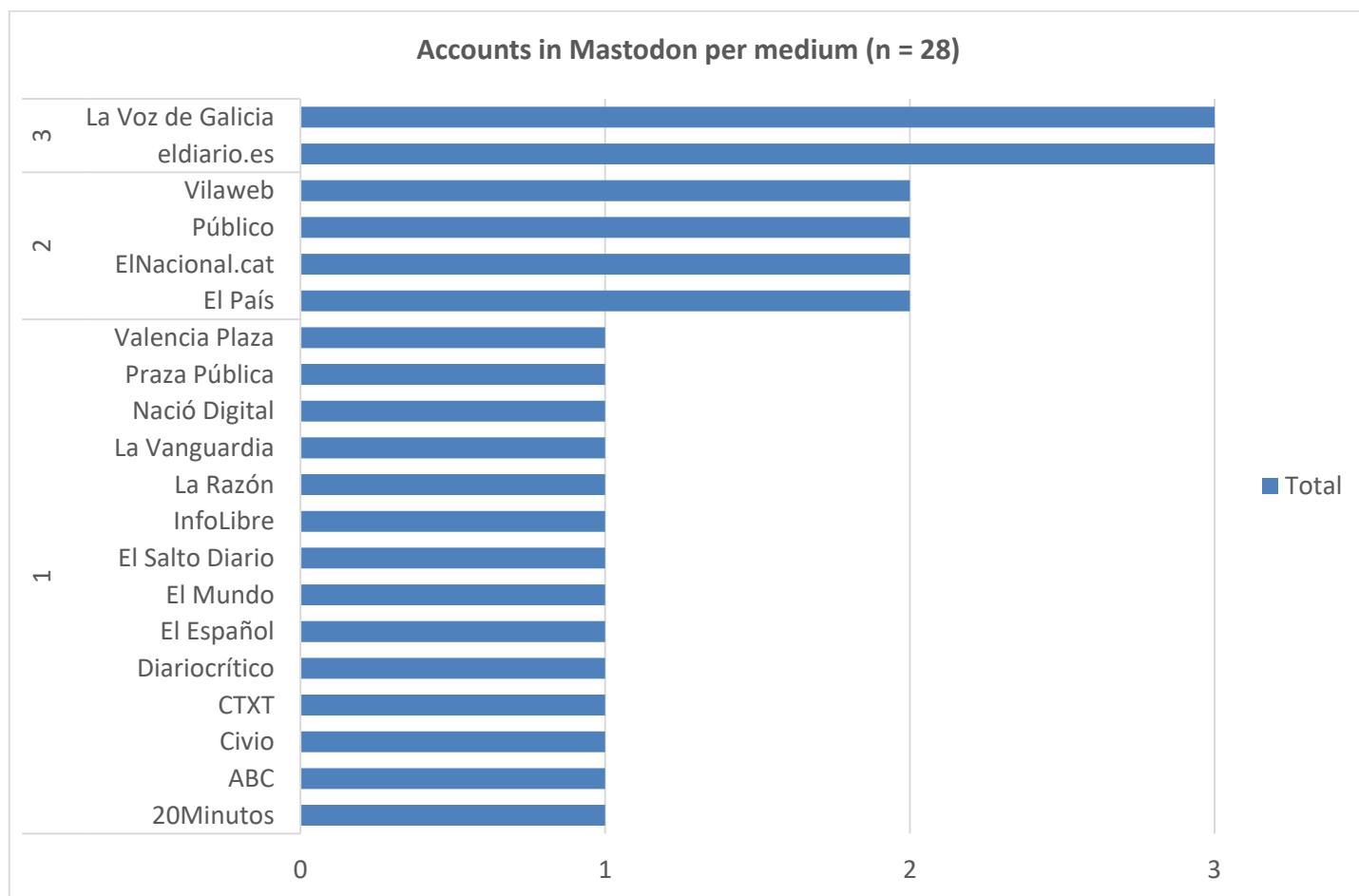

Source: Elaborated by the authors.

The total number of accounts identified in Mastodon is 28, i.e., 8 more than the subsample of media with a presence in this network. This is due to the fact that several media are overrepresented with more than one user account (Table 3). *ElDiario.es* (digital native) and *La Voz de Galicia* (legacy) have three accounts each. *El País* and *Público* (legacy) and *Vilaweb* and *ElNacional.cat* (digital natives) have two accounts each. For the rest there is only one account (Figure 4).

Table 3. *Media with more than one Mastodon account.*

Accounts	Overrepresented media	Nature	Level
3	elDiario.es	Nativo	State
	La Voz de Galicia	Matricial	Autonomous
2	El País	Matricial	State
	Público	Matricial	State
	Vilaweb	Nativo	Autonomous
	ElNacional.cat	Nativo	Autonomous

Source: Elaborated by the authors.

Figure 4. *Number of accounts per medium.*

Source: Elaborated by the authors.
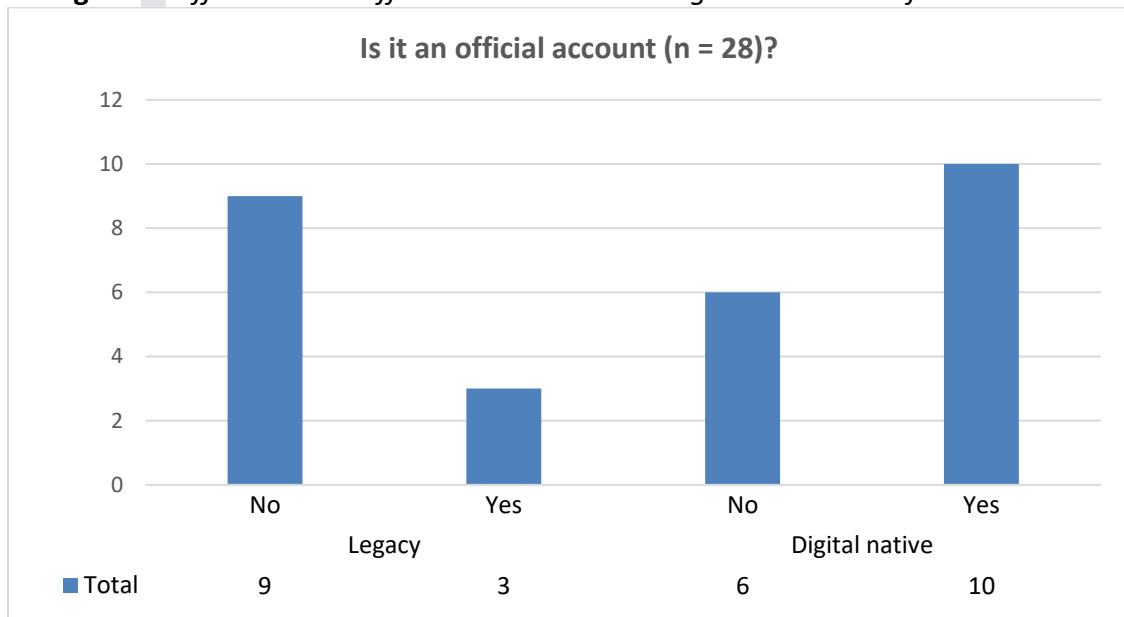
3.2. Official and unofficial accounts

Out of the 28 registrations, 13 were official accounts (46.4%) (Table 4), 10 were digital native media (76.9% of the official accounts) and 3 were legacy accounts. Disaggregated by category, unofficial accounts are the most common in legacy media (9 out of 12, 75%) and have a lower weight in native media (6 out of 10, 37.5%) (Figure 5).

Table 4. *Self-managed accounts.*

Media sample with official Mastodon accounts
Civio
CTXT
Diariocrítico
elDiario.es
El Español
El País
El Salto
ElNacional.cat
InfoLibre
Público
La Voz de Galicia
Praza Pública
Valencia Plaza

Source: Elaborated by the authors.

Figure 5. *Official and unofficial accounts according to the nature of the medium.*
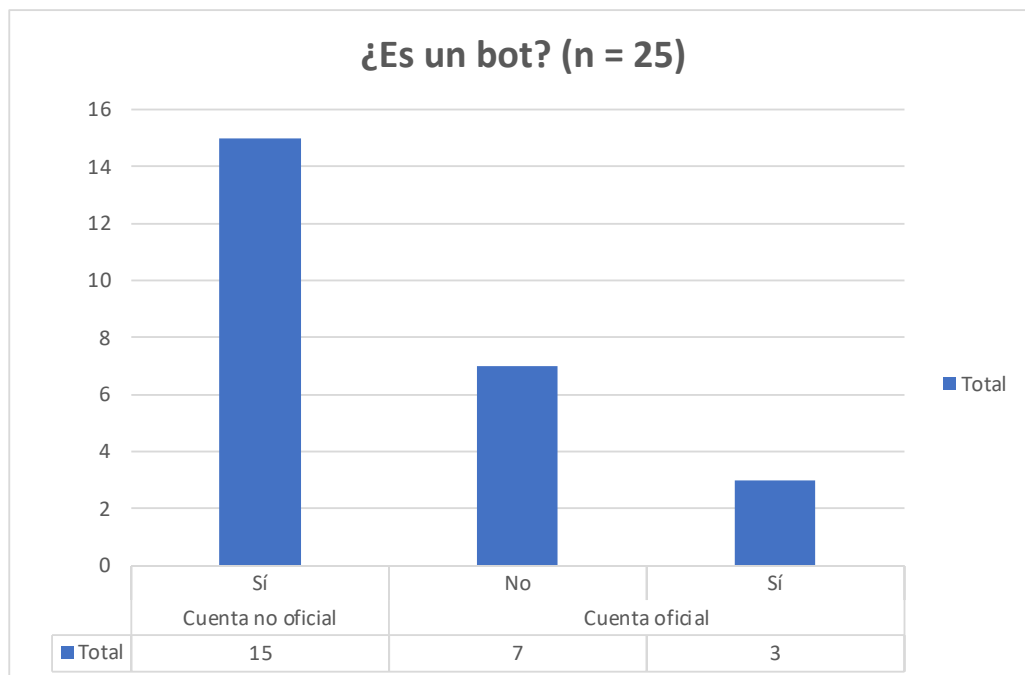

Source: Elaborated by the authors.

3.3. Bots and non-bots accounts

In order to count and distribute the bots into categories among the 28 accounts identified in Mastodon, the official accounts of *Público, La Voz de Galicia* and *Praza Pública* were excluded, since they had no publications at the time of the study (accounts that were never active). Thus, 25 accounts were analyzed (10 official and 15 unofficial). Most of them are bots (18 accounts 72%), of which 15 are unofficial accounts (60% of the total subsample, 83% of the automated accounts) and 3 are official accounts. Therefore, 70% of the official accounts are not bots, while 100% of the unofficial accounts are bots (Figure 6).

Figure 6. *Bots and non-bots between official and unofficial accounts.*

Source: Elaborated by the authors.

There is also a quantitative balance of bots in legacy and digital native media accounts (9 in each category), while the cases of accounts in which human intervention is observed are greater among digital natives (6) than among legacy (1). However, in percentage terms, bots represent 60% of the 15 digital native media in this subsample, while in the legacy media they act in 90% of the 10 cases identified (Figure 7).

Figure 7. *Bots and non-bots based on the nature of the medium.*
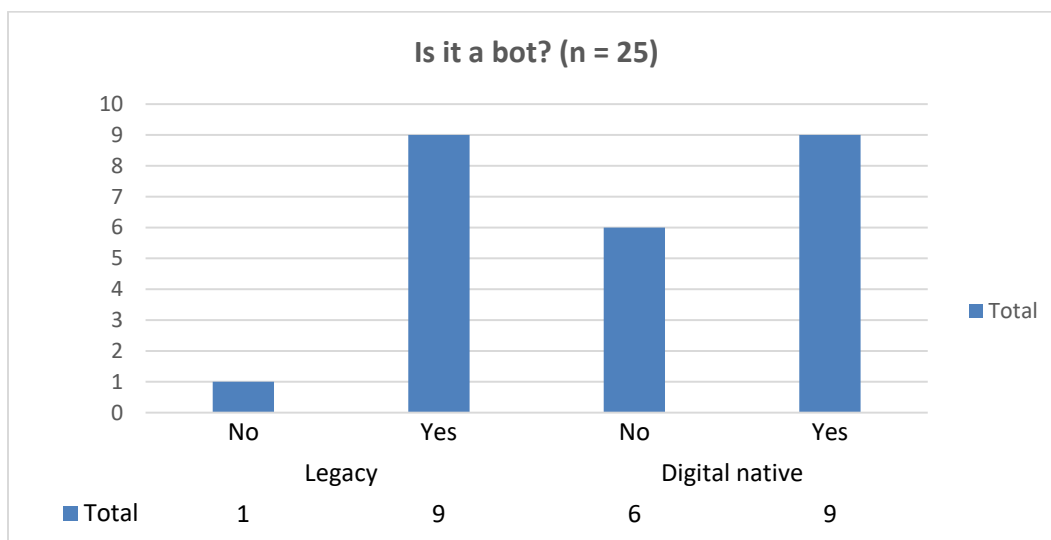
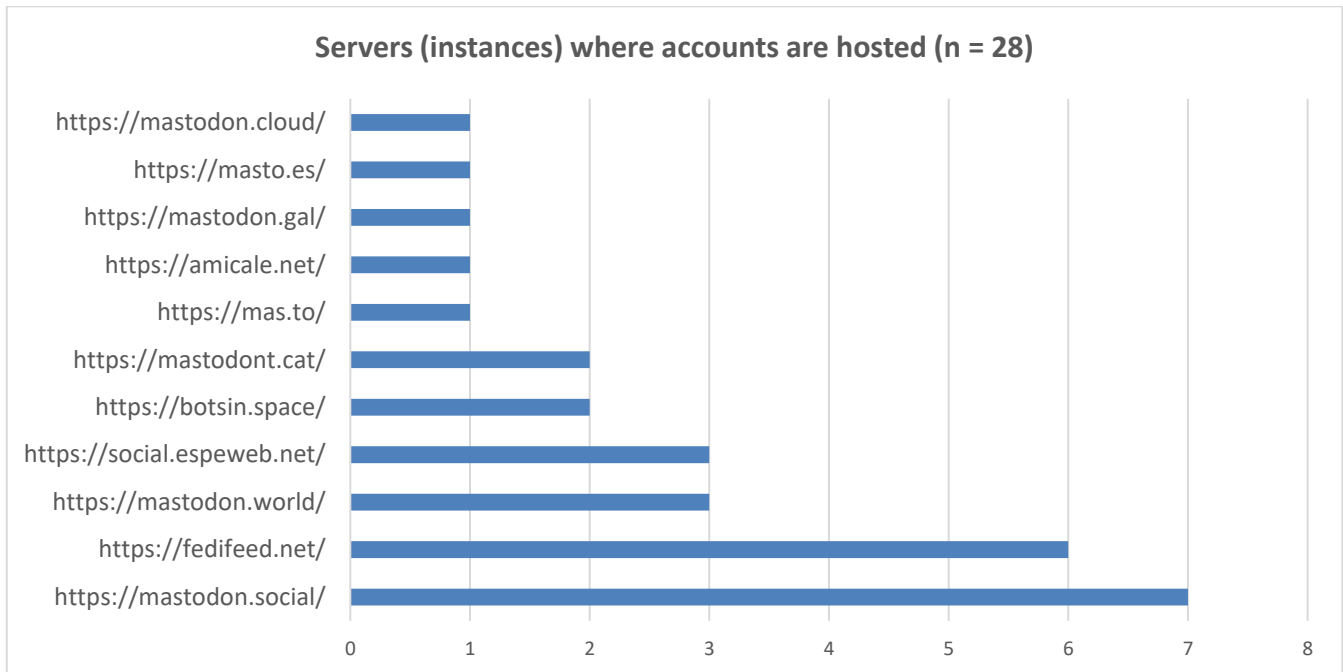**Source:** Elaborated by the authors.

3.4. Instances (servers)

In the instances, none of the 13 official accounts identified are hosted on an in-house server, they all use third-party servers.

Mastodon.social is the instance that hosts the most accounts, 7 of the 28 identified. It is the original and most popular server of the Mastodon network. It is followed by Fedifeet.net, with 6 identified accounts. In this case, it is an instance that "associates its own accounts with media RSS feeds that are not part of the Fediverse", as described on its website. Mastodon.world and social.espeweb.net each have three media accounts identified in this study. The first is defined by its administrators as a "generic Mastodon server for anyone to use"; the second is an instance of Pleroma, a microblogging network compatible with other Fediverse projects such as Mastodon thanks to the ActivityPub protocol. Botsin.space and mastodont.cat host two accounts each. The first is described by its administrator as "an instance of Mastodon for bots and bot allies," evidencing its nature as an instance of automated content. And the second is described as the "Catalan social server for the Catalan language and culture community across the Internet". Finally, with one account there are the servers mastodon.cloud (generalist instance), masto.es (server for general Spanish speakers), mastodon.gal (instance in Galician language for the Galician community), amicale.net (particular instance in French, whose administrator only admits the entry of friends) and mas.to (its administrator describes it as "a fast, friendly and well-federated server") (Figures 8 and 9).

Figure 8. *Distribution of accounts per server.*

Servers (instances) where accounts are hosted (n = 28)

Source: Elaborated by the authors.

Figure 9. *Media presence per server.*

Distribution per server

|	20Minutos	ABC	Civio	CTXT	Diariocrítico	El Español	El Mundo	El País	El Salto Diario	eldiario.es	ElNacional.cat	InfoLibre	La Razón	La Vanguardia	La Voz de Galicia	Nació Digital	Praza Pública	Público	Valencia Plaza	Vilaweb
https://amicale.net/	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
https://botsin.space/	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
https://fedifeed.net/	1	1	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0
https://mas.to/	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
https://masto.es/	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
https://mastodon.cloud/	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
https://mastodon.gal/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
https://mastodon.social/	0	0	0	0	0	0	0	1	1	2	0	0	0	1	0	0	0	1	1	0
https://mastodon.world/	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
https://mastodon.cat/	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
https://social.espeweb.net/	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0

Source: Elaborated by the authors.

Out of the 13 official accounts identified, mastodon.social (the original and most popular instance of Mastodon) hosts 5 and mastodon.world, 3. There is also an official account in each of these instances: mastodont.cat, mastodon.gal, masto.es, mas.to and mastodon.cloud.

The largest number of unofficial accounts are hosted at fedifeed.net, where there are 6 accounts. They are followed by social.espeweb.net, with 3 accounts, mastodon.social and botsin.space, with 2 accounts, and mastodont.cat and amicale.net, with one account each server (Figure 10).

Figure 10. *Official and non-official accounts per server.*
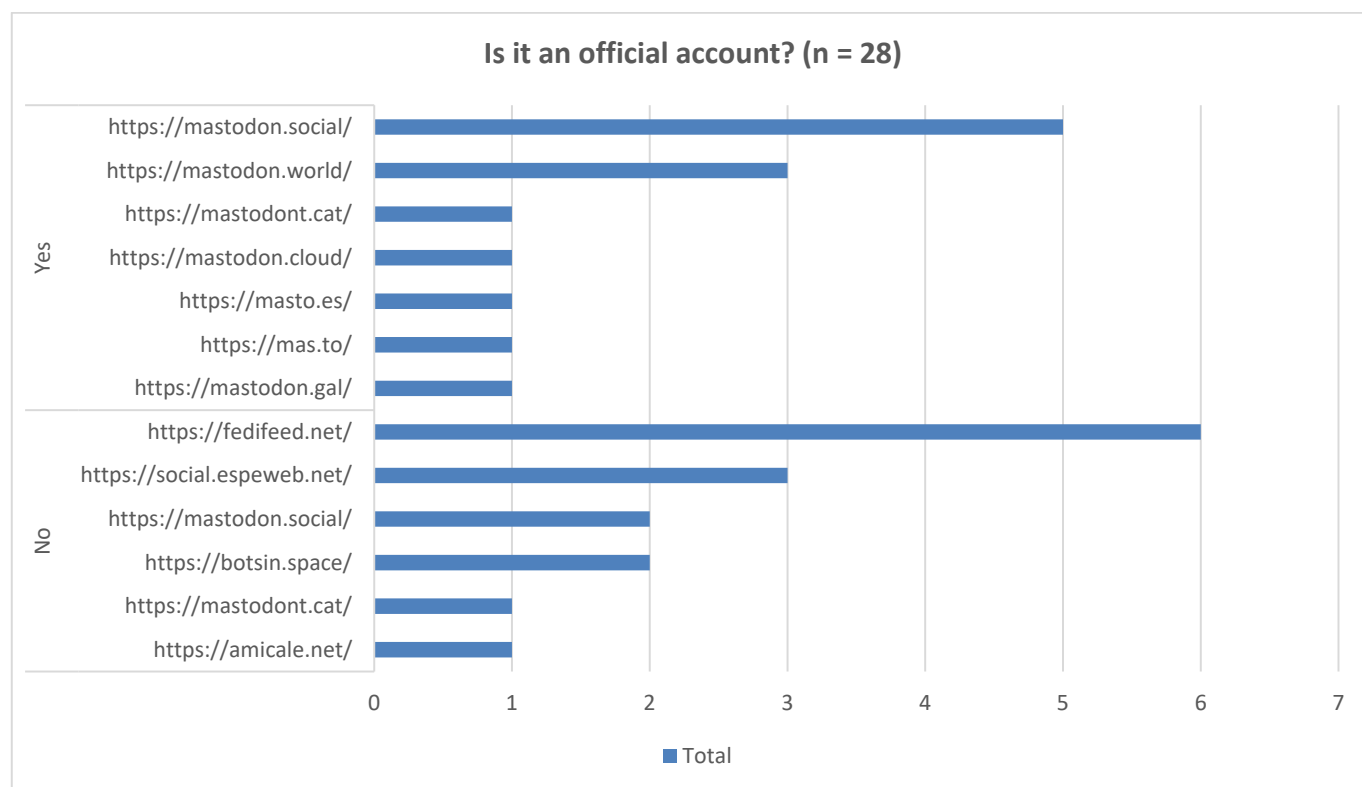
Source: Elaborated by the authors.

Fedifeet.net, which is powered by RSS feeds, hosts the most legacy media accounts (6), all unofficial, followed by mastodon.social (2), social.espeweb.net (1), botsin.space (1) and amicale.net (1). On the contrary, the server with the most digital native accounts is mastodon.social (5), followed by mastodon.world (3), mastodont.cat (2), social.espeweb.net (2), botsin.space (1), mas.to (1), masto.es (1), mastodon.cloud (1) and mastodon.gal (1) (Figure 11).

Figure 11. *Instances where legacy and digital native media are hosted.*
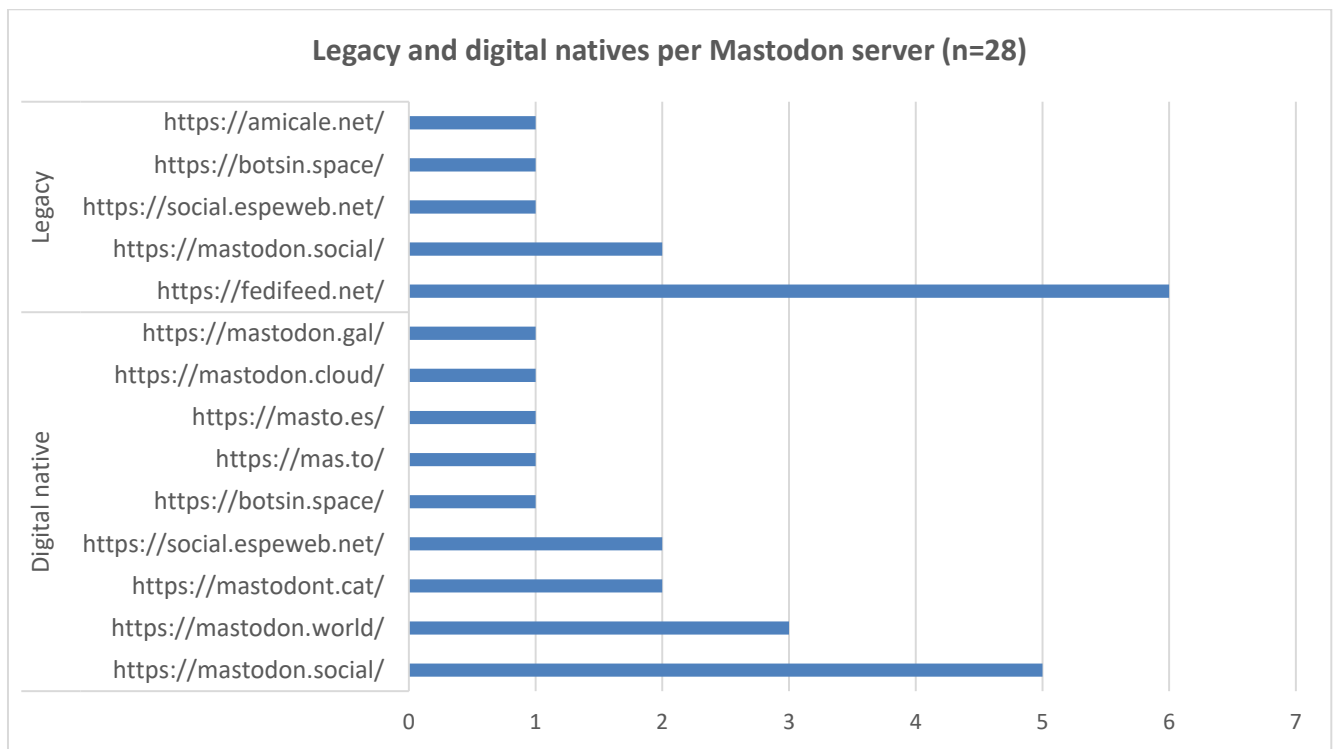
Source: Elaborated by the authors.

Fedifeet.net is also the server with the most bot accounts in the subsample analyzed (Figure 12). Out of 18 automated accounts, this instance hosts 6 accounts, followed by social.espeweb.net (3), mastodon.social (3) and botsin.space (2). The official accounts of *Público*, *La Voz de Galicia* and *Praza Pública* were excluded from this subsample, which was reduced to n=25, as they did not show any activity since their creation.

**Figure 12.** *Distribution per instance of automated and non-automated accounts.*
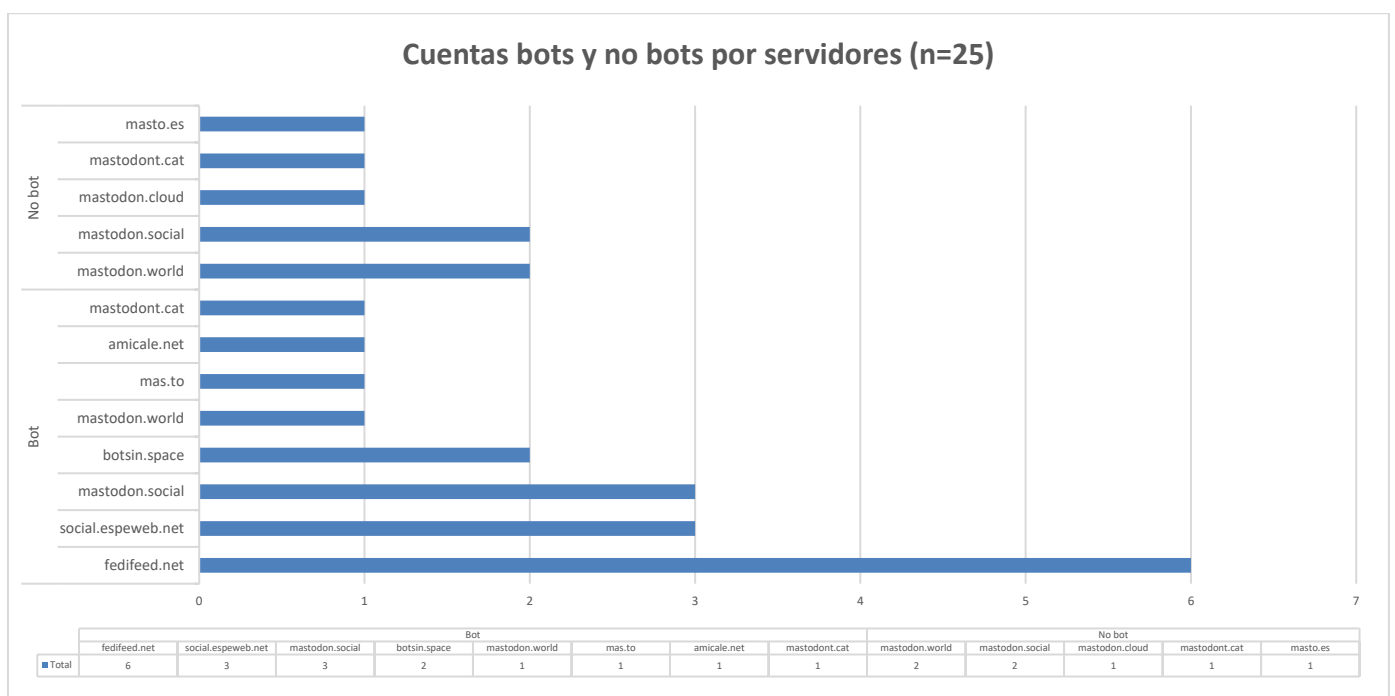
Source: Elaborated by the authors.

3.5. Active and inactive accounts

In the sub-sample of 28 accounts in Mastodon, 18 (64.28%) were identified as active (9 legacy and 9 digital natives) and 10 were inactive (3 legacy and 7 natives).

There are significant differences between legacy and digital natives. Among the former, 75% of the accounts were active (mainly thanks to the automation of content publication through RSS in 6 accounts), while 56.25% of the digital natives were up to date (Figure 13).
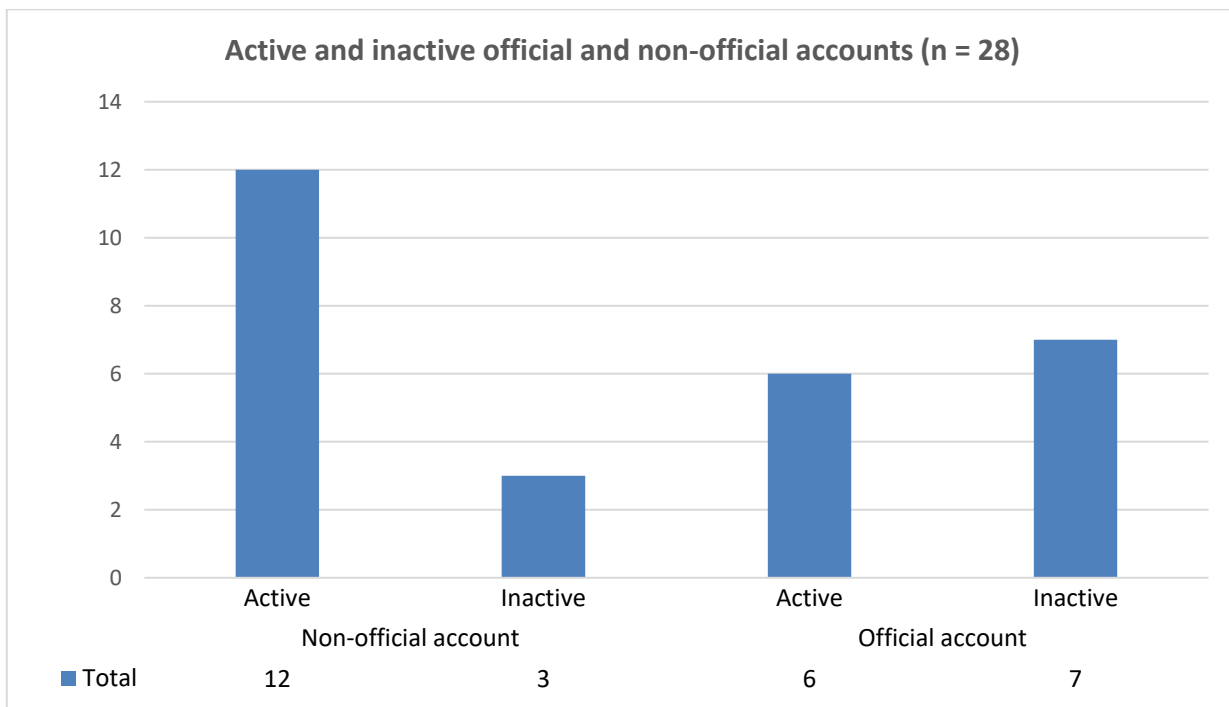
Figure 13. *Active and inactive legacy and digital native accounts present in Mastodon.*
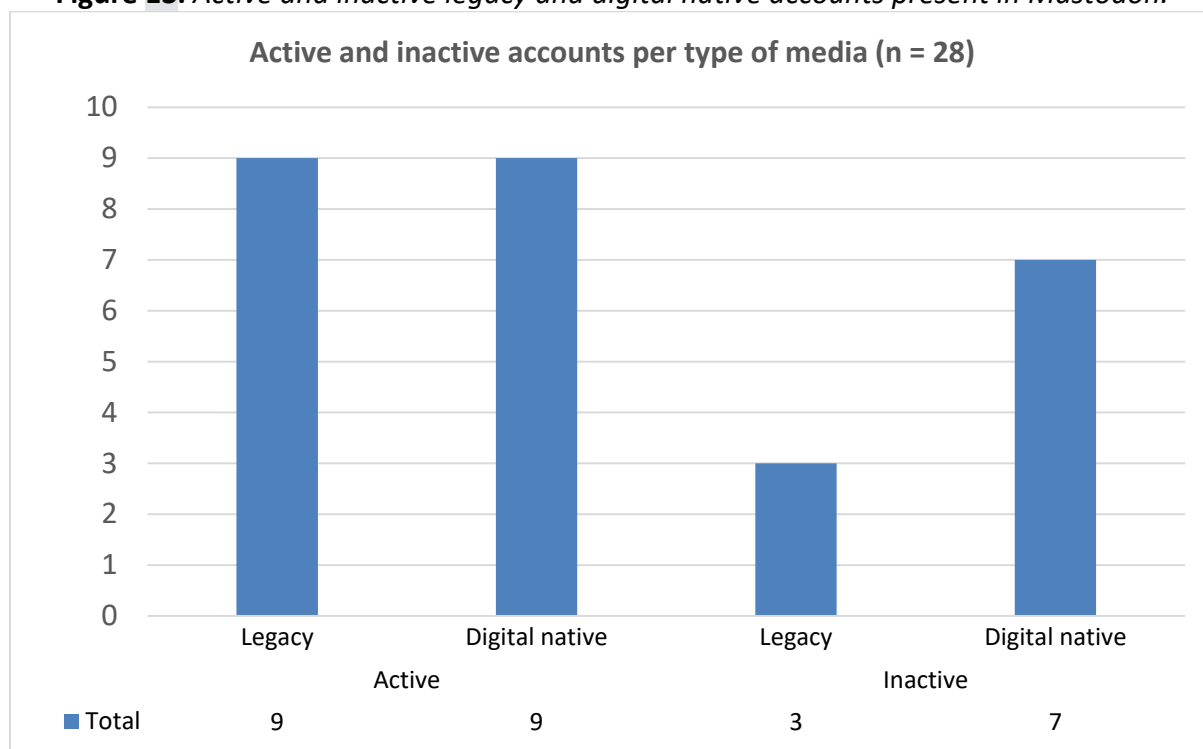
Source: Elaborated by the authors.

When this research was conducted, 12 of the 15 unofficial accounts (80%) remained active and out of the 13 official accounts, 6 were active (46.15%) (Figure 14).
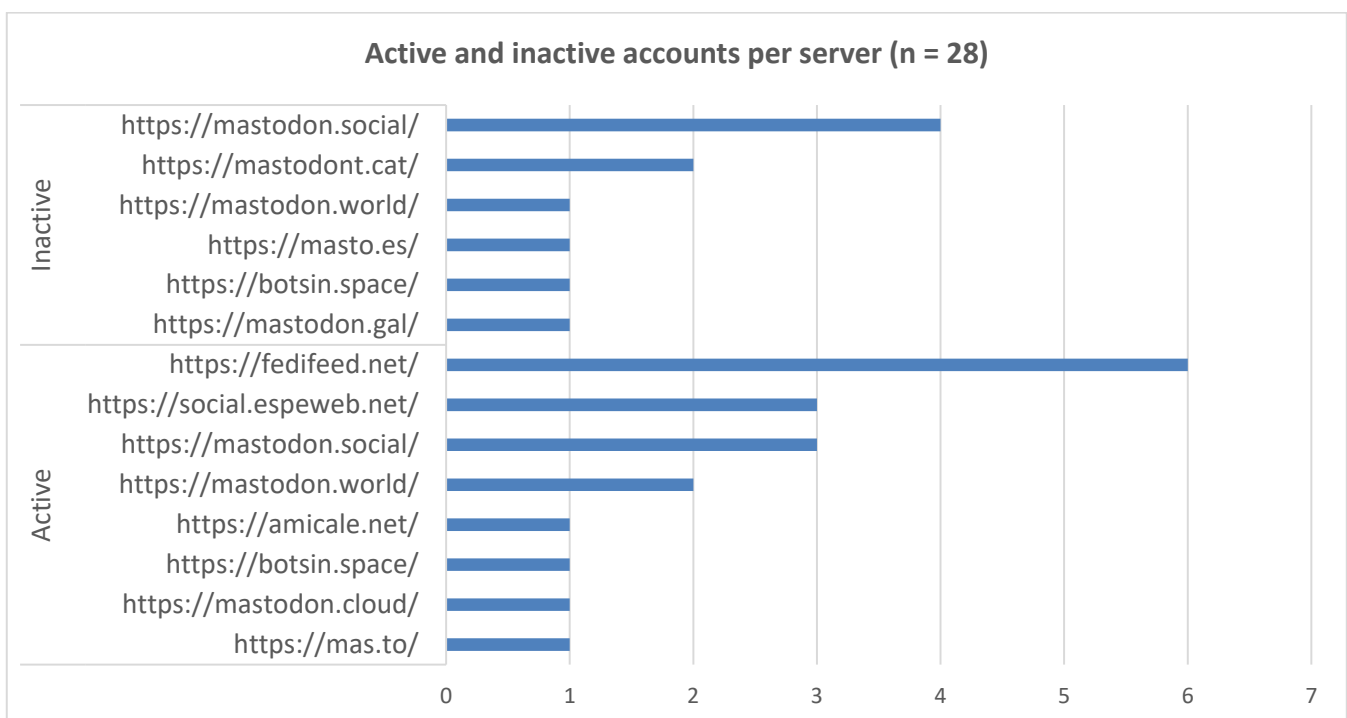
Figure 14. *Activity/inactivity of official and unofficial accounts.*

Active and inactive official and non-official accounts (n = 28)

	Active	Inactive	Active	Inactive
	Non-official account		Official account	
Total	12	3	6	7

Source: Elaborated by the authors.

The activity/inactivity of the accounts is also grouped by servers. Fedifeed.net, due to its automation, is the instance that hosts the largest number of active accounts, accounting for 6, followed by mastodon.social and social.espeweb.net, with 3 each. Out of the 10 inactive accounts, 4 are hosted by mastodon.social, but mastodont.cat also stands out, with 2 (Figure 15).

Figure 15. *Activity/inactivity of the accounts per instance.*

Active and inactive accounts per server (n = 28)

Inactive:
- https://mastodon.social/ — 4
- https://mastodont.cat/ — 2
- https://mastodon.world/ — 1
- https://masto.es/ — 1
- https://botsin.space/ — 1
- https://mastodon.gal/ — 1

Active:
- https://fedifeed.net/ — 6
- https://social.espeweb.net/ — 3
- https://mastodon.social/ — 3
- https://mastodon.world/ — 2
- https://amicale.net/ — 1
- https://botsin.space/ — 1
- https://mastodon.cloud/ — 1
- https://mas.to/ — 1

Source: Elaborated by the authors.

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The activity/inactivity relationship with the form of publication of the account (bot or non-bot) does not show percentage differences. Out of the 18 bots identified, 13 are active (72.2%), while among the 7 non-bot accounts, five are active (71.4%) (Figure 16).

Figure 16. *Activity/inactivity of automated and non-automated accounts.*
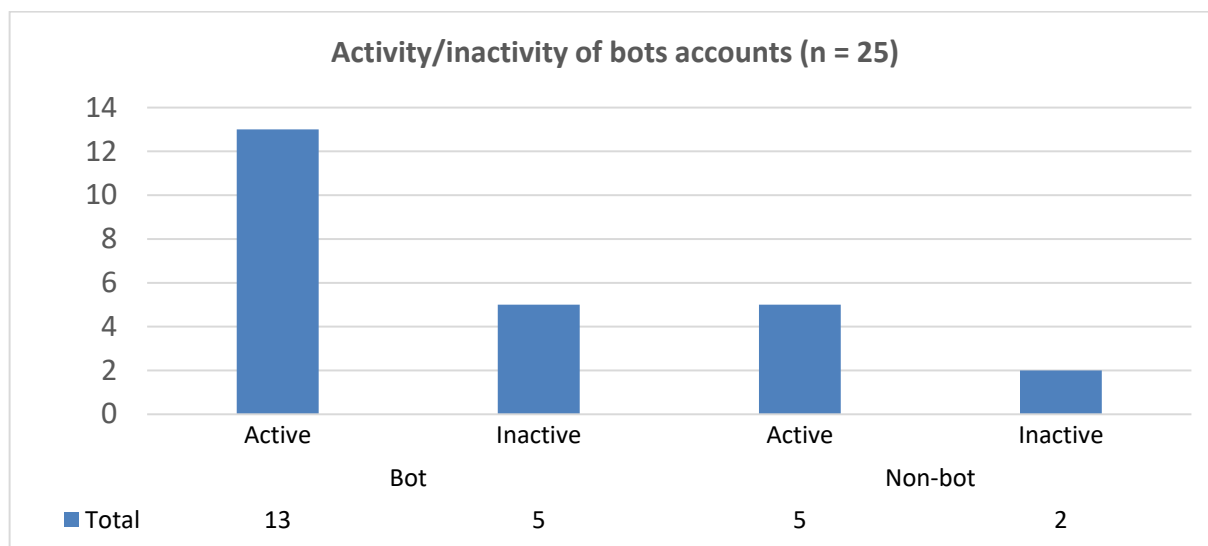
Source: Elaborated by the authors.

Finally, out of the 28 accounts identified in Mastodon, 3 do not show any publication since their creation: the official accounts of *Público*, *La Voz de Galicia* and *Praza Pública.*

Table 5 shows the main parameters of the 28 accounts.

Table 5: *Sample accounts identified in Mastodon (n=28).*

Medium	Nature	Server and account	¿Official?	*Bot*	State
20Minutos	Legacy	https://fedifeed.net/@20m	No	Yes	Active
ABC	Legacy	https://fedifeed.net/@abc	No	Yes	Active
Civio	Native	https://mastodon.cloud/@civio	Yes	No	Active
CTXT	Native	https://mastodon.world/@ctxt	Yes	Yes	Inactive
Diariocrítico	Native	https://mas.to/@diariocritico	Yes	Yes	Active
elDiario.es	Native	https://mastodon.social/@eldiario	No	Yes	Active
elDiario.es	Native	https://mastodon.world/@eldiarioes	Yes	No	Active
elDiario.es	Native	https://mastodon.social/@eldiario_bot	No	Yes	Inactive
El Español	Native	https://masto.es/@elespanolcom	Yes	No	Inactive
El País	Legacy	https://mastodon.social/@el_pais	Yes	No	Active
El País	Legacy	https://amicale.net/@el_pais	No	Yes	Active
El Mundo	Legacy	https://fedifeed.net/@elmundo	No	Yes	Active
El Salto	Native	https://mastodon.social/@ElSaltoDiario	Yes	No	Active
ElNacional.cat	Native	https://mastodont.cat/@elnacionalcat	Yes	No	Inactive
ElNacional.cat	Native	https://social.espeweb.net/@elnacionalcat_bot	No	Yes	Active
InfoLibre	Native	https://mastodon.world/@_infoLibre	Yes	No	Active
Público	Legacy	https://mastodon.social/@publicoes	Yes	(-)	Inactive
Público	Legacy	https://social.espeweb.net/@publico_bot	No	Yes	Active
La Razón	Legacy	https://fedifeed.net/@larazon	No	Yes	Active
La Vanguardia	Legacy	https://fedifeed.net/@lavanguardia	No	Yes	Active
La Voz de Galicia	Legacy	https://mastodon.social/@lavozdegalicia	Yes	(-)	Inactive
La Voz de Galicia	Legacy	https://fedifeed.net/@lavozdegalicia	No	Yes	Active
La Voz de	Legacy	https://botsin.space/@Lavozdegalicia_unofficial	No	Yes	Inactive

| Galicia					
Vilaweb	Native	https://mastodont.cat/@VilaWeb	No	Yes	Inactive
Vilaweb	Native	https://botsin.space/@vilaweb_bot	No	Yes	Active
Nació Digital	Native	https://social.espeweb.net/@naciodigital_bot	No	Yes	Active
Praza Pública	Native	https://mastodon.gal/@prazapublica	Yes	(-)	Inactive
Valencia Plaza	Native	https://mastodon.social/@ValenciaPlaza	Yes	Yes	Inactive

(-) = accounts that have never been active and for which it was not possible to verify whether they are bots or not.

Source: Elaborated by the authors.

3.6. Access from the website

Out of the 13 media with official accounts that have been identified, only two (15%) offer direct access to Mastodon accounts from their websites: *elDiario.es* and *El Salto*, both digital natives (Figure 17). Neither of these two newspapers use bots to publish on Mastodon and their accounts are active.

Figure 17. *Media with official Mastodon accounts with and without direct access on their websites.*
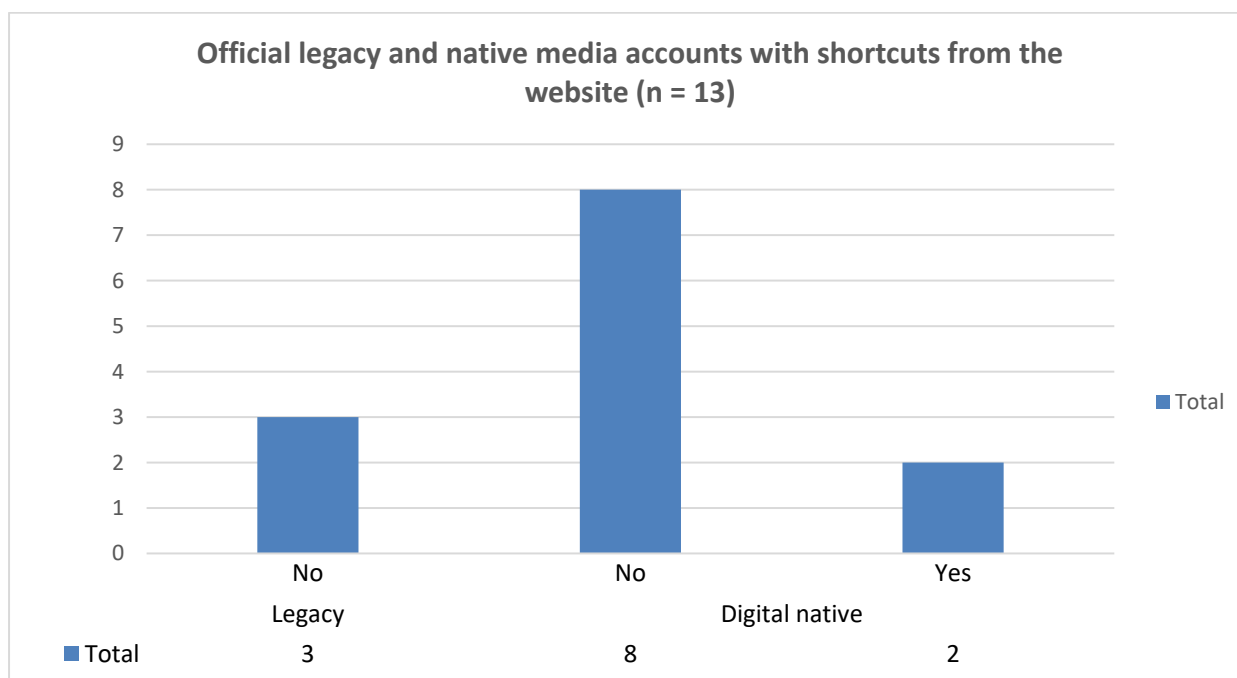
Source: Elaborated by the authors.

However, there is a substantial difference in the positioning, visibility, accessibility and integration of the shortcuts: while El Salto integrates the Mastodon icon in a box of buttons to access its social networks located in the footer of its website (Figure 18), elDiario. es, which also includes an iconographic box of buttons to its social network accounts, both in its header and footer, excludes access to Mastodon from the set of iconographic links to its networks and places it in a secondary and decontextualized place in the footer, as a textual link, located in the last position between the links to the pages "What is elDiario. es", "'The team", "Creative Commons", "Legal notice", "Privacy policy", "FAQ", "My cookies", "Cookies policy" and "Contact" (Figure 19).

Figure 18. *Footer of the El Salto website where you can find a button to access the Mastodon account (second from the right).*

Source: Screenshot taken by the authors.

Figure 19. *Footer of elDiario.es website where there is an access to the Mastodon account in a textual link in the last position, outside the social media buttons box.*


Source: Screenshot taken by the authors.

3.7. Evolution over time: created before or after the "Musk effect"?

One of the objectives of this study is to record the creation date of the accounts identified in Mastodon, not only to observe their evolution, but also to see if the purchase of Twitter by Elon Musk and the popularization of Mastodon as an alternative to this social network could have had any impact on the presence of journalistic media on the federated platform.

Out of the total sub-sample under analysis (n=28), 23 accounts (82.1%) were created in the years 2022 and 2023, 2 in 2021, another 2 in 2020, none in 2019 and one in 2018 (Figure 20). Interestingly, the oldest one is not from a digital native media, but the official account of *El País*, a legacy media, pioneer in the Spanish press in the use of Mastodon.
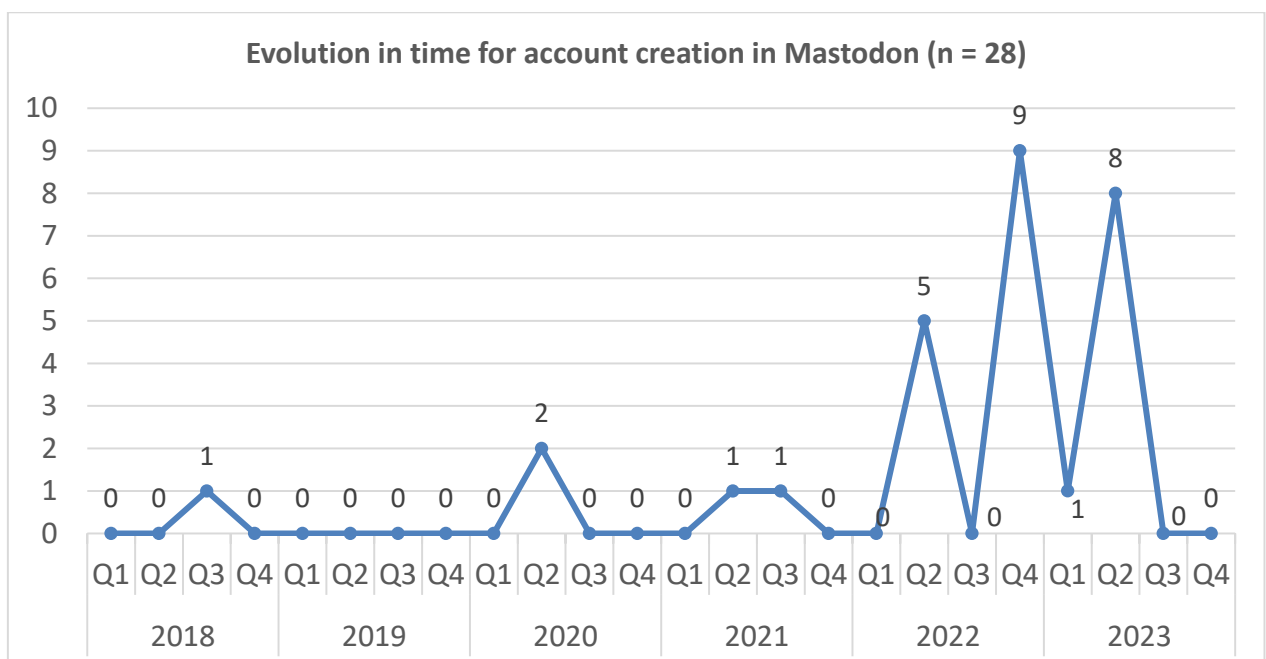
Figure 20. *Creation of accounts per year.*

Evolution over time to create the sample accounts in Mastodon (n = 28).
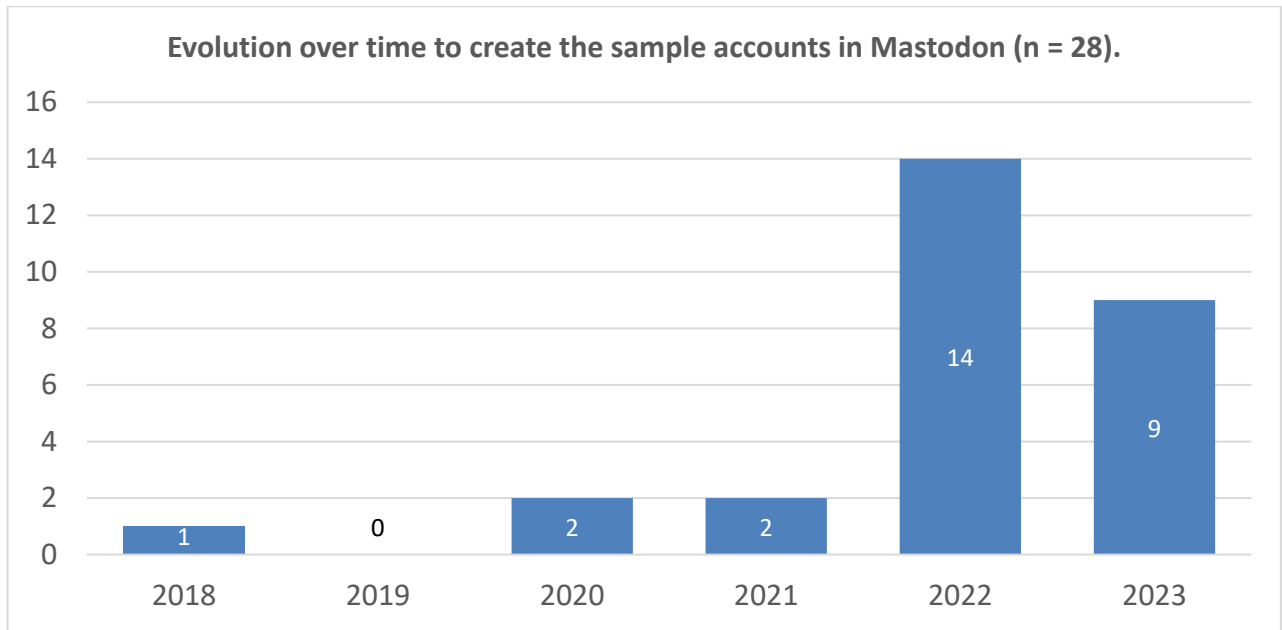
Source: Elaborated by the authors.

The most remarkable aspect of this observation is that only 5 of the 28 accounts (17.85%) emerged before 2022, the year in which the "Musk effect" on Twitter began. Most of them (23 accounts, 82.15%) were created following the release of news and the execution of Musk's purchase of Twitter: 5 emerged in Q2 2022, after the tycoon became Twitter's largest individual shareholder in March of that year and made a bid in April to buy and control the company; another 9 accounts were created in the last quarter of 2022, during the negotiation process and the final acquisition of Twitter, which was executed on October 27, 2022 (Korn, 2022); one account was created in the first quarter of 2023 and another 8, in the second quarter of the same year, coinciding with some of Musk's most controversial decisions, already as owner of Twitter (Hernández, 2023; La Cava et al., 2023) (Figure 21).

Figure 21. *Creation of accounts per quarters.*

Evolution in time for account creation in Mastodon (n = 28)

Source: Elaborated by the authors.

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November 2022 and April 2023 are the months with the highest number of new accounts being registered (Figure 22), 7 in each (50% of the total), corresponding to two key moments in Twitter's new management: Musk's aforementioned purchase of the company on October 27, 2022, and the withdrawal of the verification badge known as Twitter Blue, in spring 2023, to those users who did not agree to pay for this badge, something that generated protests from individual users, but also from major US media such as *The New York Times*, *Los Angeles Times, The Washington Post, BuzzFeed, Politico, CNN* and *Vox*, who rejected the new measure (Darcy, 2023).

**Figure 22.** *Months in which the accounts were created during the study period.*
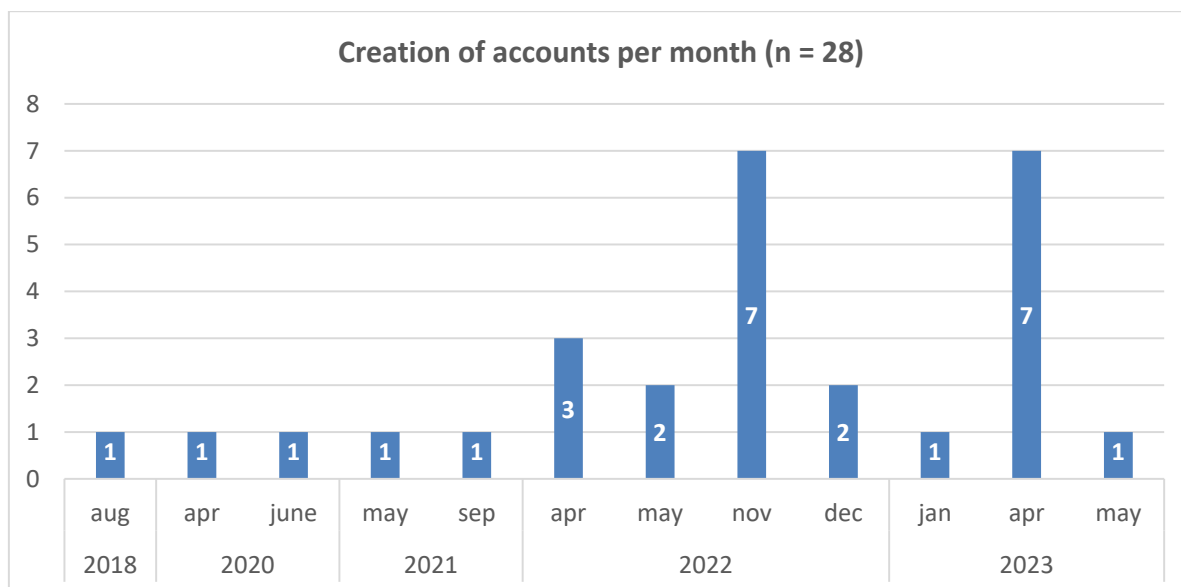
Source: Elaborated by the authors.

It is significant that 9 of the 13 official accounts that have been identified in this study (69.23%) were created between November 7, 2022 and January 18, 2023, 7 of them (53.85%) in only 17 days (between November 7 and 23). This suggests an immediate "Musk effect" in some newsrooms, especially in digital native press (8 of these 9 accounts are native media), after the purchase of Twitter took place.

Among the official accounts, the cases of El País (legacy) and El Salto (digital native) stand out, created, respectively, on August 18, 2018 and September 2, 2021, before Musk hovered over Twitter and the growing popularity that Mastodon gained from 2022 onwards (Gow, 2022b; Orihuela, 2022a; Peters, 2022).

Among the unofficial accounts (15) a different time distribution is observed: 8 were created before Musk bought Twitter (53.33%), 3 before 2022 and 5 between April and May of the same year. The other 7 emerged between December 2022 and April 2023. Therefore, if there was then a "Musk effect" in the creation by third parties of unofficial newspaper accounts, it was not as dramatic and rapid as in the case of the official ones (Figure 23).

**Figure 23.** *Dates of creation of official and unofficial accounts.*
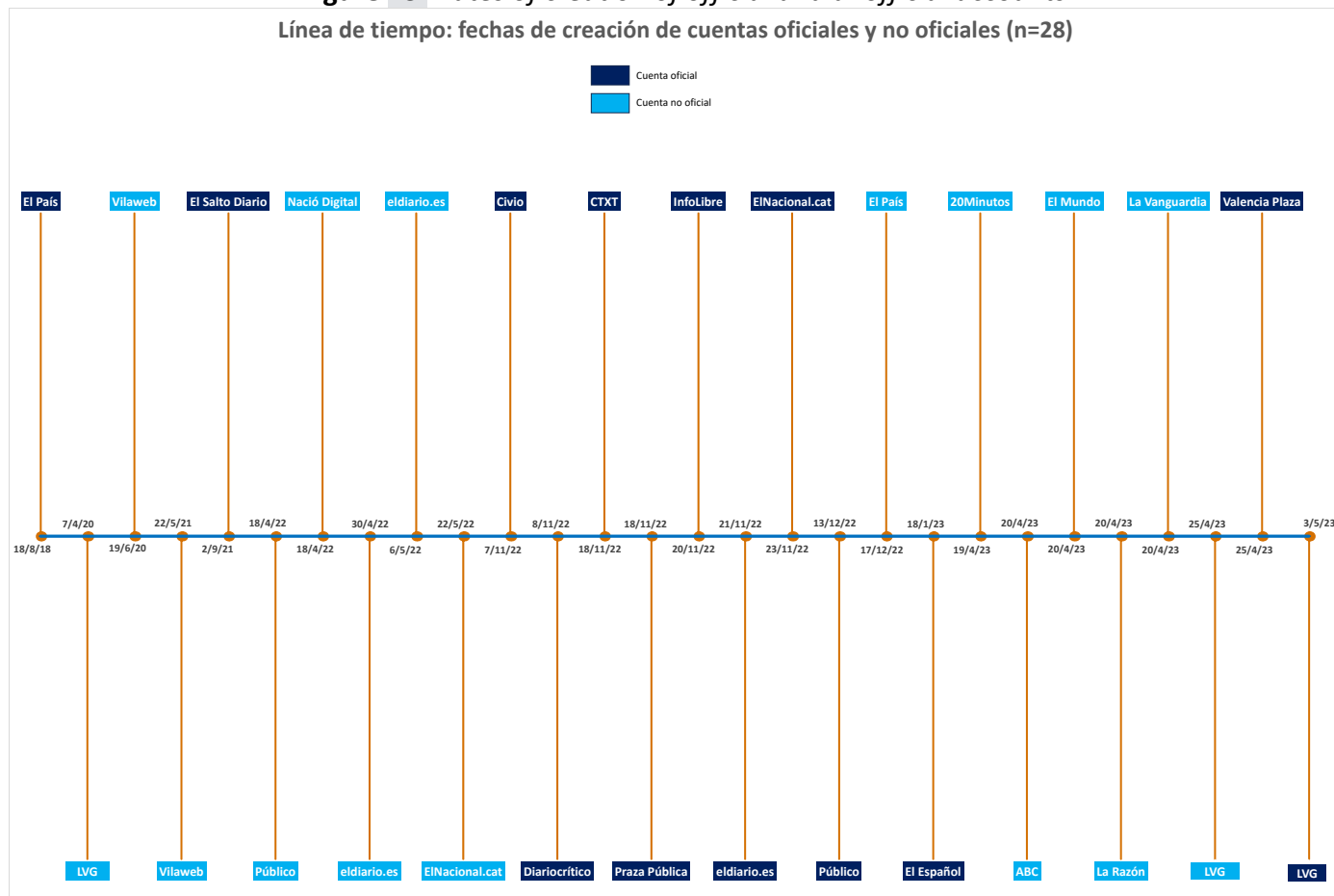
Source: Elaborated by the authors.

Digital native and legacy (official and unofficial) accounts were also grouped per month and year (Figure 24).

Out of 12 (official and unofficial) legacy media accounts, half of them (6) were created in April 2023, a time when there were media and user protests against Musk's decision to make those who did not pay for the blue verification badge pay for it and remove it from those who did not do so. Another account appeared in May 2023, 2 more were created in December 2022 and another in April 2022. As can be seen, 9 of the 12 accounts (75%) appeared after Musk took control of Twitter, and 10 of 12, in the period in which Musk became the decisive personality for the future of this social network. Only 2 legacy accounts were created before 2022, one in 2018 and one in 2020.

Out of 16 (official and unofficial) digital native media accounts, 7 (43.75%) were created in November 2022, immediately after Musk bought Twitter, and another 2, in January and April 2023, with Musk making controversial decisions about the platform. Another 4 were launched in April (2) and May (2) 2022, when Musk was already associated with Twitter; while 2 more were created in 2021 and 1 in 2020. In other words, 13 out of the 16 accounts (81.25%) of digital natives analyzed here were created during the period of time when Elon Musk became relevant on Twitter.

Figure 24. *Legacy and digital native accounts per month and year of creation.*
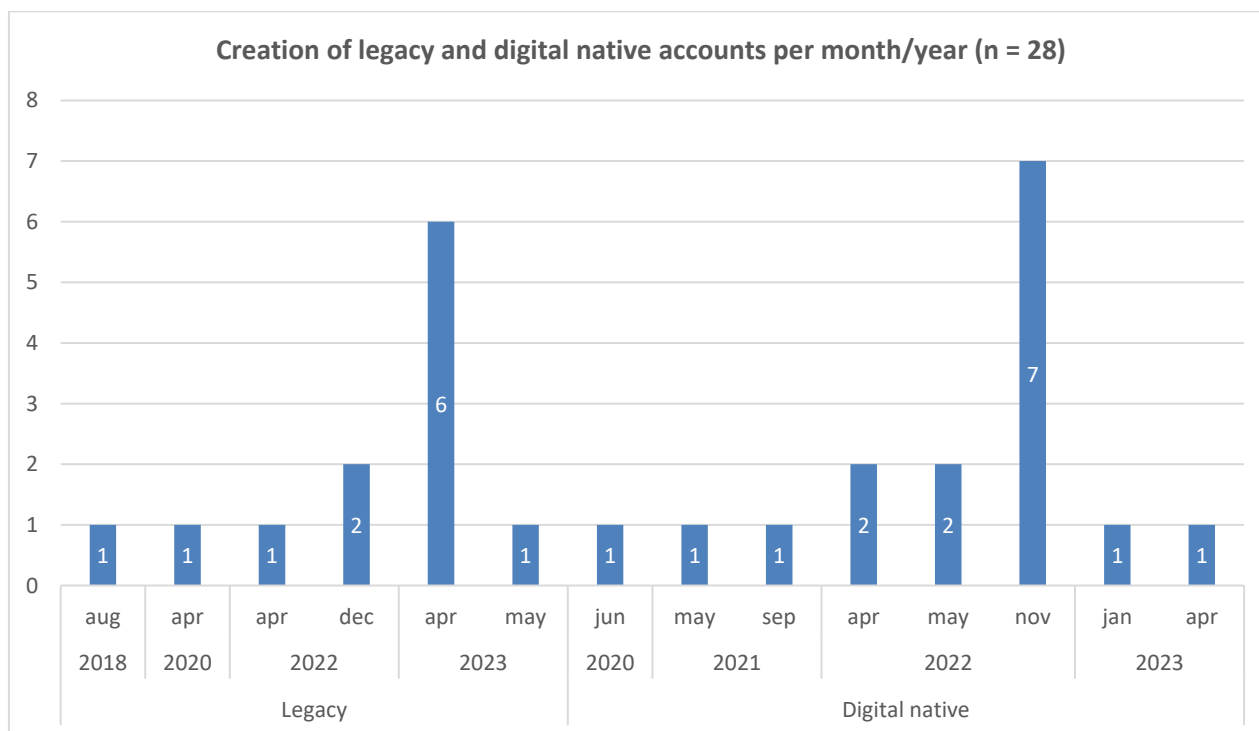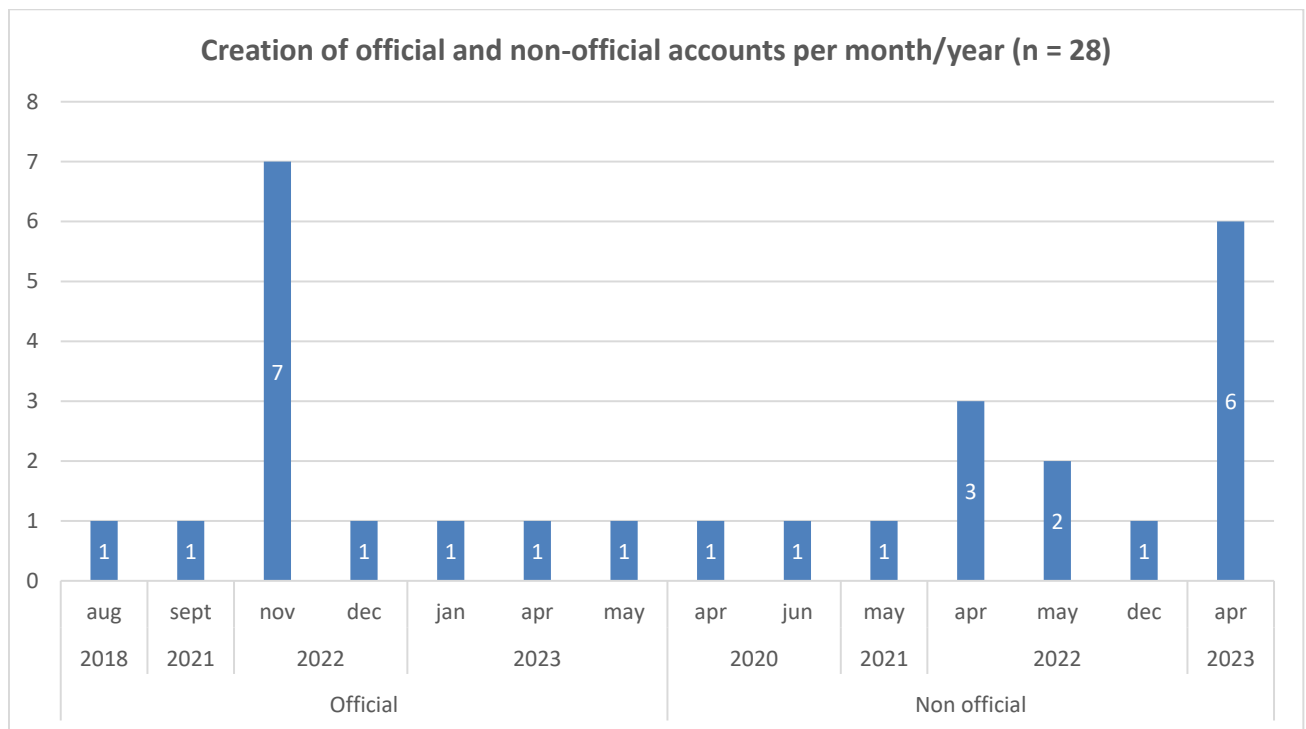

Source: Elaborated by the authors.

Disaggregating the official and unofficial accounts per month and year (Figure 25) also shows that in the former there is a higher concentration of new accounts in November 2022 and in the latter, in April 2023.

Specifically, out of the 13 official accounts identified, 7 (53.85%) were launched immediately after the purchase of Twitter by Musk, and another 4 between December 2022 and May 2023. In total, 11 of the 13 official accounts (84.6%) were created between November 2022 and May 2023, during the impact of the "Musk effect". The remaining two appeared in 2018 and 2021.

Out of the 15 unofficial accounts, 7 (46.6%) were created after Musk's operation, none in November. The highest number came later, in April 2023, with 6 new accounts (40%), and another was created in December 2022. However, 3 had already been launched in April 2022 and another 2 in the month of May 2022. In other words, 12 of the 15 unofficial accounts (80%) appeared during the period in which Musk acquired prominence and influence over Twitter. Out of the remaining ones, 2 were created in 2020 and one more in 2021.

Figure 25. *Official and non-official accounts per months and years of creation.*
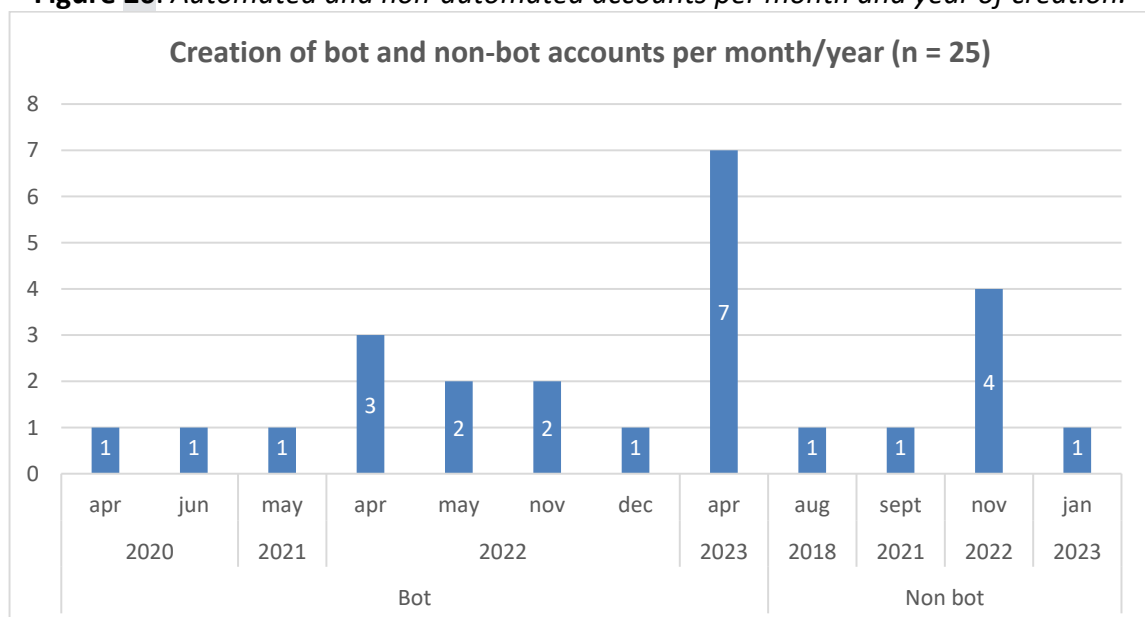

Source: Elaborated by the authors.

Taking a look at the temporal distribution of the 25 identified bot and non-bot accounts (Figure 26), the trend is similar. Out of the 18 automated accounts, 15 (83.3%) were created between April 2022 and April 2023, during the "Musk effect". And of these, 10 (55.5%) appeared after the Twitter buyout was executed. The highest number of new profiles occurred in April 2023, with the appearance of 7 accounts (38.9%). Out of the remaining, 2 appeared in 2020 and one in 2021.

Out of the 7 non-automated accounts, 5 (71.4%) were created after the purchase of Twitter and the majority, 4 (57.1%), were clustered in November 2022. The remaining two were launched in 2018 and 2021.

Figure 26. *Automated and non-automated accounts per month and year of creation.*

Source: Elaborated by the authors.

4. DISCUSSION AND CONCLUSIONS

In the reviewed literature to document this research, both Spanish and international, no similar works have been found, so it is considered that this is the first empirical study that analyzes the presence of journalistic media in the Fediverse, in general, and in Mastodon, in particular. Moreover, this research opens an unprecedented approach to the exploration of alternative social platforms that are integrated in the Fediverse and proposes a template designed to identify, characterize and compare the presence and use of Mastodon in digital native and legacy media from different perspectives.

Although this is not a study on the total population, nor on a probability sample of digital native and legacy newspapers in Spain, it is significant that more than half of the media included in the sample (20 out of 38, 53%) are represented in Mastodon in the period under study.

The results offer two important interpretations: firstly, Mastodon is a network being explored by a non-majority but significant number of the media under analysis (13 of the 38 media in the sample have an official account on this network, 34.21% of the total), and secondly, it is shown that there is interest among Mastodon server administrators in including the news media in the communication flow of this network through unofficial accounts from which information from the Spanish press is automatically published via an RSS feed (15 of the 28 accounts identified are unofficial, 53.57%). In addition, there is a coexistence of official and unofficial accounts distributed on different servers. This explains why there are more accounts (28) than media (20).

It is also relevant to note that, although quantitatively more digital natives than legacy media are identified in Mastodon (12 vs. 8) -something that was expected, both by its nature and by the greater number of natives appearing in the sample-, the percentage among legacy is higher than among natives (80% of the 10 legacy vs. 42.85% of the 28 natives included in the sample n=38). In any case, this result should be interpreted with caution since we are working with non-representative/probabilistic samples. Moreover, despite the rise of alternative and anti-system communicative and informative phenomena, the traditional press continues to enjoy prestige, attention, influence and legitimizing power (Quian & Elías, 2018), and it also finds accommodation in spaces outside the mainstream, such as Mastodon and the Fediverse.

However, there is an important nuance: Fedifeet.net is the instance that hosts the most legacy media accounts (6 in total). Most of the traditional newspapers in Mastodon have been included by the administrator of this server to connect to their RSS and automate their publications, and they are not proprietary accounts managed by the media. This reflects the interest in incorporating the mainstream press into alternative network feeds for their influence. Braun (2023, p. 2) notes that "news organizations that have not yet interacted with Mastodon often have a presence there in the form of various bots that users have set up to post updates from their respective RSS feeds." However, this author also warns of the existence of instances:

> that are led by communities that are deeply skeptical of journalism [...] interested in protecting members of groups that have long been treated terribly by the press and have experienced unpleasant impacts [...], who see the press as an annoying extension of the State. (Braun, 2023, p. 2)

On the contrary, digital natives are mainly hosted in generalist, popular and transnational instances such as mastodon.social, mastodon.world, mastodon.cloud or mas.to, but also in other similar ones with a geographical or cultural identity such as masto.es, mastodont.cat or mastodon.gal.

The nature of the media is related to the type of server and the characteristics of the account. Digital native media have a higher proportion of official and non-bot accounts than legacy media, although the proportion of automated accounts is generally high in both categories.

All this also influences the status of the accounts (active/inactive). The proportion of active legacy media in Mastodon is higher because of continuous RSS feeds on servers and accounts that are created by third parties exclusively to automate journalistic media publications.

However, contrary to what might be expected, no percentage differences are found in the activity of bots and non-automated accounts, and 7 out of 10 are active in both categories.

Moreover, the nature of the medium is not related to a greater or lesser number of accounts. There are six overrepresented newspapers, both legacy and digital natives, state and regional.

El Salto is the newspaper that best manages the potential of Mastodon and it is also the one that shows the greatest commitment to this federated network, being the only one of the analyzed newspapers that, in addition to having an active official account and not managed with a bot, integrates on its website a direct access to it in the button box of the social platforms in which it is present. The nature of *El Salto*, as a digital native, independent and alternative media, is the explanation for its better assimilation of this federated network, in which it entered in 2021, before the "Musk effect". But it also highlights the pioneering place occupied by a legacy and conventional newspaper such as *El País* in Mastodon, four years ahead of the fever that this federated network has generated among media and citizens, curious and disenchanted with Twitter. Present since 2018, and with its official account active, it is surprising that the newspaper of *Grupo Prisa* does not include on its website a direct access to its Mastodon account. Although later than *El País* and *El Salto*, it also highlights the importance that *elDiario.es* (digital native) gives to Mastodon, with an official account, not automated and with direct access from its website, although decontextualized. These three media, with different editorial, organizational, financial and conceptual characteristics, fall within the broad ideological spectrum of progressivism (GIPEyOP/Mediaflows, 2017) and, in the cases of *El Salto* and *elDiario.es*, in the so-called alternative media (Al Najjar-Trujillo et al., 2020).

The 13 Spanish newspapers with official accounts that were identified in this research join a diversity of pioneering media that use Mastodon, among which Braun (2023:2) highlights Rolling Stone, ProPublica, The Markup or The Conversation, and a "variety of local newspapers", among others. However, none of the newspapers under study created their own instance, opting for generalist servers with more users or for instances for populations that share the same language and culture. A priori, it is logical that a generalist newspaper seeking maximum impact on the Mastodon network would choose the most popular, majority and generalist instances, such as mastodon.social, mastodon.cloud, mastodon.online, mstdn.social, mastodon.world, mas.to., etc. However, smaller instances attract more active users than majority servers (He et al., 2023), something that reinforces the decentralization of Mastodon (Anaobi et al., 2023). This finding is a valuable indicator for media that intend to generate truly (pro)active communities around them, not only to select the most suitable server, but also to run their own servers.

Another significant finding of this study is that the analyzed media with official accounts on Mastodon are not taking advantage of the full potential of this federated, open and decentralized network to create and manage their own instances. Abbing and Gehl (2024) recommend researchers to study instances, not individuals, in line with the Fediverse privacy model, where the instance is the gateway. This justifies our interest in the types of servers on which the analyzed accounts are hosted.

All (13 newspapers), digital natives and legacy, hosted their accounts on servers managed by third parties. Being a free and open source software, and using the ActivityPub network protocol, Mastodon allows anyone to create and manage their own instance and to federate and interact with as many as they wish, being able to reach all or almost all the audiences of this decentralized network, but also those of other platforms in the Fediverse. Moreover, using an open, free protocol designed for the decentralization and interoperability of social platforms should be an ethical principle assumed by journalistic media, since it is the most coherent

and effective technological approach to protect freedom of expression and free information, combat censorship and avoid the centralized oligopolistic control that large technology companies have over communication and information flows and data (Masnick, 2019; Orihuela, 2022b).

Managing one's own instance grants advantages and privileges, such as dictating rules of use and moderation (for example, the instance of a newspaper could indicate that hateful or discriminatory messages will not be allowed, nor the sharing of false information or spam, or the activity of trolls). It also allows journalists to be grouped together and to create and retain a community of followers around the medium, guarantees the protection of their data, which will not be collected or used by a company or central authority superior to the medium, generating greater trust. It also ensures the full sovereignty and freedom of information and expression of the medium and its journalists, without the opportunity for censorship that companies such as X, Meta or Google can exercise over the content and accounts on their social platforms.

As opposed to the centralized moderation model of commercial social platforms, the Fediverse's open and decentralized model allows "each community to choose its own content moderation standards according to its own needs and values, while recognizing and respecting the content moderation choices of other communities" (Rozenshtein, 2022, p. 228). Kadena and Qose elaborate:

> In a decentralized network, no particular community has power over the rules of other groups. Anyone on Mastodon, for example, can run their own social networking site without the need for a parent authority, which means that they (and other users) can post whatever they want without fear of having it removed. (2022)

The possibility for users to migrate between servers, without losing established relationships with other users of the same and other instances, seems to encourage server administrators to "compete to provide the best moderation experience," coupled with "strong reputational pressure to police member behavior and not tolerate trolls and harassers" (Keegan, 2022). And the possibility of "de-federating" one instance from another also drives community moderation systems against "unwanted or harmful content" (Mansoux & Roscam, 2020, p. 129). In this sense, it would be naive to think that the Mastodon network is free of harmful speech and uninformative content in some instances (Rozenshtein, 2022, p. 229), but "those servers are largely blocked" (Braun, 2023, p. 6) in the federated network. That is precisely another advantage for newspapers managing their own servers because they could, for example, block or limit groups of trolls, harassers or toxic content that try to disrupt the medium, its journalists, its news and the community that gathers around the medium, thanks to the decentralized moderation model, which "can satisfy both those who want to speak and those who don't want to listen", putting "into practice the principle that freedom of expression is not the same as freedom of scope" (Rozenshtein, 2022, p. 229).

The Mastodon network and the Fediverse have better resources to isolate toxic players (Caelin, 2022; He et al., 2023) and limit the scope of misinformation, propaganda, and hate speech (Gehl, 2022). The rules on Mastodon instances emphasize the need to create spaces that avoid common harms, such as harassment and hate speech (Nicholson et al., 2023).

These remarks should be useful for the journalistic media present in Mastodon (or in other Fediverse platforms) to be more rigorous and raise their standards of creation, verification and publication of content, because they are exposed to be limited or blocked by users and other federated communities that may identify the media as a factory of fake news, manipulated information, propaganda or content of no or poor quality.

It is a fact that centralized social platforms have exercised enormous power over journalistic media, mainly in the circulation and impact of their news (Nielsen & Ganter, 2022). In this scenario of dependence on big tech there are demands, at least on public media, to join alternative decentralized and open networks. For example,

McKelvey and Gehl proposed that the Canadian Broadcasting Corporation (CBC/Radio-Canada) launch its own server on Mastodon to "provide access to Canadians who want social networks without relying on predominantly U.S. corporations" (McKelvey & Gehl, 2022).

In Europe, the independent media news platform Display Europe stands out, a project promoted by the European Cultural Foundation and co-financed by the European Union's Creative Europe Program, which is built on open protocols and software to respect users' privacy and ensure the project's independence from large technology companies and their platforms. As part of its strategy, Display Europe launched its own instances in the Fediverse: Mastodon (https://displayeurope.social/) and PeerTube (https://displayeurope.video/). Paradoxically, although elDiario.es joined this project, its Mastodon account has remained on the mastodon.world server.

Other media, "from the regional *Texas Observer*, to the German news giant *Heise*, have created their own instances to host their staff and news" (Braun, 2023, p. 2). Financial Times also launched its own Mastodon server for its *FT Alphaville* blog, but abandoned this project, it seems more out of ignorance (Masnick, 2023) than because of how "cumbersome" it is to manage an instance, as this media outlet claimed (Elder, 2023).

National and supranational governmental institutions such as the Swiss government (Swiss Federal Council, 2023), the German Federal Commission for Data Protection and Freedom of Information (BfDI, 2020), which also allows other federal authorities in the country to use its server to operate their own official accounts, or the European Commission (European Data Protection Supervisor, 2022), the executive arm of the European Union, have also launched their own instances on Mastodon. These governmental steps could contribute to legitimize the Fediverse as "the preferred social media architecture for democratic societies" (Rozenshtein, 2022, p. 233).

Moreover, X's new policies with Musk at the top made Twitter "a less hospitable place [...] for journalists," whom he "tried to discipline for criticizing the company with sudden account suspensions and applied misleading labels to news organizations' accounts" (Braun, 2023, p. 1). These actions led many individual journalism professionals to a strategic disconnection from Twitter (Claesson, 2023) and to try Mastodon, even to create their own instances to group only journalists, such as Newsie.social and Journa.host (Braun, 2023, p. 2), but also some media that decided to explore this federated network because of the "Musk effect", as shown in this research. These are mainly digital native media that started using Mastodon during the process of Twitter's purchase and takeover by the South African tycoon. Our results support the idea that the takeover of Twitter (X) by Elon Musk encouraged some journalistic media to join Mastodon, influenced also by the massive migration of users from one network to another in that critical period (He et al., 2023; Jeong et al., 2023; La Cava et al., 2023).

Despite all these changes and the new scenarios and opportunities that arise, the Spanish journalistic media are not taking advantage of the full potential of the technological sovereignty provided by Mastodon and are even lagging behind some political powers in the exploration of decentralized, open, secure and autonomous communication systems designed to safeguard freedom of information and expression, which is paradoxical.

The main limitation of this research lies in the non-probabilistic nature of the sample. There are also limitations due to the exploratory and descriptive nature of the study. However, the exploratory approach is justified, and necessary, when there is little or no scientific knowledge about a group, process, activity or situation to be examined. This exploration should lead to the description and understanding of what is being studied, the explanation of which is supported, when possible and desirable, by descriptive statistics (Stebbins, 2001).

Due to its pioneering nature in the analysis of the presence of journalistic media in Mastodon, and the relevance of the analyzed media, the results obtained can be very useful to open new avenues of research and a debate on the responsibility of media publishers to provide citizens with communication and information spaces that are safe for their privacy and consistent with the ethical pillars of journalism, such as freedom of expression and the free flow of information.

As a continuation of this study, future research should analyze the presence or absence of journalistic media in other platforms of the Fediverse, not only in Spain, but also in other countries, with larger and more representative samples, with special attention to public media. Another line of work should delve into the "Musk effect" on media and journalists' migration to Mastodon. There is also a need for an analysis of the communication strategies, types of content and formats used by journalistic media and the interactions they generate, as well as the opinion and degree of knowledge of journalists and media managers about Mastodon and the Fediverse.

According to Abbing and Gehl (2024), the authors of this paper agree that the Fediverse is an opportunity to open new avenues of academic research on social networks.

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