

How and Why Some Issues Spread Fast in Social Media

Boyang Zhang, University of Jyväskylä, Finland

Marita Vos, University of Jyväskylä, Finland

Abstract

This paper brings together current insights from various disciplines into the spreading of social media posts. By a structured literature review of peer-reviewed literature 39 recent articles on diffusion in social media were located. The search spanned 10 years, although all the papers found were published after 2009, indicating that the examination and observation of spread patterns in social media is still in an early stage.

The analysis focused on spread patterns and factors that may explain how rapidly issues spread in the online environment. Based on the findings, from an organizational perspective a model is constructed and directions for future research are suggested. The model focuses on characteristics of the issue, of the social media involved, actor resources and general factors. A better understanding of how social media posts spread helps organizations to be prepared for upcoming issues and crises, such as launching early rumour detection to prevent losses in organizational and brand image.

Keywords: Diffusion, spread patterns, social media, monitoring

Introduction

The aim of this paper is to clarify the diffusion patterns and factors that explain the spread of issues in social media. This can help organizations to interpret the results of social media monitoring and decide on the necessity for social media interventions. To this end, the paper adopts a broader perspective, collecting insights from various disciplines on diffusion in social media.

Social media allow people to build social networks using internet applications that provide users with a variety of exchange platforms (Nadeem, 2012; Wang, 2012). This has led to an explosive growth of social media posts. For organizations, the rapid development of social media brings not only insights into customer opinions and new ways to spread their own viewpoint (Kumar & Mirchandani, 2012), but also rapid diffusion of possibly unexpected topics, such as negative electronic word-of-mouth messages (Zhang, Jansen, & Chowdhury, 2011). Nowadays, the universal use of social media has become a priority in order to improve organizational performance and enhance communications with users (Fan, Geddes, & Flory, 2013). Social media may strengthen organizations' ability to reach a large audience. However, alongside opportunities, social media interaction also brings challenges, e.g. "the advent of consumer-generated content and its rapid diffusion takes much of the control over messages away" (Farshid, Plangger, & Nel, 2011, p. 228).

Issues are topics discussed publicly (Coombs, 2002), in issue arenas that can be traditional news media and new online media (Luoma-aho & Vos, 2010). They can pose problems or opportunities for an organization, as the topics discussed may be linked to an organization and affect the interaction with public groups. Issues are not owned or defined by organizations. As Heath (1998, p. 275) puts it, "In this era of cyberspace, the Internet and Web have come to be a powerful arena for such discussions which do not allow media reporters, editors, and news directors or governmental officials to be the final power in determining whether issues discussants can have their voices heard".

Although organizations realize that they are not in control of the spread of issues in social media, for issues management purposes they need to be aware of what might be coming. Monitoring discourse on topics related to a certain organization may reveal a number of topics, but which of these are likely to grow fast? Predicting the growth of issues requires a better understanding of the ways in which issues spread in social media, for example insight into spread patterns, and factors that may explain rapid issue growth. What makes ideas or issues stick, a phenomenon known as ‘stickiness’, can be modelled as the probability that a post is passed on to others (Romero, Meeder, & Kleinberg, 2011). Hence, as stated by Rogers, Chapman, and Giotsas (2012, p. 120) “it is crucial to understand the type of content that is likely to be shared”.

The theoretical basis for this paper is based on a structured literature review. Below, the method used to select the literature for review is described, and the insights are reported. Finally, a model is constructed, and conclusions are given.

Structured Literature Review

Following a literature search, key sources in refereed journals were identified and analysed to find recent insights on the ways in which issues spread in social media and the factors that may enable or hinder fast issue growth. The method of a systematic literature review was chosen to provide a consistent knowledge base, adopting explicit procedures and including documentation of the selection criteria (Sümer, 2011). After trying out different keywords, the words “social media” and [diffusion or disseminat* or prognos*] and [issue or "information spread*" OR message*] were chosen. The search included the databases EBSCO and ProQuest and spanned 10 years. Initially, 62 papers were identified, and after scanning for relevance based on the keywords, this yielded 31 articles from 2010-2013. Snow-balling added 8 more articles. A total of 39 articles (marked with an asterisk in the list of references) were further analysed.

The content of the articles was scrutinized in a thematic analysis using a data extraction table.

The analysis focused on the following research questions:

- (1) How are issues diffused in social media, according to the literature?
- (2) What factors, according to the literature, influence the spread of an issue in social media?

The findings show increasing research attention to the spread of social media posts. Of the refereed articles found, 6 were published in 2010, 7 in 2011, 17 in 2012 and 9 articles up to mid-2013, when the search ended. The journals showed a wide range, four journals yielding 2 articles (Behavioural scientist, Physical Review, Vaccine and PLoS ONE) and several journals one article. In this way insights from various disciplines were gained. Below, we report the findings on viewpoints concerning diffusion in social media, how issues spread in social media and, what are the enablers and barriers to this, according to the literature.

Viewpoints on Diffusion in Social Media

The point of departure of this study was to clarify insights in the literature on the spread of social media posts. Each article found revealed a different and often unique angle on the topic, making it difficult to form a clear picture of the state of play. Therefore, we first reflect more deeply on the different objectives of the investigated publications in investigating the spread of social media posts.

In the investigated literature – drawn from a variety of disciplines –the reasons for studying diffusion in social media, show considerable diversity. Many authors were keen to find out how messages can be spread *rapidly and widely* on the web:some had advertising goals in mind (Li,& Shiu, 2012; Williams, Crittenden, Keo,& McCarty, 2012; Zhang et al., 2011), while others sought to engage people in an educational health campaign (Bosley, Zhao, Hill, Shofer, Asch, Becker,& Merchant, 2013; Desai et al., 2012) or a political campaign (Bronstein, 2013).

However, some researchers were interested in finding ways of *reducing* the diffusion in social media, in order to counteract incorrect messages. This concerned false rumours about

organizations, or messages that could be detrimental to the health of the receivers (Lau, Gabarron, Fernandez-Luque, & Armayones, 2012), for example vaccine-critical blogs (Keelan, Pavri, Balakrishnan, & Wilson, 2010) or videos on YouTube (Robichaud et al., 2012).

Other authors were not interested in spreading a message widely, but rather at a more *precisely targeting* of message content (e.g. Cain, Romanelli, & Fox, 2010). Finally, for some authors, the focus was not on social media interventions but on collecting evidence about the *evolving needs* of public groups so as to reveal problems at an early stage and thereby support risk communication and management (Hiltz, Diaz, & Mark, 2011).

In all of the above cases, a better understanding of the factors that influence the spread of issues in social media may, depending on the purposes of the organizations and their communication policy, facilitate decision-making on tailored communication strategies. The importance of monitoring the social media environment has been underlined (Ruggiero & Vos, 2014).

Monitoring provides a picture of the situation at a certain moment, but does not per se reveal which of the issues found will spread fast. To do this would involve *repeated measurement* to extrapolate trends. However, while this may enhance quantitative understanding of the spread of issues, a fuller understanding would also need a *qualitative approach* to reveal the factors behind the (expected) success of some issues, and the (expected) failure of others, in achieving rapid and wide dissemination. Therefore, ongoing monitoring activities and a better understanding of issues spread in social media and the factors that may enable or hinder dissemination, are important for organizational decision-making.

How Social Media Posts Spread

In the social media environment, the organization does not need to seek out all the relevant stakeholders, as social media users are linked in various ways and messages may find their way via searches as well as, for example, followers or friends (Bronstein, 2013; González-Bailón, Borge-Holthoefer, & Moreno, 2013). Moreover, users often produce and

initiate the spread of issues themselves. In the following sections, we summarize how issues spread in social media, as described in the literature.

Cascading

In the literature, spread patterns are seen as directed by the paths along which messages travel in social media. Various authors (e.g. González-Bailón, Borge-Holthoefer, & Moreno, 2013) have conceptualized this as cascading, a process by which a particular message is passed to a first group of receivers who then *pass it on* to the next, and so on, until an extensive network is built up. Generally, by standing out in social media, cascading allows users to contribute to a virtually unlimited process of diffusion. In micro blogs such as Twitter, people have followers, and therefore any message emitted from a node will immediately be available to anyone following the tweet sender (Borge-Holthoefer, Rivero, & Moreno, 2012). By a simple retweet, messages spread, embarking on numerous different paths (Bosley et al., 2013; Stefanidis, Crooks, & Radzikowski, 2013; Stieglitz, & Dang-Xuan, 2013; Zhang et al., 2011).

The concept of cascading suggests that posts that are passed on may multiply. However, not all posts will be shared by cascading. Empirical research on Facebook did not show evidence of cascading as such, but rather the colliding of shorter chains while a *threshold* amount of start-nodes were needed in order to spread apost wider (Rogers et al., 2012).

Spread Pattern Analogies

According to Banerjee and Agarwal (2012), the spread pattern in social media can be compared to a stream of ants using *swarm intelligence*, meaning that the ants do not move in a random way but follow the intelligence of the swarm, making their behaviour easier to predict. Similarly, by observing the interactions within a certain phase one can predict the future behaviour of a large number of users in the online environment.

More often, with its characteristics of self-replication and fast diffusion, the spread pattern in social media is compared to a *virus*, and the speed of spreading addressed as the ‘infection

time’ of individuals (Doerr, Blenn & Mieghem, 2013). For example, Coombs (2002) uses the concept of ‘issue contagion’ to address the spread of issues. In epidemiology, the spreading of viruses is, for example, related to contact probability and frequency, based on a model developed by Reed and Frost in the 1920s. In recent years, this model has inspired the development of mathematical models for the spread of messages in social media (see a later section).

Like the spread of viruses, the diffusion of social media messages may start in a particular location and then spread to others. To analyse the diffusion of messages, starting for example in a local event, *geo-location* can be used, as was done in the case of political communication on Twitter (Stieglitz,& Dang-Xuan, 2013). However, currently only a small proportion of social media messages is geo-located.

Comparing Message Reach to Adoption of Innovations

In the literature, the number of people reached by a social media message is often explained by reference to the model of *diffusion of innovations* as developed by Rogers (1995), who defined diffusion as a process by which an innovation is communicated through certain channels over time amongst the members of a given social system. His model shows a normal (bell) curve with successive groups of people adopting the innovation. The model was also applied by communication scholars, for example, to investigate the diffusion of news among the public (Valente,& Rogers, 1995). To apply this model to hypes in social media, the consultancy firm Gartner extended the curve after the peak of inflated expectations to show a steady plateau of productivity (Fernando, 2010).

The literature shows that spread patterns do not always follow the normal curve, as the structure of networks and their paths for diffusion differ, as also do the positions of those who trigger the diffusion and help disseminate the message (González-Bailón et al., 2013). Time intervals also need to be considered as, particularly in the initial stage, there may be a *time lag* in the passing of a message (Fan, Geddes, & Flory, 2013). Similarly, long power outages

may also result in unexpected time lags. More importantly, a study on the reputation of the brand Toyota showed that the content of a social media post *changes* as it is passed on, and may become more positive, neutral or negative (Fan et al., 2013). This adaptation in the process of passing on social media posts was also noted in the activism engendered during the so called Arab spring, when resistance leaders reconstructed messages to suit their needs, after which the local message was recreated for a global audience (Newsom & Lengel, 2012). This shows that the spread of social media posts, rather than passing on a package, can be seen as an interaction between various actors.

Network Patterns and Roles

The way issues spread depends on the *roles* of the actors in the network. According to Castells (2008, p. 152), a network can basically be seen as “a set of interconnected nodes”. Some individuals are more connected than others, so connectivity is not equally distributed across the network. In the network of micro blog followers, only a few highly connected nodes act as hubs (Borge-Holthoefer et al., 2012). A hub has a dominant position in a network, as it functions as a gatekeeper (Gruzd, Wellman, & Takhteyev, 2011), deciding whether to pass on or not pass on social media posts to other users.

It has been suggested that, in particular, *weak links* are important for diffusion in the online environment (Granovetter, 1973). However, in social media the role of weak links needs to be specified. Empirical research in the social media environment showed that weak links do not speed up diffusion, but “act as bridges to connect isolated communities” (Zhao, Wu, & Xu, 2010, p. 2). Diffusion may stagger to a halt if connections are bounded; in such instances, wider links with other networks are important for the growth of an issue.

Mathematical Models

To predict the spread of social media posts, various authors (e.g. Laskela, 2010) have developed mathematical models to describe the relationships between the variables that influence diffusion. Such quantitative models often focus on the speed and number of nodes

reached or patterns occurring, rather than what kinds of issues are shared and what kinds of people are reached. According to Zhao et al. (2010), such models, based on relational data, provide an estimation of *random* diffusion, although it has proved difficult to include all the complexities of real world exchange on the Internet.

According to Kumar and Mirchandani (2012) only few attempts have been made to define message spread, influence and impact in relation to marketing or communication management. They tried to predict the ability of influencers to generate viral spread, based on e.g. the number of times a message was forwarded and the number of comments or replies received. Along similar lines, Li and Shiu (2012) designed a diffusion support mechanism for selecting endorsers in social media, and tested its performance in measuring user preference through click-through rate, network influence by re-post rate, and propagation strength by exposure rate. The above sections show the variety of approaches that exist for determining how issues spread in social media.

Factors Influencing Dissemination in Social Media

To better understand what influences the spread of social media posts on the web, we further analysed the selected literature. This yielded various factors that may enable or hinder dissemination in social media. We then organized these factors, following a research model of communication in issue arenas (Vos, Schoemaker, & Luoma-aho, 2014) according to whether they concerned characteristics of issues, media or actors.

Characteristics of the Issues Involved

In a network or micro blog, all users have their own friends or followers. What posts are passed on also depends on what people like to share with each other. According to Wang (2012, p. 309), “If the message itself is valid and possesses high social value, it is likely that the message will be shared by many different users on multiple occasions, thereby increasing the instances of exposure”. In the literature, various characteristics of an issue were expected to promote dissemination in social media.

- *Considered worthwhile.* Content is more likely to be shared in social media, for example by retweeting, if it is expected to benefit the receiver personally (Borge-Holthoefer et al., 2012), as for example, with health-related messages. Also favoured is content that increases knowledge (Desai et al., 2012), as it may provide a solution to a particular problem or offer the receiver “true value and benefit” (Bates & Riedy, 2012).

- *Expresses needs or emotions.* If a post relates to needs or emotions it is more likely to be passed on. “Emotionally charged Twitter messages tend to be retweeted more often and more quickly” (Stieglitz & Dang-Xuan, 2013). This may also apply to emotional experiences related to a product or service, for example, expressed in blogs, micro-blogs such as Twitter, and on YouTube or networks such as Facebook.

- *Has entertainment value or imparts a positive sentiment.* Qualities like humour enable the sharing of posts, for example allowing “participants to move from initial nervousness into more relaxed and comfortable conversations” (Byron et al., 2013, p. 40). Meanwhile, positive messages are generated and spread easily. For example, Desai et al. (2012, p. 4) noted in a study on re-tweeting messages about a conference, that a positive tweet “leaves a good impression with the reader and increases the likelihood that future tweets will be amplified by that reader”.

- *Has news value.* A message that has news value, for example includes eye-witness accounts during a crisis, is more likely to be passed on (Hiltz, Diaz, & Mark, 2011). News content of social media messages may be related to a well-known organization (Williams et al., 2012) and the content positive, negative or neutral (e.g. Fan et al., 2013). It may also concern a well-known person or celebrity, as Sanderson & Cheong (2010) showed in a study on how high frequency posting and tweets facilitated the communication of grief after the death of Michael Jackson.

- *People want to be identified with it.* Consumers use social media to engage with brands, products and services they want to identify with (Williams et al., 2012). What users reinforce, for example by re-tweeting or ‘likes’, is often shown on their homepage. Since it adds to their identity, people may be opportunistic in what they wish to show and with whom they want to be seen to belong. How fast a message travels also depends on societal factors, which basically turns users into sensors (Stefanidis et al., 2013). Therefore, issues shared in social media are less likely to include topics related to taboos, as users do not wish to invite gossip or bullying, as “social media content is incorporated into broader practices of self-presentation and identity management” (Byron et al., 2013, p. 41).

The way issues take form in social media differs widely from that in news media, as it seems that people use social media especially from a personal perspective, to express their views, depict their experiences and share what they perceive around them, for example in eye-witness reports. Consequently, such motives then influence how an issue is communicated and takes form in the online environment.

Characteristics of the Media Involved

The particular features of the individual social media may facilitate diffusion of an issue on a smaller or broader scale. It should, for example, be noted that Facebook and Whatsapp are based on strong ties and emphasize the strengthening of friendships, while Twitter is primarily based on weak ties and is suitable for factual exchange (Zhao, Wu, & Xu, 2010). Social media have various features that enable fast dissemination, including ease of searching, sharing, and connecting with other users. Therefore, it matters from which social media platform the issue discussion has originated, although transfer to other social media platforms is possible and is more easily initiated in some social media than others. Mainly, however, diffusion depends on ease of sharing, ease of finding what one is looking for, and ease of connecting in the social media used.

Ease of sharing has to do with how well the online service facilitates exchange. Twitter’s ability to signpost further materials (Kiernan and Wigglesworth, 2011) makes it easy to pass

on links to YouTube videos (Robichaud et al., 2012). Facebook in turn facilitates active involvement with friends, e.g. through ‘likes’ that strengthen relationships (Rogers et al., 2012). The use of “likes” has also been used in campaigns to create weak ties.

Ease of finding what one is looking for, or posting matters that can easily be found by others, for example by using a hashtag on Twitter, is also related to ease of dissemination (Kiernan and Wigglesworth, 2011).

Ease of connecting may be higher in some social media services than in others (Bronstein, 2013). Users of Twitter are free to follow others, which also results in weak ties while, for example, WhatsApp is a more closed friendship environment. Consequently, Gruzd et al. (2011, p. 1294) note, that “connections on Twitter depend less on in-person contacts, as many users have more followers than they know”. When ease of connecting is high, this may result in connections to an undeterminable degree and “constantly shifting clusters of conversations that have collapsed the traditional boundaries of space and time” (Farshid et al., 2011, p. 222).

Characteristics of Actor Resources for Social Media

The actors involved in the issue-spreading process may be more or less connected, and more or less active in interaction on the web. Therefore, organizations that are successful in their use of social media will devote considerable *resources* to laying the foundation for their social media activities and involving other actors (Nah, & Saxton, 2013). They may do this by building platforms, content and followers, and developing ongoing monitoring and multi-channel approaches. In social media campaigns, organizations may want to spread matters widely, rapidly and/or to targeted groups by involving key-stakeholders (Suarez-Almazor, 2011), including not only policy makers and various public groups but also intermediaries through which relevant public groups may be reached. An organization can be supported in its online activities by *cooperating* with its (business) partners who may, for example, retweet important messages. How many are reached depends on the interconnectedness of the actors that provide the post or pass it on (Gruzd et al., 2011).

Organizations can form links with partners to increase their interconnectedness; this may include other organizations or, for example, bloggers.

Actors who often pass on social media posts to others are known as *influencers*. Such actors have the knowledge and willingness to support dissemination, for example, through tweet amplification (Desai et al., 2012). Following the growing interest in social media, organizations have begun to attribute a profound role to influencers. Influencers with an established network in social media are also called ‘social endorsers’ (Li, & Shiu, 2012). Authority is attributed to those who are highly influential because they have many links with well-connected others; for example, if a blogger is highly influential “we would expect his ideas to propagate to other blogs” (Lawrence, Melville, Perlich, Sindhvani, Meliksetain, Hsueh, & Liu, 2010, p. 3). Since some bloggers have influence within a community, while others (also) have influence outside that community, measures are being developed to help organizations select the most suitable blogs for dissemination (Lawrence et al., 2010).

In social marketing practice, identifying influencers who are highly influential, also called *influentials*, is organization- and case-specific (Kumar, & Mirchandani, 2012), and thus the choice of influencers will often depend on the issue at stake. In purchasing decisions, customers may be affected by *user-generated content* (Stieglitz, & Dang-Xuan, 2013), often referred to as ‘consumer-generated media’ or ‘consumer-generated advertising’ (Farshid et al., 2011). In that sense, consumers can be good influencers, as “a skilled consumer may offer a more compelling message that has more credibility than a company-generated message” (Williams et al., 2012, p. 129). However, Freberg (2012) found that user-generated sources are not always more effective, as their trustworthiness may be perceived differently according to users also depending on the topic. In any case, interconnectedness in the online environment is seen as a resource of actors.

A Model Showing Factors that Enable Online Issue Spread

Below, based on the findings reported in the previous section, we present a model of the key factors that influence the diffusion of issues in social media. First, the model shows the *characteristics of an issue* that influence its rapid dissemination on the web, as it is these characteristics that make it more or less attractive for users to pass the message on. Second, the model shows the *social media characteristics* that may also facilitate the rapid spreading of an issue. It matters from which social media platform the issue discussion originates, although there may also be transfer among different social media platforms. Third, the model shows the *organizational resources for social media*, influencing the preparedness of the organization for social media monitoring that, depending on the issues management policy, may be geared towards a better understanding of stakeholder points of view or towards influencing the spreading of issues.

Next to these factors that relate specifically to the online environment, there are also factors of a more *general* nature related to societal developments and organizational reputation. For example, organizations should consider their *vulnerability* concerning issues and that issues related to them may travel more or less rapidly on the web. Such vulnerability could relate to societal factors or similar crises in the past, in the history of the organization or its (business) sector. Therefore, organizational reputation should be seen as an important general factor, just as developments and power relations in the broader social environment that all may influence the interplay of actors in traditional as well as online issue arenas (Vos et al., 2014).

Together, these factors pull or push the discussion on the issue, explaining the speed at which the issue travels on the web, as shown in Figure 1. The centre of the model symbolizes the iterative process of reflection on the spread of social media posts to better understand the outcome of all these influences. Inspired by Rogers' (1995) model for the diffusion of innovations, we assume that in the various stages of dissemination different actors may be active in the process, such as early adopters (or, for example, activists drawing attention to an issue), who may act and be perceived differently from the broader public, which may be

involved at a later stage. This would call for *continued assessment*, giving consideration to all the groups of factors throughout the lifecycle of the issue.

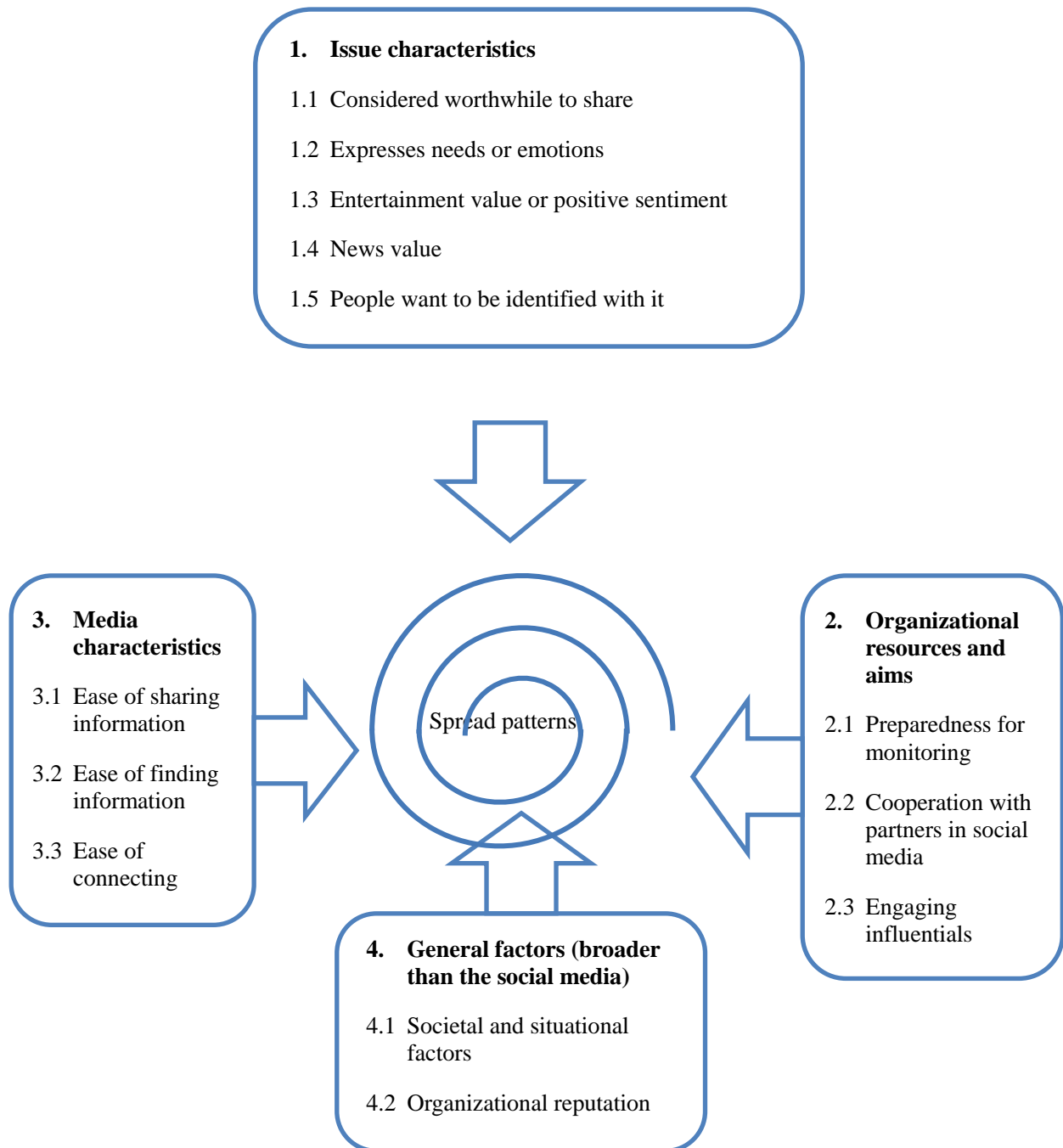


Figure 1. Issue characteristics, media characteristics, organizational resources, and general factors influencing the spread of an issue in social media.

The specific characteristics of the issue in question may promote or hinder fast dissemination on the web. Users will be more inclined to pass on a message if it is considered worthwhile for other users, expresses needs or emotions, has entertainment value or imparts a positive sentiment, or has news value, or represents something with which they want to be identified. Media characteristics include ease of sharing, finding what one is looking for, and connecting. As the current trend is in the direction of closed environments (e.g. WhatsApp rather than Twitter), this may set thresholds for the dissemination (Rogers et al., 2012), cause a less free flow and hinder possibilities to monitor upcoming issues. Organizational resources and aims refers to preparedness for social media monitoring and activities, utilizing cooperation and engaging influentials. How these resources are used will depend on the organization's communication policy. This should be taken into account, not only with respect to the organization itself but also with respect to other actors in the issue arena (Luoma-aho, & Vos, 2010). The general factors in the model refer to societal factors that describe whether an issue relates to current interests, whether other issues are present that may dominate the news, and history and reputation of the organization.

First, the model can be used to better understand the challenges to monitoring introduced by social media. Many organizations will be able to identify and follow a number of issues that may affect their operations, and the insights collected can help them make sense of a fast changing environment. When monitoring identifies new issues, the components of the model can contribute to predicting whether such an issue is likely to grow. Second, the model can be used either to influence issue spread, for example by adding value to messages that will make them attractive for further dissemination or reinforcing messages posted by business partners, or to decrease the likelihood of further dissemination by counteracting false rumours or asking partners to refrain from enlarging attention to the issue. Nowadays, issues are not considered to be very 'manageable'. However, the fast moving environment of social media calls for sensemaking in organizations, reflection on new opportunities, and finding a balance that fits the organizational policies.

Conclusions

Social media provide users with new tools for sharing views. Issues can spread rapidly on the web, calling for anticipatory actions based on insights into spread patterns. Diffusion in social media is described in the literature, by means of analogies such as cascading or viral spreading, by comparing it to the adoption of innovations, by reference to network patterns and roles, or by means of mathematical models. In the literature, various factors, from various perspectives, are mentioned as influencing issue spread, providing a fragmented and complex picture of the topic. In this paper, these factors are compiled to provide a more holistic view of this current topic from an organizational perspective.

The articles that described how issues spread in the media often focused on a particular instance and the process of diffusion of a single issue or message. A clear event is often the starting point, for example the crisis that accompanies a product recall. As time goes by, the diffusion process may break down, or the topic may possibly re-appear in the online discussion when a related matter pops up. There may be no such clear event at the endpoint, leaving the possibility of a return of the topic (or a similar one) open. For an organization, an issue is not a one-time event, and hence monitoring should also cover successive or overlapping issues.

Limitations

The literature search was limited to refereed journals and, despite spanning 10 years, yielded only articles published after 2009, showing that the topic is of current concern. An online search revealed some recent conference proceedings with additional input on the topic, e.g. Choudhury, Lin, Sundaram, Candan, Xie and Kelliher (2010) who show how sampling methods can influence the spread patterns found in the currently large volume of social media data.

The model presented here may help organizations to interpret the results of social media monitoring and to reflect on the possibilities of social media interventions. However, more research is needed to show which factors are more important than others. For example, in a

case study published in conference proceedings, Yang and Counts (2010) found that tweets that came later during the observation period and those that included links often travelled further in the network. There might also be a threshold for diffusion in social media, resembling that in epidemiology, where a minimum number of infections is required to increase the probability of a disease spreading to the whole network, or as in game theory where an innovation needs to attract a minimum number of adoptees before its utility for other prospective users is at a high enough level to induce them to adopt it as well (Song, 2013).

Directions for Future Research

Current mathematical models focus on the spread of individual messages, for example, in random diffusion, whereas the various complexities related to the spread of organizational issues in social media have yet to be taken into account. Changes in messages as they are passed need to be further investigated, as some authors state that in this process the message content becomes adapted in a more negative or positive direction, or to suit a broader public (Fan et al., 2013; Newsom, & Lengel, 2012).

We also argued that transfer within different social media and with traditional news media needs to be taken into account. Moreover, interference between the traditional news media and social media is not reflected in the models. For organizations, it is relevant that issue transfer between social media and traditional news media exists (Meriläinen, & Vos, 2013), although it has been suggested that this needs to surmount a threshold in order to gain momentum, rather like the threshold described in the diffusion of posts in, for example, Facebook (Rogers et al., 2012).

Implications for Practice

When companies monitor social media, the results may reveal various issues related to organizational policies. However, monitoring in itself does not clarify what issues mostly need attention. This needs a better understanding of the factors that determine whether an issue can

be expected to develop rapidly. The model presented here brings together current insights on the diffusion of social media posts and provides input for decision-making on communication strategies and a more critical outsourcing of related monitoring services, by enhancing understanding of the principles of diffusion. In the social media environment, above all, it is interconnectedness that counts.

Acknowledgements

This study received partial funding from the European Community's Seventh Framework Programme under grant agreement number 284927 (project PEP). We thank Professor Jari Veijalainen for critically reading the manuscript.

References

(Sources derived from the structured literature review are marked with an asterisk.)

- Anderson, I. K. (2011). The uses and gratifications of online care pages: a study of CaringBridge. *Health communication*, 26(6), 546-559. *
- Banerjee, S. & Agarwal, N. (2012). Analyzing collective behavior from blogs using swarm intelligence. *Knowledge and Information Systems*, 33(3), 523-547. *
- Bates, S. B. & Riedy, C. A. (2012). Changing knowledge and beliefs through an oral health pregnancy message. *Journal of public health dentistry*, 72(2), 104-111. *
- Borge-Holthoefer, J., Rivero, A., & Moreno, Y. (2012). Locating privileged spreaders on an online social network. *Physical Review E: Statistical, Nonlinear & Soft Matter Physics*, 85(6-2), 1-6. *
- Bosley, J. C., Zhao, N. W., Hill, S., Shofer, F. S., Asch, D. A., Becker, L. B., & Merchant, R. M. (2013). Decoding twitter: Surveillance and trends for cardiac arrest and resuscitation communication. *Resuscitation*, 84, 206-212. *
- Bronstein, J. (2013). Like me! Analyzing the 2012 presidential candidates' Facebook pages. *Online Information Review*, 37(2), 173-192. *
- Byron, P., Albury, K., & Evers, C. (2013). It would be weird to have that on Facebook: young people's use of social media and the risk of sharing sexual health information. *Reproductive health matters*, 21(41), 35-44. *
- Cain, J., Romanelli, F., & Fox, B. (2010). Pharmacy, social media, and health: Opportunity for impact. *Journal of the American Pharmacists Association: JAPhA*, 50(6), 745-751. *
- Castells, M. (2009). *Communication power*. Oxford University Press: Oxford.
- Choudhury, M. de, Lin, Y-R., Sundaram, H., Candan, K. S., Xie, L., & Kelliher, A. (2010). How Does the Sampling Strategy Impact the Discovery of Information Diffusion in Social Media? In Proceedings of the 4th Int'l AAAI Conference on Weblogs and Social Media, 34-41. Retrieved from <http://www.aaai.org/ocs/index.php/ICWSM/ICWSM10/paper/view/1521/1832>
- Coombs, W.T. (2002). Assessing online issue threats: issue contagions and their effects on issue

- prioritization. *Journal of Public Affairs*, 2, 215-229.
- Desai, T., Shariff, A., Shariff, A., Kats, M., Fang, X., Christiano, C., & Ferris, M. (2012). Tweeting the Meeting: An In-Depth Analysis of Twitter Activity at Kidney Week 2011. *PLoS ONE*, 7(7), 1-9. *
- Doerr, C., Blenn, N., & Miegheem, P. V. (2013). Lognormal Infection Times of Online Information Spread. *PLoS One*, 8(5). *
- Fan, D., Geddes, D., & Flory, F. (2013). The Toyota Recall Crisis: Media Impact on Toyota's Corporate Brand Reputation. *Corporate Reputation Review*, 16(2), 99-117. *
- Farshid, M., Plangger, K., & Nel, D. (2011). The social media faces of major global financial service brands. *Journal of Financial Services Marketing*, 16(3), 220-229. *
- Fernando, I. (2010). Community Creation by Means of a Social Media Paradigm. *The Learning Organization*, 17(6), 500-514. *
- Freberg, K. (2012). Intention to comply with crisis messages communicated via social media. *Public Relations Review*, 38(3), 416-421. *
- González-Bailón, S., Borge-Holthoefer, J., & Moreno, Y. (2013). Broadcasters and Hidden Influentials in Online Protest Diffusion. *American Behavioral Scientist*, 57(7), 943-965. *
- Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, 78(6), 1360-1380. *
- Gruzd, A., Wellman, B., & Takhteyev, Y. (2011). Imagining Twitter as an Imagined Community. *American Behavioral Scientist*, 55(10), 1294-1318. *
- Heath, R. (1998). New communication technologies: An issue management point of view. *Public Relations Review*, 24(3), 273-288.
- Hiltz, S. R., Diaz, P., & Mark, G. (2011). Introduction: Social media and collaborative systems for crisis management. *ACM Transactions on Computer-Human Interaction*, 18(4), 1-6. *
- Keelan, J., Pavri, V., Balakrishnan, R., & Wilson, K. (2010). An analysis of the Human Papilloma Virus vaccine debate on MySpace blogs. *Vaccine*, 28(6), 1535-1540.
- Kiernan, M., & Wigglesworth, N. (2011). The use of social media in the dissemination of

- information from scientific meetings. *Journal of Infection Prevention*,12(6),224-225.
- *
- Kumar, V.,&Mirchandani, R. (2012).Increasing the ROI of Social Media Marketing.*MIT Sloan Management Review*,52(1),55-61. *
- Lau, A. Y. S., Gabarron, E., Fernandez-Luque, L., &Armayones, M. (2012).Social media in health - what are the safety concerns for health consumers?*Health Information Management Journal*,41(2),30-35. *
- Lawrence, R., Melville, P., Perlich, C., Sindhvani, V., Meliksetian, S., Hsueh, P.-Y.,& Liu, Y. (2010).Social media analytics.*OR-MS Today*,37(1),26. *
- Leskelä, L (2008). Stochastic relations of random variables and processes..*Journal of Theoretical Probability*,23(2), 524-546. *
- Li, Y.-M., &Shiu, Y.-L.(2012). A diffusion mechanism for social advertising over microblogs.*Decision Support Systems*,54(1),9-22. *
- Luoma-aho, V., &Vos, M. (2010).Towards a more dynamic stakeholder model: The role of issue arenas for corporate reputation. *Corporate Communication, an International Journal*,15(3),315-331.
- Meriläinen, N.,&Vos, M. (2013).Framing issues in the public debate: the case of human rights. *Corporate Communications, an International Journal*,16(4),293-310. *
- Nadeem, M. (2012).Social Customer Relationship Management (SCRM): How Connecting Social Analytics to Business Analytics Enhances Customer Care and Loyalty?*International Journal of Business and Social Science*,3(21).*
- Nah, S.& Saxton, G. D. (2013).Modeling the adoption and use of social media by nonprofit organizations.*New Media & Society*,15(2),294-313. *
- Newsom, V. A.,&Lengel, L. (2012).Arab Women, Social Media, and the Arab Spring: Applying the framework of digital reflexivity to analyze gender and online activism..*Journal of International Women's Studies*,13(5),31-45.*
- Roloff, J. (2008). Learning from multi-stakeholder networks: Issue-focussed stakeholder management.*Journal of Business Ethics*,82,233–250.
- Romero, D.M., Meeder, B., & Kleinberg, J. (2011). Differences in the Mechanics of

- Information Diffusion Across Topics: Idioms, Political Hashtags, and Complex Contagion on Twitter. *In Proceedings 20th ACM International World Wide Web Conference*, 695-704. Retrieved from <http://dl.acm.org/citation.cfm?id=1963503>
- Robichaud, P., Hawken, S., Beard, L., Morra, D., Tomlinson, G., Wilson, K., & Keelan, J. (2012). Vaccine-critical videos on YouTube and their impact on medical students' attitudes about seasonal influenza immunization: A pre and post study. *Vaccine*, 30(25), 3763-3770. *
- Rogers, E. (1995). *Diffusion of Innovations*. New York: Free Press.
- Rogers, M., Chapman, C., & Giotsas, V. (2012). Measuring the diffusion of marketing messages across a social network. *Journal of Direct, Data and Digital Marketing Practice*, 14(2), 97-130. *
- Ruggiero, A., & Vos, M. (2014). Social media monitoring for crisis communication: process, methods and trends in the scientific literature. *Online Journal of Communication and Media Technologies*, 4(1), 103-130.
- Sanderson, J. & Cheong, P. H. (2010). Tweeting Prayers and Communicating Grief Over Michael Jackson Online. *Bulletin of Science, Technology & Society*, 30(5), 328-340. *
- Song, D (2013). Research on Information Propagation Model for Microblogging. *Journal of Networks*, 8(7), 1647-1653. Retrieved from <http://ojs.academpublisher.com/index.php/jnw/article/view/jnw080716471653/7409>
- Stefanidis, A., Crooks, A. & Radzikowski, J. (2013). Harvesting ambient geospatial information from social media feeds. *GeoJournal*, 78(2), 319-338. *
- Stieglitz, S. & Dang-Xuan, L. (2013). Emotions and Information Diffusion in Social Media-Sentiment of Microblogs and Sharing Behavior. *Journal of Management Information Systems*, 29(4), 217-248. *
- Suarez-Almazor, M. (2011). Changing health behaviors with social marketing. *Osteoporosis International*, 22, 461-463. *
- Sümer, B. (2011). The importance of literature review in research design. In: Tomanić Trivundža, I., Carpentier, N., Nieminen, H., Pruulmann-Venerfeldt, P.,

- Killborn, R., Sundin, E., & Olsson, T., *Critical Perspectives on the European Mediasphere*, 219-227, Ljubljana, ECREA.
- Valente, T.W. & Rogers E.M. (1995). The Origins and Development of the Diffusion of Innovations Paradigm as an Example of Scientific Growth. *Science Communication*, 16, 242-273.
- Vos, M., Schoemaker, H. and Luoma-aho, V. (2014), Setting the agenda for research on issue arenas. *Corporate Communications: an International Journal*, 18(2), 200-215.
- Wang, H. (2012). Six P's of youth social media from a young consumer's perspective. *Young Consumers*, 13(3), 303-317. *
- Williams, D. L., Crittenden, V. L., Keo, T. & McCarty, P. (2012). The use of social media: an exploratory study of usage among digital natives. *Journal of Public Affairs* (14723891), 12(2), 127-136. *
- Yang, J. and Counts, S. (2010). Predicting the Speed, Scale, and Range of Information Diffusion in Twitter. In Proceedings International AAAI Conference on Weblogs and Social Media 2010. Retrieved from <http://www.aaai.org/ocs/index.php/ICWSM/ICWSM10/paper/viewFile/1468@misc/1896>
- Zhang, M., Jansen, B. J. & Chowdhury, A. (2011). Business engagement on Twitter: a path analysis. *Electronic Markets*, 21(3), 161-175. *
- Zhao, J., Wu, J. & Xu, K. (2010). Weak ties: subtle role of information diffusion in online social networks. *Physical review E: Statistical, nonlinear, and soft matter physics*, 82(1), Pt2. *