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Debating Glyphosate: A Macro Perspective on the Role of Strategic Communication in Forming and Monitoring A Global Issue Arena Using Inductive Topic Modelling

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ABSTRACT

Stakeholders debate issues of public interest in global online issue arenas, but political decision makers decide on these macro issues at national and supranational levels. A better understanding of the role of organizations in forming and monitoring such issue debates is necessary, given the influence of public affairs activities and media debates on politicians' and public opinion. However, such a macro perspective is largely missing. This study analyzes the debate around the use of the pesticide glyphosate when the European Union decided on a license renewal in 2017. To uncover emerging salient topics and their relations with organizations, the online global coverage of the issue from the GDEL database ($N = 1677$) was analyzed using inductive automated content analysis (LDA topic modeling). Only three topics were salient in the arena, most prominently the carcinogenicity of glyphosate, thereby sidelining other relevant aspects. Furthermore, online issue arenas reach globally and are converged communicative spaces where a variety of media participate. Thus, the article develops and tests a typology of online news media for issue arena research. Advancing theory on organizations' roles and strategies in these online issue arenas, a new classification of actors based on their visibility and communication strategy is proposed.

Societally relevant issues, such as the use of pesticides in agriculture and its consequences for public health, are discussed in global (online) issue arenas (Vos et al., 2014), but decided politically at national and supranational levels. Given the influence of the media's issue framing on public and politicians' opinions (Van Aelst & Waalgrave, 2016), a better understanding of issue debates in global issue arenas is necessary, particularly when they focus on macro issues that bear consequences for all of society (Ewing, 1990). However, a truly global perspective is largely missing in strategic communication research, as its focus has most often been on national issues of public interest (e.g., Luoma-aho et al., 2013) or cross-national analyses (e.g., Ihlen et al., 2018). Societal-level, i.e., macro, analyses of an organization's environment are of importance to strategic communicators in practice, and thus performed by applied research companies, but often lack in strategic communication research, where the organization rather than its environment is at the center of analysis (Zerfass et al., 2018).

A variety of organizations be they companies, governments, or other interest groups form and monitor societal debates through strategic communication management. Issue arenas open offline and/or online when various actors communicate about a societally relevant subject (Luoma-aho & Vos, 2009). Organizations actively form these arenas by communicating directly via owned media to get their issue position heard, by using shared media to engage in dialogue, and by approaching (earned) media outlets to build their agenda to reach political decision makers indirectly and via their constituents (McCombs & Shaw, 1972; McGrath, 2007). While shaping issue arenas, organizations at the same time

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scan the global media environment to detect strategically significant issues early in the life cycle to set the goals for their communication strategy (Lauzen, 1997; Zyglidopoulos, 2003) or to identify strategic responses, for instance, through public affairs activities (Oberman, 2017; Zerfass et al., 2018).

Particularly for globally discussed public issues, adopting a broad perspective can aid in mapping relationships and topics formerly unidentified (Lock & Seele, 2017). The use of pesticides in agriculture and its potential harmful effects on humans and the environment is such a globally salient issue, where big corporate and civil society players such as the agricultural producer Monsanto and the nongovernmental organization Greenpeace attempt to influence European Union (EU) policy. Furthermore, political decisions on this macro issue bear consequences for society: using pesticides in agriculture can have harmful consequences to public health, for instance, through an increase in cancer rates, or on the environment, because of shrinking biodiversity. To map the global discussion surrounding the use of the pesticide glyphosate along the four interrelated levels issue characteristics, actors, course of debate, and places of interaction (Vos et al., 2014), the following overarching question is addressed:

RQ: How was the use of the pesticide “glyphosate” in the year of the European Union’s decision on a license renewal 2017 debated online globally?

Most research on public debates in strategic communication research has adopted a deductive perspective on national or cross-national contexts to detect specific issue frames (e.g., Liu & Kim, 2011; Nicolini & Hansen, 2018). However, when mapping a debate at a global scale, a deductive perspective may potentially limit the focus of analysis to predefined framing logics. In a global media environment, multiple sources that propel a variety of salient topics compete for public attention and may play an influential role in agenda-setting and opinion formation. Thus, inductive analyses of public policy debates can aid in unravelling formerly unidentified agenda building practices of lobbyists in online media (Lerbinger, 2006). Such inductive analyses are rare and mostly concentrate on single countries (e.g., Nyberg et al., 2018). However, with the possibilities of automated content analysis of text and access to global databases such as GDELT (Global Database of Events, Language, and Tone; Hopp et al., 2019), inductive topic modelling based on large amounts of global coverage has become feasible and can lead to new insights on the processes of online debate of relevant public issues in a global media environment. Such an inductive approach allows detecting emergent relationships between actors, places of interaction, and issue characteristics over the course of the debate (Vos et al., 2014).

Thus, by performing an inductive topic modeling analysis of the global online coverage of the issue glyphosate in the year 2017 (N = 1667), this study outlines the emerging topics salient during the course of the debate and detects which actors were partaking in the issue arena via which media. From the study’s findings, four major contributions to the field of strategic communication and the issue arena approach emerge. First, online media are multi-faceted and thus their analysis is in need of a fine-grained typology, which is developed and tested here. Second, online issue arenas are converged spaces to be regarded – and possibly studied – in combination rather than in isolation, because traditional media discourses, social media, and physical arenas are interlinked. Given the various communication strategies of participating organizations, third, a new classification of actors in online issue arenas is proposed that takes into account the visibility of the actors along with their strategic communication. Last, from a methodological perspective, the study showcases the use of inductive topic modelling and the online database GDELT for strategic communication research and discusses possible future research directions.

Literature review

Global public issues in online issue arenas

Putting issues and their debates rather than organizations’ goals or communications at the center of attention of empirical strategic communication research is a fairly recent approach (Luoma-aho & Vos, 2009). It can be seen as a parallel – and related – line of investigation besides organization-centric

stakeholder models (Roloff, 2008), dyadic studies of organizations' relationships with publics (Huang & Zhang, 2013), or dialogic approaches (Kent & Taylor, 1998). What differentiates the issue arena approach from these is that it reflects the idea of the public sphere (broadly viewed by Marcinkowski, 2008, p. 4041, as an "arena of discussion [...] open to the public") more closely than relationship-based models that have as a focal point the organization and its various stakeholders, relationships with publics, or dialogic interactions (Lock, 2019). It shares this reorientation with the concept of the rhetorical arena, which opens up when a crisis hits (Frandsen & Johansen, 2016) and focuses on the actors' rhetorical strategies. Indeed, also the issue arena can be thought of as a communicative space, where multiple actors – be they organizational or individual – meet independent of time, physical abilities, or technical constraints (Bentele & Nothhaft, 2010). However, the starting point is the issue, not the actor, as proposed and applied in rhetorical arena theory (Raupp, 2019).

Organizations communicate in issue arenas as actors, which are open to participation, purposefully to create meaning and advance their mission (Hallahan et al., 2007). Strategic communication herein then "means arguing that your [the organization's] interest is *also* in the interest of the public, of society in general, in some way or another" (Bentele & Nothhaft, 2010, p. 113). Given this strategic communication perspective, the focus here is on organizations as actors in the issue arena; these can be corporations, political institutions, research institutes, civil society and activist groups, or media outlets. The latter have a hybrid role by channeling the communication of other organizations or by acting as agenda-setters (McCombs & Shaw, 1972).

Organizations in issue arenas communicate through various channels, commonly classified as paid, earned, shared, and owned media (Macnamara et al., 2016). While through paid and earned channels organizations communicate indirectly with the public (via the media in which the advertisement or respectively the article is placed) aiming for agenda-setting effects (Kiousis et al., 2007), through shared and owned media organizations communicate directly with their audiences, predominantly (apart from some moderate control via social media platforms) without editorial gatekeepers.

High visibility in these channels affects organizations' reputation (Carroll & McCombs, 2003) and in the case of corporations influences stock prices (Strycharz et al., 2018). The visibility of an organization in these media is understood as the amount of coverage an organization receives (Wartick, 1992), thus, how often it is mentioned (Raupp, 2019). In this regard, offline media arenas where "the contest of voices is the product of journalists' selection and sourcing practices" (Raupp, 2019, p. 2) and different shared social media arenas as places "where the communication between the actors takes place" (e.g., Twitter: Hellsten et al., 2019, p. 37; online forum: Luoma-aho et al., 2013) have been investigated in the past. Online media are of greater importance for global discourses due to their reach and wide application in strategic communication than offline channels (Valentini, 2015). Regarding these different channels, organizational visibility in earned and shared media is interlinked: public presence of organizations in earned media predicts visibility in shared media (Yang & Kent, 2014). While shared media are not the focus of this study, here, instead, the visibility of organizations in online coverage including earned online media such as traditional news media, specialist news, and owned online media such as blogs is addressed (Stephen & Galak, 2012) to understand the communicative behavior of actors in issue arenas.

This is a more fine-grained approach than the distinction between active and passive actors purported in issue arena research and opens the perspective to reach beyond a physical space (Vos et al., 2014). However, so far the communication strategies of the participating organizations, whether direct or indirect communication is used to receive or prevent visibility, or in how far paid, earned, shared, or owned media play a role, have not been in the focus that much (Savič, 2016). With increasing power of organizations to address publicly relevant issues, uncovering the underlying communication processes can give insight into how debates in the public sphere play out (Bentele & Nothhaft, 2010).

Through globalization, the influence of organizations other than governments – be they from civil society or private sectors – on the emergence of and solution to public issues has increased (Vogel, 2008). To deal with them, a "global public domain beyond the sphere of states" has formed that is

“open, fluid, and tightly coupled” (Ruggie, 2004, p. 509) between different nations. The issues discussed in such public spheres are likewise of global importance, either because they are dealt with in different nation states (such as harmfulness of pesticides for humans as in the case of glyphosate) or because their solution is too complex to be tackled by one government alone (climate change and the Paris Agreement; Vogel, 2008).

Thus, issue arenas are the spaces in which these global public issues are addressed through strategic communication by a variety of actors with different perspectives and involving collective action (Buchholz, 1988). The perspective needs to focus on a global discourse, even though some of the political decisions may be taken at a national or supranational level, because these different global issue arenas are tightly intertwined. Companies, governments, and civil society organizations communicate via different types of media in various countries to pursue certain goals: to influence politicians directly by rendering an issue more salient in the media which politicians respond to (Van Aelst & Walgrave, 2016); to reach decision makers indirectly by influencing their voters who then ideally urge the politician to take action (McGrath, 2007); to set the public agenda by addressing journalists and positioning the organization strategically around an issue (McCombs & Shaw, 1972). This study focuses predominantly on the first goal mentioned, the saliency of an issue, more specifically, an issue’s characteristics as apparent from the topics to which it is related in the media. It is not concerned with the delineation or effects of issue framing (Happer & Philo, 2013; Klüver et al., 2015), because an inductive topic modelling analysis as performed here is aimed at providing the big picture of topics circulating in an issue arena, but not an in-depth analysis of frames present.

Four levels of issue arena analysis

The issue arena model proposes to analyze issue debates along four dimensions, which are in the following applied to the issue arena glyphosate in 2017: issue characteristics, actors, the course of the debate, places of interaction, and (Vos et al., 2014), leading to these research questions:

RQ1: In the 2017 global online discourse (course of the debate), which topics (issue characteristics) were discussed in relation to glyphosate?

RQ2: Which organizational actors were mentioned most frequently by topic (actors)?

RQ3a: Which topics are discussed within which country contexts (places of interaction)?

RQ3b: Which types of online media propelled which topics (places of interaction)?

Course of the debate: The year 2017 (RQ1)

The decision on a renewed license of glyphosate was one of the most prominent cases of corporate influence on politics in the EU in the last years. Farmers worldwide had widely and effectively been using this chemical since the early 1970s (Roundup, 2019) to kill weeds and control their spread. Today, it is the most widely used pesticide in the world (European Commission [EC], 2019), also to produce food. Since 2002, glyphosate has been licensed for use in the EU, running out in 2017.

In light of a prolongation of the license, the European Food and Safety Authority (EFSA) – an EU institution – assessed the carcinogenicity of the substance between 2012 and 2015 and found that it is unlikely to cause cancer (EC, 2019). This finding contradicted research conducted by the International Agency for Research on Cancer (IARC, belonging to the World Health Organization – WHO) that found that the substance is probably carcinogenic (Cressey, 2015). However, based on its own assessment that found no causal link to cancer, the EC proposed to renew the license for the pesticide for another ten years in 2016, which was to be decided in the year 2017. Given the disagreements among several member states regarding the negative impacts of glyphosate, the contradictory scientific

evidence, and severe lobbying by corporate and civil society organizations using such contradictory results as a basis for lobbying (Greenhalgh, 2019), several discussions on the approval of glyphosate in European countries occurred during the entire year 2017. This was accompanied by the successfully supported European Citizens Initiative “stop glyphosate” that, amongst other prominent organizations, brought the issue to the agenda of European media. Eventually, in November 2017, the EC renewed the license of glyphosate on the EU market for another five years (EC, 2019). That is why the entire year 2017 was used as the time frame for studying this issue arena.

The idea that issues follow a cycle of up- and downturns has been developed early on in strategic issues management research (Zyglidopoulos, 2003). In the traditional, organization-centric view, public issues arise when stakeholders’ expectations are not met by the organization’s behavior (Lauzen, 1997). If the issue then receives political attention, the classic issue life cycle starts evolving through several phases starting from a stage of latency to increased attention and awareness climaxing in a period of crisis followed by (or sometimes parallel to) a phase where the solution to the issue gets implemented through new rules and standards (Post et al., 2002). However, in practice, it has been argued that issue cycles often do not follow such a linear pattern (Jaques, 2007). They can also re-start, end abruptly, or consist of several sub-cycles. Furthermore, approaching public issues from an issue arena perspective does not need to entail an expectations gap between organizations and stakeholders, but – as in the case of glyphosate – can center on a legitimate issue of public concern such as food safety (Coombs, 1992) and environmental consequences such as crop resistance. For the issue arena glyphosate, a Google Trend analysis gives one perspective of how the issue developed. It is based on the frequency that the term glyphosate was entered into the global Google search mask and thus gives a pretty rough estimate of the interest in the topic in 2017, where the issue is latent in the first two months of the year, followed by a rather long phase of awareness and public attention with two smaller peaks in May and July, before peaks in search interest are observable in October and November (see Figure 1).

As indicated above, the issue characteristics lend support to focus on this specific year in the issue debate, as the political decision of the license renewal stretched over the entire year (until the decision was taken in November); the European Citizen Initiative was founded only in December 2016; new scientific evidence had been published on glyphosate’s impact before (Federal Institute for Risk Assessment, 2015). Since the renewed license was only approved by the EC for another five years (instead of the initially anticipated ten years), it is likely that the issue cycle has not yet ended, but rather continues in a phase of latency or public awareness. Furthermore, newly released studies on glyphosate’s effects (Gillezeau et al., 2019) give the topic repeated attention in the media, along with

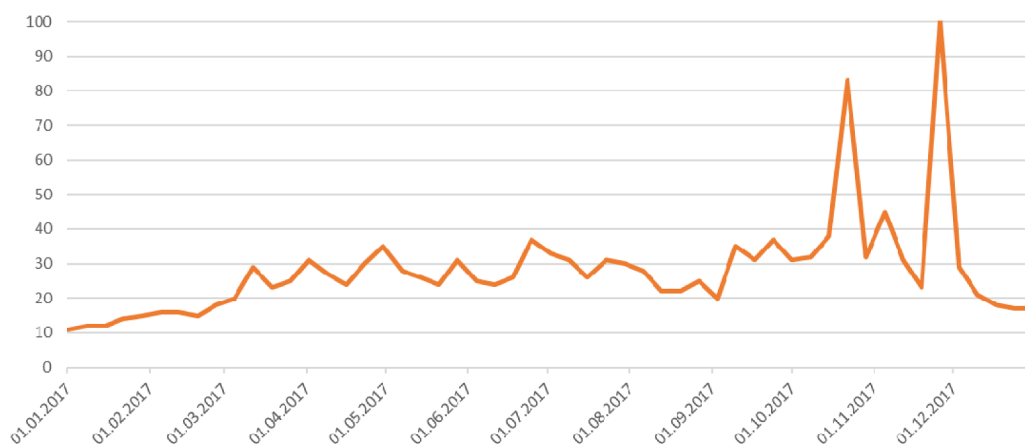


Figure 1. Google trends analysis as search interest relative of the term “glyphosate” in the year 2017 (01 Jan – 31 Dec). 100 indicates peak popularity. <https://trends.google.com/trends/explore?date=2017-01-01%202017-12-31&q=glyphosate>

several pending lawsuits in the US against Monsanto (Levin, 2019). From this perspective, Figure 1 depicts a sub-cycle in this issue's life.

Issue characteristics: Licensing glyphosate as a global public issue (RQ1)

Glyphosate is a legitimate public issue that has been discussed over an extended period of time before the EU decision and at a global level.

Since glyphosate is the most widely used pesticide in the world, its use is a legitimate issue for many people who are concerned about food safety, because it directly affects their everyday lives (Coombs, 1992). Potential health threats from food are a topic that often evoke emotions (Bundy et al., 2013), which makes it a valuable issue for news media (Roberts et al., 2002). Thus, glyphosate touches news values considered central for online media, namely, that readers can identify with the subject (via food security) and that it entails a potential for drama and bad news (Harcup & O'Neill, 2017). Given these online news values, glyphosate has been attracting media echo. Specifically, three topics were discussed: the potential for resistance of crops to this pesticide since it is sold with an adhesion contract that prevents farmers from using other weed killers ("What's coming to dinner," 2002); limiting the biodiversity in agricultural land (Nelsen, 2015); consequences for the health of humans in contact with the chemical, particularly its carcinogenicity (Wylie, 2015).

These topics have been discussed globally. Other countries outside of Europe had debated a ban on the pesticide in the years leading up to the EU decision, and intensified in 2017. In California, for instance, several communities have started discussing a ban (Fowler, 2017). First public discussions to ban glyphosate in New Zealand started in 2015, when a charitable fund and the green party called for prohibit the pesticide (Bruning & Browning, 2017). Ever since, the public and media debate on glyphosate and its consequences for crop resistance and human health have been ongoing at a global level, also due to successful lawsuits by claimants in the US ("Glyphosate under fire," 2018). Recently, a meta-analysis on the carcinogenicity of glyphosate by the German Federal Institute for Risk Assessment (Federal Institute for Risk Assessment, 2019) found that it is not causing cancer. Thus, the debate around the use and effects of glyphosate takes place globally, and touches on political, agricultural, corporate, and civil society interests around the world, making it a global public issue, even though policy implementation – as in the EU or New Zealand – is decided at national or supranational levels.

A multitude of actors (RQ2)

The glyphosate issue arena is marked by a variety of corporate, political, scientific, and civil society actors that influenced the discourse inside, but also outside the EU. These actors participate in the arena for purposes of "issue-promotion" (Van Aelst & Walgrave, 2016, p. 501), thus, to share their understanding of the issue via owned media or to put it on the agenda in the first place (Kiousis et al., 2007). The proposed method and analysis can possibly identify both: by analyzing the different sources and identifying owned media, it provides insights as to which organizations communicated directly; by analyzing the mentioning of organizations in earned media, it gives an indication of how active organizations were in building a media agenda or it hints as to how other actors talked about the organization when debating the issue. Such external analysis of media products cannot, however, identify agency of single actors, let alone speak to the internal considerations of organizations' strategies.

Regarding corporations, there are several producers of the pesticide in Europe, North America, and Asia (above all China) and the market has consolidated significantly forming corporations with large market shares: the US-American Monsanto corporation was bought by German Bayer, and the US-based Dow Chemicals and DuPont merged, while Swiss Syngenta merged with ChemChina (MacDonald, 2019). A frequent strategy in lobbying campaigns is building a coalition with competitors and allies to join resources for influencing politicians and public opinion (Oberman, 2017). Thus, several European chemicals corporations dealing in glyphosate organized in the industry consortium Glyphosate Task Force to influence the EU decision (Glyphosate Task Force, 2019). At the industry

level, the European Crop Protection Association is likely the interest group representing most of the pesticide industry in Europe, besides its national counterparts.

On the political level, the most prominent organizations are the EC and the European Parliament, the member states, and governments around the world. As a political and scientific organization, The European Food and Safety Association (EFSA, 2015) and the European Chemicals Agency (2017) found that glyphosate is unlikely to evoke cancer in humans and thus paved the way for the renewal of the license in 2017. Other scientific organizations that have been concerned with glyphosate assessments in the past and on an ongoing basis are manifold. The International Agency for Research on Cancer (IACR 2017) published a study contradicting the EU's findings and arguing for potential carcinogenicity in humans. Furthering the US-American debate, the California Office of Environmental Health Hazard Assessment, as part of the Environmental Protection Agency, stated in 2017 that it saw glyphosate as a chemical substance causing cancer and set it on a list of chemicals not to be spilled into drinking water (California Office of Environmental Health Hazard Assessment, 2017). The German Federal Institute for Risk Assessment in 2013 published a meta-analysis finding that results of previous studies regarding the glyphosate-cancer link were contradictory (2015).

Regarding civil society actors prominent in the issue arena, the environmental non-governmental organization (NGO) Greenpeace has been active in lobbying against the license renewal. In a coalition building effort (Oberman, 2017), it helped raise funding for a European Citizen Initiative with the title "stop glyphosate." In this new format of direct democracy, more than one million European citizens from seven different member countries need to sign to make an issue heard by the EC. In this case, the number was achieved in a short amount of time, illustrating the salience of the issue. The initiative was supported financially by a variety of other NGOs active in the issue arena, amongst others Campact, Greenpeace, BUND, Avaaz, or the Pesticide Action Network, which is a NGO specialized in taking action against pesticide use in the US (EC, 2017; Marquez, 2013). Resulting from the successful "stop glyphosate" initiative, the issue position of this group was officially heard twice by the EC (2019).

Places of interaction: Beyond Europe and global online media (RQ3a and 3b)

Places of interaction in issue arenas include physical as well as virtual spaces (Vos et al., 2014). As the European institutions are predominantly anchored in Brussels, and with most lobbying organizations hosting their European offices there, the city marks the most important space for the physical arena. The multiple actors, however, spread their positions in the media via various online outlets. Media arenas have been conceptualized to denote that politicians operate also outside of parliament to exert political influence, by acknowledging the important role of the media to reach and influence the public and other political decision makers (Van Aelst & Walgrave, 2016). Besides that, strategic communication via earned media (Stephen & Galak, 2012) is vital for all sorts of corporate, political, civil society, and scientific organizations (Savič, 2016). Some media outlets, such as Euractiv or Politico, are specialized in reporting from European politics. However, given the global salience of the issue in the year of the European decision and before, a variety of media outlets can be expected to have reported on the issue alongside. Thus, media reporting in different European countries, but also beyond in the US or Asia, have addressed the same issue thereby potentially connecting the global public issue with the local/national context (Vogel, 2008). For instance, California debated a ban of glyphosate after the EU discussion (Fowler, 2017). Such spillovers of salient and legitimate public issues from one national context to another can be observed by widening the scope of analysis beyond single countries to a global scale.

To classify different online media, the Pew Research Center has developed a typology of online news used for surveys (Purcell et al., 2010) including local and national online news (e.g., *South China Morning Post*), websites of radio or TV (e.g., iHeart Radio, CNN), or news portals (e.g., *Google News*). Next to these classic outlets, it also lists blogs or news offering predominantly commentary (e.g., Breitbart) that likely partake in the arena. However, with the topic touching on the one hand upon an issue important to the general public and on the other hand targeting specific audiences such as farmers or the chemicals industry, specialist media play a role in this issue arena, too. That is

why the existing news typology (Purcell et al., 2010) is detailed and expanded by an array of special interest media reflecting the most important actors: agriculture, chemicals, business, agribusiness, health, and politics. Moreover, to account for the different actors and their likely use of owned media in the issue arena (Savič, 2016), the online media typology used in this study adds owned media from the actors, thus, corporate, activist, and political organizations' websites, and, as a multiplier, press release wires.

Method

This study analyzed the global online coverage of the pesticide glyphosate inductively. This approach was chosen to study unknown topics in the debate and to uncover emergent relationships between the four levels of issue arena analysis (Kovalchuk et al., 2017). All online publications containing the keyword “glyphosate” in the entire year of 2017 as tracked by the GDELT (Global Database of Events, Language, and Tone) database ($N = 1677$) were analyzed with automated content analysis. The sampling was restricted to English-language publications by the system. GDELT is an openly accessible database that “monitors the world’s broadcast, print, and web news” (GDELT, 2019). It continuously scrapes the Internet globally and automatically analyzes the sources’ contents according to the GDELT 1.0 Global Knowledge Graph codebook. Here, themes, organizations, persons, locations mentioned in a text are – amongst other variables – automatically detected and can be used for further analyses. Given that the sample contains the entire online coverage of glyphosate in one year, the sample size invites an inductive, data-driven perspective for reasons of feasibility.

To analyze the topics emerging in the global issue arena on glyphosate (RQ1), this study analyzed the automatically coded themes of the GDELT 1.0 Global Knowledge Graph with LDA (latent dirichlet allocation) topic modelling, an inductive method of content analysis apt to uncover topical structures in large amounts of text (Maier et al., 2018; Strycharz et al., 2018) using the Gensim Python package (Rehurek & Sojka, 2010). To select the appropriate number of topics for the model, four models with three, five, ten, and fifteen topic models were calculated and alpha and eta were adjusted automatically. These four resulting topic models were validated by topic coherence per topic (see Table 1) and per model, and in terms of internal validity by manually checking a sub-sample of 25 cases per topic. The best fitting model contained three topics and had average topic coherence in terms of $U_{mass} = -0.61$. The topic scores were used for regression analyses, while for descriptive statistics, a cut-off value of 10 was defined to determine if a case featured a topic. Each source could cover multiple topics.

To bring these three emergent topics in connection to the organizational actors and locations, the study also systematically analyzed the mentioned organizations and countries as coded by GDELT (RQs2, 3a) using Python code and SPSS 25 (the data set is available via the author’s institutional data repository: <https://doi.org/10.21942/uva.c.5000639>). The subsequent analysis thus refers on the one hand to the visibility of organizations and countries in online news, but also on the actors’ direct communication with stakeholders via analysis of the sources, which is also referred to as “voice” in rhetorical arena theory (Raupp, 2019). As Hellsten and colleagues remark (2019), also passive stakeholders that are merely visible can possess agency in online issue arenas.

Following the GDELT 1.0 Global Knowledge Graph Codebook that suggests to delete outliers (cases appearing only a few times), only organizations that were mentioned more than four times in the sample were included, reducing the number of organizations in the dataset to 247. Multiple organizations and countries could be mentioned in a text and all of them were included in the analysis. Furthermore (RQ3b), the 478 different sources of media outlets emerging from the data set were classified into the expanded typology of online news media (Purcell et al., 2010). After initial coding, the typology was expanded inductively to further include lifestyle news, news agencies, and given the European tradition of publicly funded media, also public service broadcasters that offer a variety of channels (e.g., RTF in France; see also Table 3 for the typology developed and tested).

Table 1. Overview of the three topic models with article examples (which are exclusive to the topic).

Topic	Carcinogen	Political Action	Ban and its consequences for agriculture
Labels	Health nutrition and population Disease and population General health Medical Non communicable disease and injury Disease cancer Cancer Forests rivers oceans World mammals Agriculture and food security	Health nutrition and population Forests rivers oceans Policy Non communicable disease and injury Cancer Politics general Disease cancer General health Medical	Agriculture Policy Forests rivers oceans Farmers Ethnicity Ban Politics general Agriculture and food security World languages Leader
n	955	394	501
Umass	-0.53	-0.64	-0.67
Example article	Rosendahl and Forsell (2017)	“France to ban controversial weedkiller ‘within three years’ despite EU vote” (2017)	“Time running out in EU for glyphosate” (2017)

Results

RQ1: Issue characteristics – topics

To identify which topics were present in the glyphosate online issue arena (RQ1), the data was analyzed with LDA topic modeling. Based on the manual validation, close inspection of the labels, and several topic model calculations ($K = 3$), the following three topics emerged, which are not mutually exclusive (Table 1).

Texts adhering to the topic “carcinogen” center on the discussion whether glyphosate causes cancer in humans (and animals). This topic includes articles that argue for and against the carcinogenicity of the pesticide. The second topic, “policy action,” refers to media that debate a political action such as legislation, licensing, and approvals of glyphosate in different national and supranational contexts. Texts pertaining to the last topic, “ban (and its consequences for agriculture),” are about a (potential) ban of glyphosate and which consequences it might have or has had for the production of food, agricultural business, soils, efficiency, and related.

Over the analysis period, the topics follow a similar distribution (Figure 2), with “carcinogen” being the dominant topic throughout the entire period. Toward the decision date in November, “policy action” and “ban” are discussed more frequently by online media, but the discussion whether glyphosate causes cancer equally peaked around that time.

RQ2: Actors

RQ2 asked which organizations were mentioned most often in combination with the three topics (Figure 3). Looking at the top ten of most frequently mentioned organizations in the entire sample, dominant organizations were: Monsanto, the institutions of the European Union (EC, European Parliament, European Chemicals Agency, EFSA), research institutes such as WHO’s cancer research institute, and the US Environmental Protection Agency (EPA) and its department Californian Office of Environmental Health Hazard Assessment. These ten organizations were mentioned in combination with all three topics. More diversity appears at the ranks 11 to 20. The scientific journal *Environmental Health* appeared that published widely cited studies on the carcinogenicity of glyphosate in rats (Mesnage et al., 2015) and humans (Gillezeau et al., 2019; Myers et al., 2016) and was

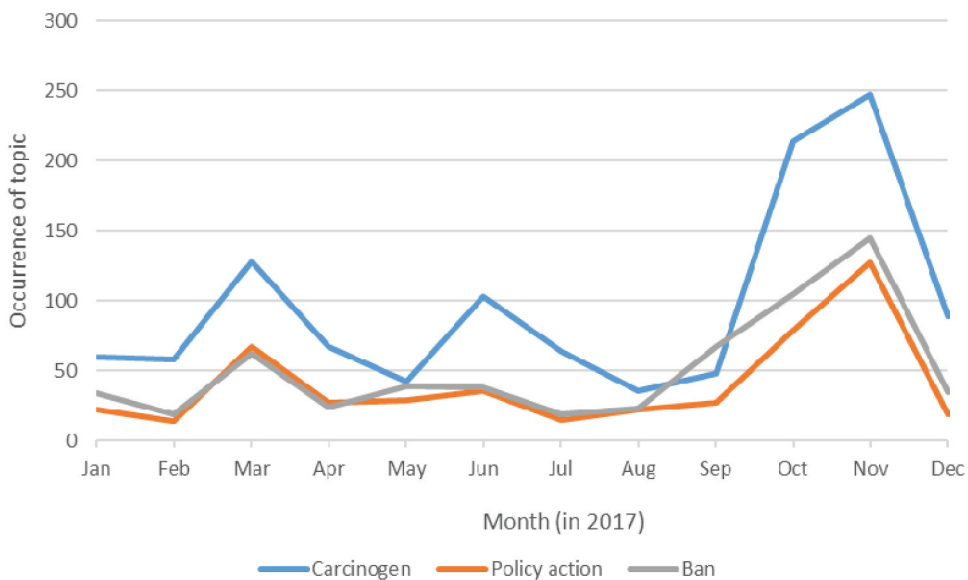


Figure 2. Topic frequencies per month in 2017.

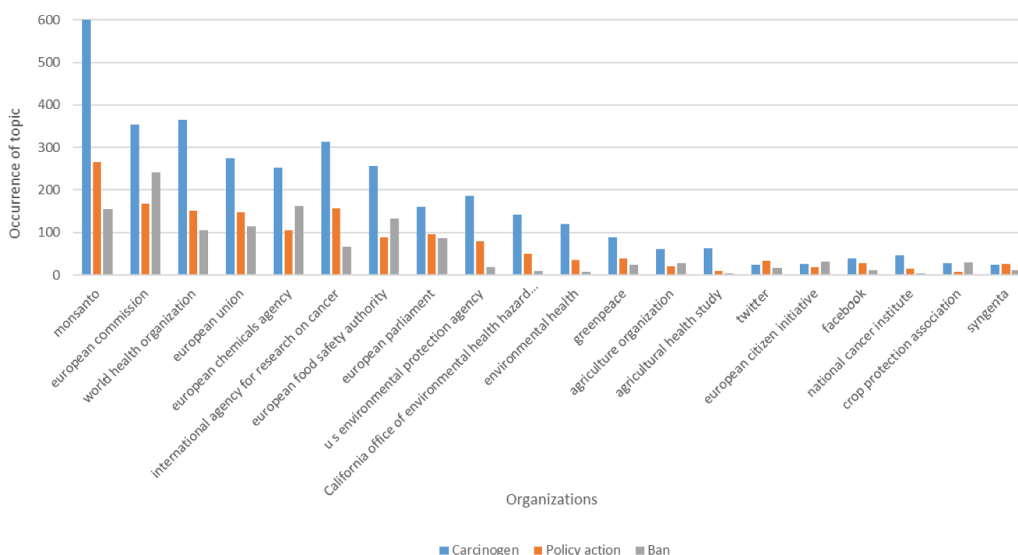


Figure 3. Twenty most frequently mentioned actors per topic.

automatically coded as an organization by GDELT, which implies that it is explicitly named in several documents. Similarly, reference is often made to the Agricultural Health Study, a large-scale US-American survey on farmers that found no relationship between glyphosate and cancer (2019). These two and the National Cancer Institute are often present when it comes to the topic of carcinogenicity, but barely mentioned in relation to a ban of glyphosate. The Crop Protection Association, the lobbying organization of pesticide producers, was visible in the topics “ban” and “carcinogen,” not so much in terms of policy actions. Furthermore, the National Cancer Institute and the Agricultural Health Study do not appear much in terms of policy actions. Surprisingly, Monsanto and Syngenta are the only two companies mentioned in relation to glyphosate. Greenpeace is the only nongovernmental actor present in the top 20, entering the debate mostly on the topic “carcinogen.” The European Citizens Initiative for a ban of glyphosate has been one of the first initiatives of this kind in the EU and has taken part in the debate especially on this topic. Twitter and Facebook appeared frequently as the only two social media platforms, indicating that considerable discourse on glyphosate also happened via these channels. Whether these social media platforms or their properties such as hashtags (Hellsten et al., 2019) can be considered actors in issue arenas is an intriguing question for future research but goes beyond the scope of this study.

RQ3a and 3b: Places of interaction – sources

RQ3a analyzed with which countries the emerging topics were associated to evaluate whether it is a global public issue. Overall, the United States ($n = 784$) and France ($n = 529$) were mentioned most frequently (Table 2), and the top five countries constituted additionally by the United Kingdom, Germany, and Belgium also make up the five most frequently countries per topic. Apart from these top five, different patterns per topic could be observed (Figures 4–6). References to European countries are most prominent with the topics “ban” (Figure 6) and “policy action” (Figure 5), while the matter of carcinogenicity appears to be debated also in Oceania and Japan (Figure 4). Interestingly, a ban was frequently discussed in Sri Lanka, where a ban on the pesticide had already been implemented. The country prohibited the use of the pesticide in 2015 (“Govt bans import of chemical herbicide,” 2015), before lifting the ban again in 2018 for specific agricultural sectors due to massive pressure from the tea industry (“Cabinet approves lifting of Glyphosate ban,” 2018).

Table 2. Twenty most frequently mentioned countries.

Country	# mentioned
United States	784
France	529
Germany	425
Belgium	391
United Kingdom	374
Canada	170
Italy	129
Ireland	128
Portugal	104
Australia	92
India	88
Netherlands	86
Japan	79
Sri Lanka	75
China	74
Argentina	72
Poland	71
Spain	66
Malta	61
Romania	61

Table 3. Frequencies and percentages of online sources and news in the sample. Multiple sources can publish the same article.

Online (news) source	n	%
<i>Source websites:</i>		
Activist groups	68	4.01%
Corporate	14	0.83%
Industry associations	7	0.41%
Blog	54	3.19%
Political organization	13	0.77%
<i>News types:</i>		
News agency	76	4.49%
Local and regional news	133	7.85%
National news	214	12.63%
News portal (e.g., Google News)	46	2.72%
Press release wire	55	3.25%
Public broadcaster	36	2.13%
Radio	69	4.07%
TV	58	3.42%
<i>Specialist news:</i>		
Agriculture	344	20.31%
Agribusiness	43	2.54%
Business	104	6.14%
Chemicals	3	0.18%
Environment	47	2.77%
Health	27	1.59%
Lifestyle	39	2.30%
Mixed	100	5.90%
Politics	87	5.14%
Science	11	0.64%
Other specialized	22	1.30%
Other	14	0.83%
Unavailable	10	0.59%
Total	1694	100%

A variety of 478 online sources published on the issue glyphosate in 2017 (RQ3b). They could be classified into 25 different types of media (Purcell et al., 2010; see Table 3). Contents on social media

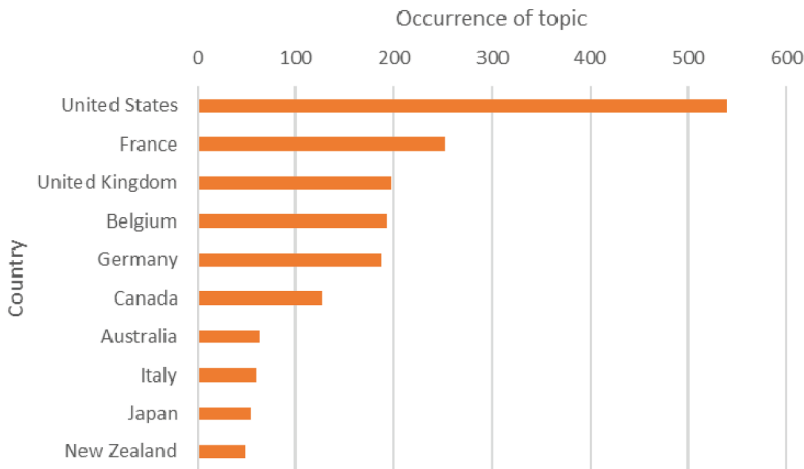


Figure 4. Ten most frequently mentioned countries topic “carcinogen.”.

such as Twitter and Facebook were not included in this data set; they only appear when explicitly mentioned by one of the media sources (see results on actors above).

Direct communication via owned media was rare. The most often mentioned actors in the issue arena, namely, the regulators and the corporations affected by a regulation, did not communicate directly with their stakeholders, as only 13 (0.77%) documents in the sample stemmed from political organizations (e.g., EC). Corporate actors, either alone or via industry associations, amounted to a small 1.2% ($n = 21$). Press release wires ($n = 55$, 3.25%) are potentially another channel for distributing official statements from these actors, but the origins of the press releases were not traceable. Online media with the most publications in the issue arena were agricultural news ($n = 344$, 20.31%), followed by national ($n = 214$, 12.63%) and local news ($n = 133$, 7.85%), business news ($n = 104$, 6.14%), and news that mix journalistic content and commentary ($n = 100$, 5.90%).

Moreover, RQ3b asked in how far these media pushed any of the three topics specifically. To answer it, three multiple ordinary least square regressions were performed with the topic scores of the three topics as the dependent variables and the news types as binary independent variables. Only news types with more than 25 cases were included in the regression (i.e., excluding specialist chemicals

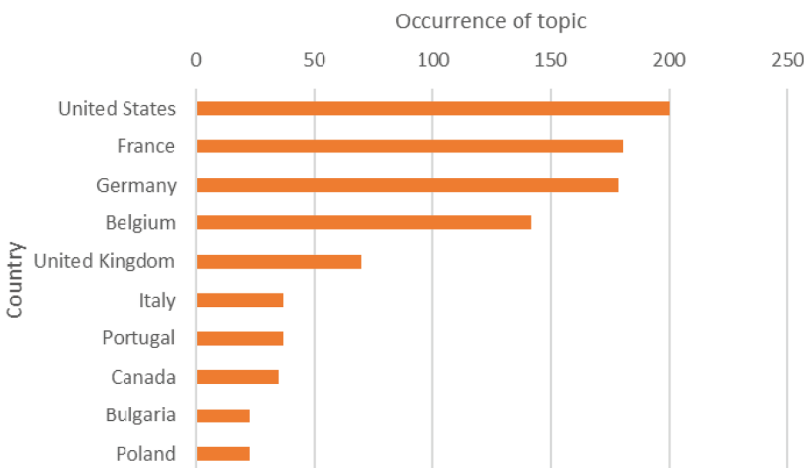


Figure 5. Ten most frequently mentioned countries topic “policy action.”.

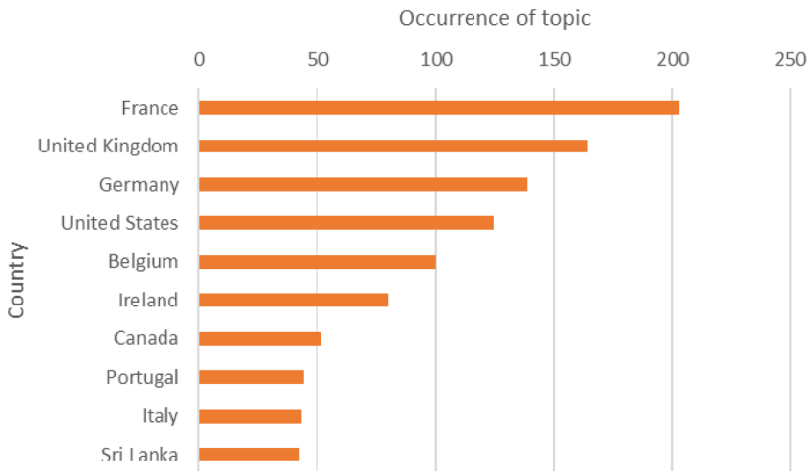


Figure 6. Ten most frequently mentioned countries “ban.”.

media, corporate, industry associations, unavailable, other specialist, political organizations, science, and others). Table 4 shows the results of the three regression analyses.

Different patterns per topic model emerge. The topic “carcinogen” is propelled by activist websites and a variety of specialist media, including environmental, health, and lifestyle news, along with public broadcasters, local news, and mixed news, but not by press release wires and agricultural news. On the contrary, “policy action” is pushed by environmental and mixed news, but not by press release wires and agricultural news. The “ban (and its consequences for agriculture)” is significantly more present with lifestyle news, but significantly less featured by TV, national and local news, blogs, mixed news, news agencies, and the least by activist media.

Thus, activist and local news websites appear to push the topic “carcinogen,” while it is not likely that they cover the “ban (and its consequences for agriculture)” prominently. Mixed news websites

Table 4. Three multiple linear regressions predicting the occurrence of each of the three topics independently from different news sources, showing unstandardized coefficients.

DVs IVs	Carcinogen	Policy action	Ban (and its consequences)
Intercept	19.61**	10.46**	11.08**
Activist	6.55*	4.31	-7.70**
Agency	0.87	.36	-3.20*
Agriculture	-1.58*	-1.92**	.31
Agribusiness	1.80	-1.28	.08
Blogs	.41	1.26	-1.53**
Business	-.20	-.36	-.45
Environmental	2.02**	1.37**	-.44
Health	1.34**	-.47	-.61
Lifestyle	.73*	-.00	.54*
Mixed	.57*	.64**	-.40*
Local news	.47**	-.30	-.27*
National news	.01	-.00	.02
Politics	.10	.23	.22
News portal	.09	.04	.08
Press release wire	-.35*	-.38*	-.27*
Public broadcast	.54**	-.13	-.27
Radio	-.15	-.18	-.15
TV	-.22	-.24	-.25*
R ²	.071	0.06	0.05
F	(18, 1676) = 7.04**	(18, 1676) = 5.64**	(18, 1676) = 4.44**

N = 1677. * p ≤ .05, ** p ≤ .01.

seem to propel the topics “carcinogen” and “policy action,” but not the “ban (and its consequences for agriculture).” Also for environmental news, the focus is likely to be on “carcinogen” and “policy action.” Press release wires are not likely to feature any of the topics prominently.

The finding that activist websites appeared to focus on the topic “carcinogen,” but did not push the “ban (and its consequences for agriculture)” is intuitive in so far as the websites included in the sample such as *slowfood.com* or *beyondpesticides.com* are clearly positioned against pesticides. Similarly, environmental media such as *inhabitat.com* or *ecowatch.com* featured “carcinogen” and “policy action” prominently. Websites that mix commentary and news such as *huffingtonpost.com* or *opednews.com* were not likely to cover the “ban (and its consequences for agriculture),” but rather “carcinogen” and “policy action.” While one might have expected agricultural news websites not to focus too much on the carcinogenicity of glyphosate and the policy actions, more prominence of a possible ban and its consequences for farmers in these channels would have been intuitive. However, the latter was prominently covered only by lifestyle media.

Discussion

Organizations continuously scan the environment to detect emerging issues and to properly respond to other actors’ communications. Thus, online issue arenas where global public, i.e., macro, issues are debated merit a large-scale analysis of the topics discussed in relation to the issue, also over time. An inductive approach that scans global online media comprehensively for a variety of upcoming topics (Van Aelst & Walgrave, 2016) allows for such an open-ended macro-level analysis to describe emerging communication patterns.

In the online issue arena glyphosate in 2017, three topics were most salient: carcinogenic, policy action, and ban (and its consequences for agriculture). All these topics followed the same pattern over the course of 2017, with peaks in March, June, and October/November. While the last peak is attributed to the EU decision prolonging a license for glyphosate early November and the public hearing of the “stop glyphosate” initiative in October, the peaks in March and June do not follow the course of events of the issue. A discussion at the EC level on restarting negotiations with States took place in May, and then again in July. The peaks in media attention in the months following up on these two events could indicate that actors in the issue arena attempted to influence decision makers in the foreground of these discussions via online media on purpose through their strategic communication (Hallahan et al., 2007) in the hope for agenda-setting effects (McCombs & Shaw, 1972). Agenda-setting effects have a time lag, thus, for some issues it takes longer until decision makers are aware of a specific issue position, for instance, because the issue is very controversial (Roberts et al., 2002). In this case, the early media coverage one/two months before the political events can be explained with an indirect communication strategy pursued by the actors in the arena, targeting political decision makers via public opinion (McCombs & Shaw, 1972). This is also evident from the finding that earned media were the most frequent sources in the arena, while direct communication via websites was comparatively rare. Supporting this conclusion, recent press coverage indicates (Balsler & Bauchmüller, 2019) that lobbyists established direct contacts with decision makers on glyphosate before the official discussions. The online media echo detected by this study can thus be seen as a communication strategy accompanying lobbying activities to exert influence indirectly and to make the issue appear more salient in the eyes of politicians (Van Aelst & Walgrave, 2016).

News values research for online environments indicates that sensation and identification are central to attract readers, along with drama and bad news (Harcup & O’neill, 2017). While the carcinogenicity of the substance was most salient, it is but one of the many effects of the pesticide worth of discussion. Interestingly, the issue of crop resistance or glyphosate’s detrimental consequences for biodiversity (Nelson, 2015) were not prominent in the arena. Since the scientific results on the carcinogenicity of the chemical were contradictory, they appeared worthy of discussion, and in addition stemmed from research institutes with high reputations, such as EFSA or IACR. Moreover, carcinogenicity is emotional, touching on stakeholders’ identity and culture (Bundy et al., 2013). Clearly, a link between

the most widely used pesticide in food production in the world and cancer touch upon more news values than crop resistance or biodiversity. This is also evidenced by the finding that environmental NGOs such as Greenpeace feature carcinogenicity as the main issue with glyphosate and did not promote resistance and biodiversity – that at first glance appear closer to the organization’s mission – as fiercely.

When it comes to indirect influence via the media, the prominence of carcinogenicity can also be a sign of a particular lobbying tactic, namely, using (selective) scientific evidence to corroborate an issue position to enhance the credibility of the claim by reference to renowned institutions (Lock et al., 2016). This is supported by the fact that neither scientific organizations nor specialized science media appeared as directly communicating participants in the issue arena. Scientific knowledge was visible, but mostly via earned media. Considering that the journal *Environmental Health* was mentioned so frequently in the arena also lends support to this thesis, as reference to peer-reviewed journals has in the past been witnessed in other public policy debates as a lobbying tactic (Moodie et al., 2013).

This study thus shows that with the glyphosate-cancer link being most dominant, other debatable impacts of glyphosate were sidelined. From a strategic communication perspective, one could argue that the organizations intentionally focused on this aspect of the issue of detrimental effects of pesticide use because of its newsworthiness for agenda-building purposes (Kioussis et al., 2017). Focusing on a particular aspect of an issue (Klüver et al., 2015) speaks better to the short news cycles and attention span of readers than promoting a complicated story. In this vein, it is not a surprise that only three topics emerged overall that were dominant in the arena.

Policy action as the second most frequent topic in the arena speaks to the context of this global public issue, namely, that it is decided in the policy realm of the nations or supranational institutions (Vogel, 2008). The third topic “ban (and its consequences of agriculture)” illustrates that one of the main stakeholders in this issue arena are farmers who are directly affected by this policy decision. It could be expected following agenda-setting theory (Kioussis et al., 2017) that particularly the corporate actors, Monsanto, Syngenta, and with them the industry association Crop Protection Association or other agricultural organizations, propelled this topic, as it would strategically fit with the organizations’ policy position to avoid a ban. However, we only have evidence that these organizations were mentioned together with the ban frequently but cannot identify agency here directly.

Visibility and communication strategy: Classifying actors in online issue arenas

The study contributes a novel perspective on the role of actors in online issue arena research by proposing an alternative model for actor classification. A variety of civil society and political organizations, scientific institutions and corporations participated in the issue arena glyphosate, but with different strategies. While corporate and political actors were highly visible, only civil society actors communicated directly with stakeholders via their websites. The most prominent channels through which the debate took place were news media (Hellsten et al., 2019). Thus, the communication strategies applied by most actors relied on agenda-setting effects rather than controlling the message through owned media, which are, as many scholars have argued, organizations’ preferred channels in a digital communication environment (e.g., Valentini, 2015).

The issue arena approach proposes that active and passive stakeholders take part simultaneously. Passive actors can take on an active role (and vice versa) any time (Vos et al., 2014). However, the glyphosate issue arena shows that the distinction is more fine-grained: the scientific institutions IACR and EFSA were passive actors as they did not interfere in the arena, but they were highly visible with very few publications (studies and related press releases). On the other hand, Monsanto was certainly a central actor active in the arena. However, it did not communicate directly with other stakeholders, but via agricultural news or traditional news media, and, as some news reports indicate (Balser & Bauchmüller, 2019), also indirectly sponsored media coverage and scientific results, a practice known from the food industry (Greenhalgh, 2019). Thus, these actors would be regarded as passive and active,

but they both communicate indirectly via different media. Therefore, it is suggested here not to classify actors according to their active and passive role, but along their visibility and communication strategy.

As Raupp (2019) suggested, actors in media arenas are visible if they are mentioned often in news media, but only have voice if they are cited directly. This can be seen as a media-centric perspective of organization's strategic communication. To add another dimension emerging from the analysis, it is suggested to also take into account their communication strategy. Combining these two elements, a new model of actor classification in online issue arenas is proposed taking in these two dimensions and taking on an issue arena perspective from a strategic communication point of view. One axis reflects the visibility of the organization or stakeholder in the issue arena, measured by the frequency of mentions of the actor and ranging from low to high. The other axis reflects the communication strategy of the actor, from direct communication via owned media such as websites or blogs to indirect communication via news or specialist media or via social media. Figure 7 illustrates the classification of the actors in the glyphosate issue arena along the two axes:

Overall, the analysis indicates that corporate, scientific, and political actors were visible, but did not use owned media to communicate directly with stakeholders (shared media were not part of the analysis). Two corporate actors were most visible, Monsanto followed by Syngenta. This can be explained by past scandals involving Monsanto resulting in more public spotlight on the company (e.g., "Monsanto deny cancer threat," 1999). Alternatively, these organizations might have reached out to earned media for building their agenda indirectly to profit from agenda-setting effects on stakeholders' attitudes toward the issue (Kiousis et al., 2017; Stephen & Galak, 2012).

Organizations do not only form issue arenas through their strategic communication, but also monitor them to find strategic responses to the issue along its life cycle (Ewing, 1990; Lauzen, 1997), which can explain why other corporate players such as DowDuPont and the industry association Glyphosate Task Force were neither highly visible nor appeared to be communicating directly. Political organizations such as the EC and scientific institutions such as the EFSA were equally highly visible in the debate but did not interfere via their own websites. Among civil society, the variety of organizations was rather limited to Greenpeace and the "stop glyphosate" initiative, showing a coalition building strategy also among civil society actors in this lobbying campaign (Oberman, 2017). While these activists were highly visible and communicated directly,

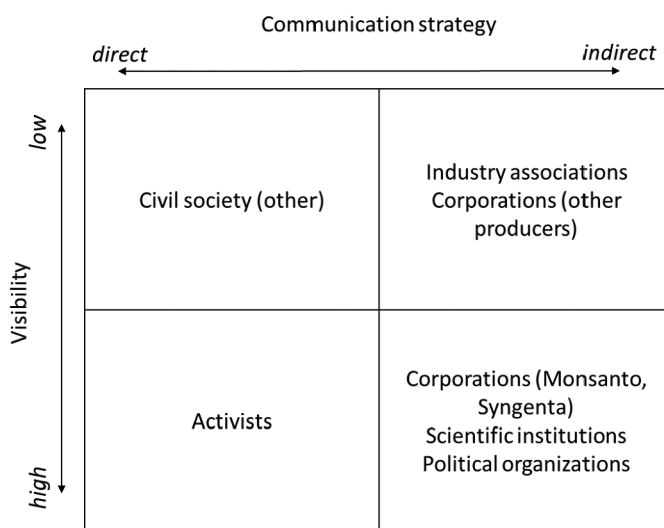


Figure 7. Classification of actors in the online glyphosate issue arena.

there were also quite some civil society actors not mentioned as frequently, but using their own channels to communicate directly, for instance, via blogs.

This actor classification can aid strategic communication researchers to set up research designs for case studies of, for instance, crisis communication cases, and can help in the analysis of global online issue arenas other than glyphosate. For practitioners, it provides a useful combination of two important strategic considerations: an organization's (intended) visibility and its communication approach. Thus, it helps identifying the communication strategies per life cycle stage depending on the desired visibility of the organization.

Convergence of arenas

Research on the rhetorical arena of the Volkswagen diesel scandal (Raupp, 2019) and the issue arena of the swine flu discussion in Finland (Luoma-aho et al., 2013) assumed that first, distinct social media and media arenas exist (Van Aelst & Walgrave, 2016), and found that, second, corporate, political, and scientific actors were more dominant in the media arenas. The glyphosate issue arena, however, emerged as a converged communicative space, where a myriad of owned and above all earned media outlets – traditional local and national news media, activist groups' websites, blogs, websites mixing news and commentary, and specialist media – participate actively. Thus, the online media landscape appears fragmented and multifaceted. In addition, also in supposedly separate social media arenas it is often news media, not the actors themselves, that most actively communicate (Hellsten et al., 2019). Thus, organizations act in a converged communicative space where besides owned and earned, also shared media are present (Vos et al., 2014). This complicates practitioners' task of developing and enacting a successful strategic communication plan addressing owned, earned, and shared media and targeting specific audiences. Therefore, it appears vital to use an extended typology of news media as proposed here to cope with the multiple (here, 25) facets of the online media landscape.

Just as the different online media arenas are intertwined, so are the discourses at a global level, resulting in a global issue arena in the case of glyphosate, which the organizations need to monitor, and most likely do with the help of applied research companies. A geographical focus on four European countries (UK, D, F, BE) and the US emerged. Belgium was likely frequently visible because the physical playing field is Brussels. Similarly, it can be deduced that the US is mentioned often because it was at the time home to the most frequently mentioned corporate actor Monsanto and since its research institutes (e.g., IACR) and political institutions such as the Environmental Protection Agency published important studies and positions regarding the most prominent topic carcinogenicity. France and Germany are the largest countries in the EU, with France hosting (part of) the Parliament in Strasbourg and Germany's Federal Institute for Risk Assessment (2015) partaking in the debate by publishing evidence on the carcinogenicity of glyphosate contradictory to the IACR (2017). However, the data also showed that glyphosate was debated outside the Western hemisphere, particularly in Oceania and Japan, but also South America. The focus on "ban" is evident in Sri Lanka, with the political decision to set and three years later lift a ban on glyphosate imports ("Cabinet approves lifting of Glyphosate ban," 2018). In Oceania and Japan, the cancer link was discussed more. Given this global media environment and the role of online media for agenda setting and its effects on politicians', but also public attention (Happer & Philo, 2013; Lerbinger, 2006), it can be assumed that this global discourse also influenced the debate in Europe. Thus, the inductive method applied here allows to uncover global discourses that might not have been in the researcher's focus. It thereby also aids strategic communication practitioners' environmental scanning procedures by identifying potentially emerging issues that might become relevant for an organization in the future (Lauzen, 1997), but which are not salient in the organization's main national contexts. By localizing the issue in its life cycle, such an analysis then also helps fitting a communication plan to the life cycle stage of the issue (Post et al., 2002).

Limitations and future research: Using GDELT data in strategic communication research

Since this study – to the best of the authors' knowledge – is the first analysis of GDELT data in strategic communication research, next to discussing its limitations also suggestions for future research with these real-time data are proposed.

A limitation of this automated inductive content analysis is that it focuses on large scale rather than in-depth analysis and thus provides a rough picture of an issue arena, mostly resulting in descriptive statistics. Thus, by applying this method researchers can identify emerging communication structures in an issue arena with a broad focus and at a large scale. However, it cannot provide an in-depth investigation into discursive patterns or unravel latent constructs in communication exchanges as for instance, discourse analysis can do (King, 2009). However, this limitation also marks a starting point for further research: inductive topic modelling is suited at the outset of a project to build a research design focusing in detail on specific actors' communication strategies, for developing codebooks, or to qualitative analyze the discourse. It thus aids in mapping the communication environment of an organization regarding a specific issue.

This study does not claim to extract the frames of the debate on glyphosate; rather, it has singled out topics that are salient in online media. For further analysis from a framing theory perspective (Klüver et al., 2015), manual content analysis is necessary as a start, to be adopted, in a following step, as input for supervised machine learning. From a practitioners' point of view, the applied method can neither inform the organization about the framing or rhetorical strategies of other actors in the arena, nor can it provide suggestions on which messaging strategies to apply. However, it can aid in identifying potentially relevant emerging issues also outside of the organization's main societal context and help localize them in the issue life cycle, thus improving environmental scanning procedures and the planning of communication (Lauzen, 1997).

It is argued here that the different arenas of issue debate converge; however, the study here focused on online media only, and given the focus of the GDELT database on online coverage, did not include shared social media. Furthermore, physical arenas where the actual political decisions are taken both locally, nationally, or supranationally have not been studied here. To deepen the assumptions of convergence of arenas, further studies on social media and, above all, physical arenas are necessary.

The study found that only a few topics of the issue debate were dominant. However, it could not detect why they resulted prominent and how they emerged. Particularly the emergence of online issues and the salience of different aspects would merit further scrutiny by strategic communication researchers. This is important also to practitioners, as identifying the underlying factors that trigger the emergence of issues could optimize their environmental scanning activities.

The study introduced the GDELT database as a fruitful data source to be tapped for strategic communication research (for a newly introduced tool facilitating its use, see Hopp et al., 2019). It provides real-time data on media and online coverage worldwide. Several different data sets can be accessed by researchers, such as event data or, as used here, automatically coded themes according to the GDELT codebook and knowledge graph. This double automated content analysis procedure has certain drawbacks in terms of internal validity and makes interpretation rather difficult. That is why the manual check of sources per topic is crucial.

GDELT data can be used for a variety of digital strategic communication research applications. Besides the coded themes, the underlying codebook offers a lot more variables to be included in further analyses. Sentiment data could be correlated with an organization's visibility to analyze in how far the online coverage is positive or rather negative and to detect changes over time and sources, for instance, in crisis communication research. Single persons are registered by the codebook, such that, for instance, the prominence of managers of a company can be analyzed, to contribute to the literature on CEO reputation. For the study of social movements, GDELT data can be used to map protests, for instance, the Women's March, and organizations' reactions to such events, either in terms of crisis communication or regarding corporate political advocacy. With the development of more accessible tools for (strategic) communication researchers (Hopp et al., 2019), even more application areas will

become apparent that do not require programming or database handling skills. Furthermore, the global focus of the database allows including the under researched area of the Global South to get a bigger picture of strategic communication's impact across the world.

Conclusions

The issue arena approach has been proposed as an alternative to organization-centric stakeholder models of communicative interaction and allows studying salient and societally relevant issues (Vos et al., 2014) just as the controversy over the pesticide glyphosate. Looking at this big picture allows researchers to analyze the role of organizations in forming and monitoring such global debates. For practitioners, monitoring the macro-level can help set the goals of the (communication) strategy and can inform the many facets of strategic communication practice, media relations, public affairs, political public relations – just to name a few. On a methodological level, this study proposes using topic modeling as an inductive method to analyze issue arenas without limiting the researcher's focus to predefined framing logics to address and help understand complex digital communication environments (Kovalchuk et al., 2017). This approach thus facilitates discovering unknown frames, uncovering emerging communication patterns, or building theory from observation.

Disclosure statement

No potential conflict of interest was reported by the author.

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