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Keep Them Engaged: Romanian County Inspectorates for Emergency Situations' Facebook Usage for Disaster Risk Communication and Beyond

Monika Meltzer *, Lucrina Ștefănescu and Alexandru Ozunu

Research Institute for Sustainability and Disaster Management Based on High Performance Computing—ISUMADECIP, Faculty of Environmental Science and Engineering, Babeş-Bolyai University, Fantanele St. no 30, 400294 Cluj-Napoca, Romania; lucrina.stefanescu@ubbcluj.ro (L.Ș.); alexandru.ozunu@ubbcluj.ro (A.O.)

* Correspondence: meltzer.monika@gmail.com

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Abstract: Nowadays, the use of social media by public institutions involved in disaster management is starting to become common practice. However, despite scientific interest in the effect of social media on disaster risk and crisis communication, data exploring emergency management agencies' round-the-clock Facebook usage and the impact of their content and media choices on stakeholder engagement is limited. This study set out to investigate Romanian local emergency agencies' Facebook usage patterns and stakeholders' engagement with their content. The data is comprised of 7810 messages posted between the 1st January and 25th October 2017 by 32 County Inspectorates for Emergency Situations. First, using content analysis techniques, the topics of the posts were summarized to illustrate how these agencies use Facebook. Second, stakeholder engagement was investigated using social media marketing techniques. Third, messages related to natural hazards were analyzed in greater depth to reveal disaster risk communication patterns. The results suggest that Romanian emergency agencies mainly promote transparency and their institutional image on Facebook. Stakeholders were most likely to engage with brand-oriented posts, especially if these also offered rich multimedia feature. Meanwhile, stakeholders were less likely to interact with messages about natural hazards, particularly if they incorporated educational content. These observations suggest that, while at the moment Romanian local emergency management agencies take advantage of Facebook to create and maintain relationships with their stakeholders, they bypass opportunities to implement communication strategies for effective disaster risk reduction.

Keywords: Facebook; engagement; emergency management agencies; disaster risk communication; media and content type

1. Introduction

As of late, there has been an increasing interest in the utilization of social media (SM) for disaster risk and crisis communication, and it seems that there are no emergencies without scientific coverage on SM use anymore [1]. Research on the use of SM focuses predominantly on the event and post-event phases of disaster management, investigating the manner in which SM is utilized by emergency management agencies and other stakeholders to cope with an impending disaster of natural or technological nature [2–5]. Studies examining the potential of SM for the pre-event phase, fewer in number, focus especially on how to disseminate preparedness information and monitor SM to identify risks [6,7]. These studies are equally relevant in light of the fact that practice calls for the utilization of SM to promote strategies to raise awareness in disaster risk reduction [8].

Emergency management agencies are encouraged to leverage SM in order to engage with their stakeholders, especially considering the citizens' growing demand for their permanent SM presence [9,10]. Recently, numerous recommendations have emerged from research and practice to guide emergency managers through the process of implementing and maintaining SM pages. These recommendations cover a wide range of topics, such as the identification of the most suitable SM tools/applications to fulfil specific communication objectives [7,11]; the development of policy documents [12] or best practices in order to establish an active presence on SM; and the establishing of a network of stakeholders [13,14].

There is a wide range of different SM applications, such as blogs, social networking sites, media-sharing services, web map services and wikis, that can be used for risk and crisis communication in unique ways [15]. In each of these SM applications, stakeholder engagement can be measured in different ways, giving valuable insight on their interactions. These measures can serve as metrics for evaluating SM effectiveness in risk and crisis communication [16]. However, only a handful of studies examine how factors such as content or media type influence stakeholder engagement in the field of disaster management. For example, Sutton et al. [17] examined the relationship between the audience's behavior in terms of retransmitting a tweet and the content and style of tweets generated by official response agencies during the warning phase of the Waldo Canyon Wildfire. The authors' results showed that tweets regarding evacuation and warning were more frequently retweeted than off-topic tweets. Nevertheless, this study examined the relationship between message content and user engagement exclusively in the event phase; hence, the engagement dynamics throughout the entire disaster management cycle were not addressed. In another study, van Gorp et al. [18] analyzed 10,000 Facebook messages posted by state-level emergency management organizations in the United States. Messages were classified into three topic categories: emergency preparedness and update (preparedness and recovery information, updates on ongoing emergencies or links to further resources on emergency advice), emergency response organization operations (information on the organization, job and volunteer recruitment ads) and non-emergency-related updates (information not related to emergencies, discussion with stakeholders). Most of the messages contained emergency preparedness information, followed by emergency response organization operations and, lastly, non-emergency related updates. Regarding user engagement measured in average post likes, van Gorp et al. observed that non-emergency-related messages had the highest average of likes, while emergency preparedness messages the lowest. Nonetheless, while these categories capture the "big picture" of Facebook topics used by emergency management agencies, they are too wide for a more in-depth inquiry into specific trends, especially when it comes to disaster risk communication. The purposes and functions of disaster risk communication depend heavily on the disaster management cycle [19]; therefore, breaking disaster risk and crisis communication into further categories (e.g., pre-event, during event, post-event) may lead to a better understanding of what message emergency management agencies should distribute on their SM channels to maximize stakeholders' engagement and increase the audiences prior to, during and after an emergency situation.

County Inspectorates for Emergency Situations from Romania—Their Communication Principles and SM Use

In Romania, many public administration authorities and organizations qualified for emergency management have risk and crisis communication responsibilities, in line with their specific areas of competence [20]. Communication has to be carried out at national, regional and local levels. The Department for Emergency Situations and the General Inspectorate for Emergency Situations, subordinated to the Ministry of Internal Affairs, have key responsibilities in risk and crisis communication at the national level, while the 41 County Inspectorates for Emergency Situations (CIES) are vested with risk communication responsibilities at regional and local levels.

CIES have key responsibilities for civil protection, fire safety and disaster risk reduction, each of these fields involving specific public information activities stipulated by the national legislation [21–24].

Their communication effort is focused on the specific risk of the region to increase the resilience of the local communities to risk. CIES also have to comply with the following communication principles [25]:

- Professionalism: emergency management personnel involved in disaster risk and crisis communication have to receive specific training in public relations and campaign management;
- Proactive approach: messages have to be designed and tested prior to an emergency situation;
- Audience orientation: communication efforts should be designed based on the needs assessment of specific target-groups;
- Multi-channel approach: communication has to be carried out through multiple channels to reach a wider audience with the messages;
- Integrated approach: disaster risk communication requires compact and complementary planning of different activities regarding public information and education, such as campaigns, exercises;
- Brand orientation: the image of the CIES has to be popularized by applying modern marketing strategies, developing brand campaigns, establishing web presence and using symbols of visual identity of the institutions;
- Transparency: measures taken by CIES and their activities have to be promoted;
- Partnership: partnership with the civil society has to be developed by supporting volunteering, programs and platforms for public consultation and communication.

CIES may establish official SM pages for their unit, if the institution's management agrees. The set-up, administration, permanent update and monitoring of official SM pages are guided by internal procedures and are conducted by designated personnel [26].

2. Study Aims

This study sets out to investigate how and what CIES post to their institutions' official Facebook page through the whole disaster management cycle. Additionally, the study proposes an approach for evaluating stakeholder engagement with these posts. Despite the fact that SM studies in the field of disaster risk and crisis communication have mainly focused on Twitter (Reuters, 2017), in this study an analysis was carried out on Facebook, because in Romania, Facebook has almost three times more active users than Twitter [27]. CIES were chosen because they disseminate messages about risks in the physical proximity of their target audience, increasing the likelihood of a more diverse audience interaction [28].

In this study, stakeholder engagement was measured by drawing on research from the domain of social media marketing. In line with previous research [29–32], popularity, commitment, virality, and engagement of posts related to content and media type was calculated. This quantitative approach to measuring stakeholder engagement is appropriate for identifying communication and interaction trends. However, while the results shed light on which content and media types are the most liked, shared and commented on by stakeholders, it gives no indication as to how stakeholders make use of or act on specific information.

A more in-depth analysis was performed on messages related to natural hazards. A posting timeline of these specific messages was created and compared with the timeline of interventions and warnings regarding natural hazards during the study period. By doing so, a pattern of disaster risks and crisis communication of CIES through Facebook emerged.

The originality of this research consists in the use of social media marketing techniques to assess the Romanian local emergency management agencies' Facebook communication. The findings can be used to improve in the future how these agencies use Facebook to engage with their stakeholders.

3. Materials and Methods

The study sample is comprised of the 41 CIES from Romania. Out of the 41 CIES, 34 had an official and active Facebook page within the study period. Data retrieval took place on the 25th October 2017, beginning with the 1st January 2017 using the free software Facepager [33]. After the removal of

duplicate messages and automatically added Facebook items, the posting frequency was calculated by dividing the total number of posts by the number of days within the study period. Weekends were also considered, because CIES have a 24/7 service. The average posting frequency was 0.87 posts/day. 2 CIES had a posting average below 0.07 posts/day; therefore, they were excluded from the study. In total, 7810 posts were analyzed. Data regarding the number of page fans was collected using the observational method on the 25th October 2017 (Figure 1).

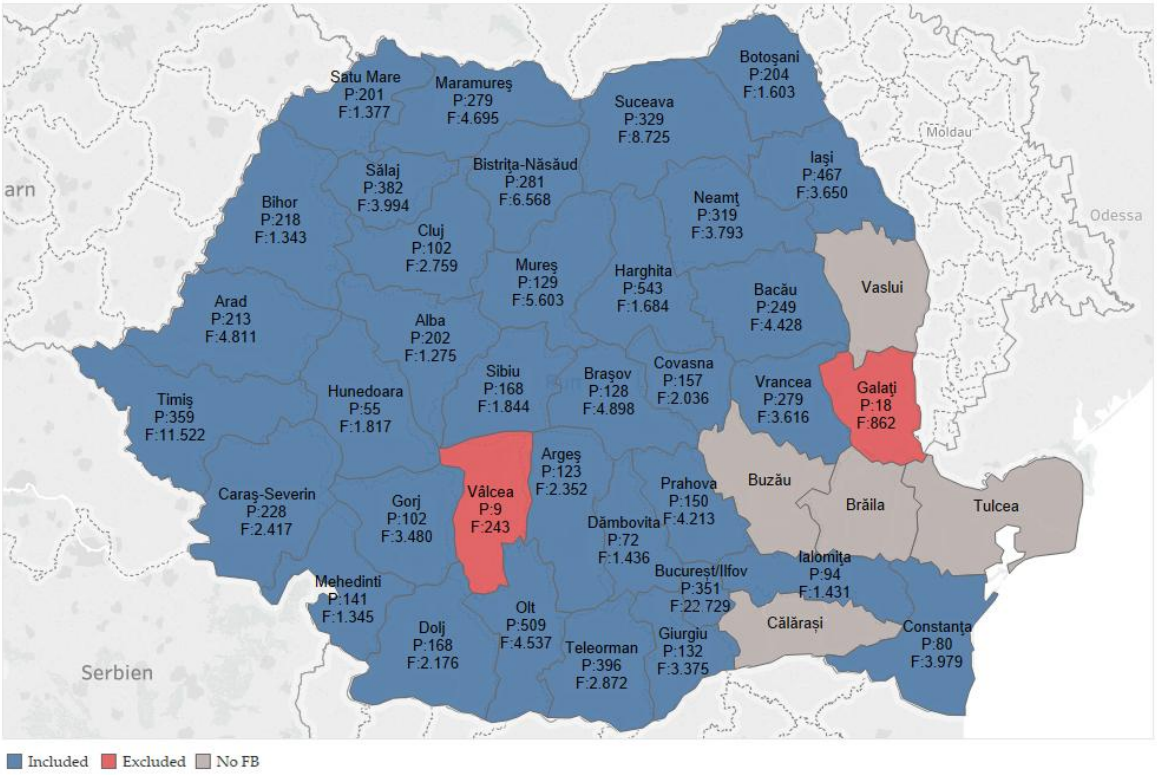

Figure 1. The number of Facebook fans (F) and Facebook posts (P) for each of the 41 Romanian counties.

Each Facebook post, considered as a unit of analysis, contained the following automatically retrieved information: message, message type, message story, date and time of posting, link to the original post and number of reactions, comments and shares.

To find the most suitable means to measure stakeholder engagement, a literature review was carried out. There is no consensus among scholars on how to calculate stakeholder engagement on Facebook [34]. Scholars measure user activity mainly as the average number of likes, comments and shares [35], considering control variables such as number of page fans or post length [36–39]. Pletikova et al. argue that user engagement is related to the number of page fans at the moment the post was published; therefore, they propose that it be calculated as likes ratio, comments ratio [40] and shares ratio [41]—by dividing the total number of likes, comments and shares of a post by the number of page fans on the day of the posting. This approach makes possible multiple deductions [34], but it requires that researchers capture data regarding the number of fans each time a post is published. However, in some of the studies, the analyzed data is extracted days or even months after the initial posting, when there is no possibility of extracting the number of fans from the past; therefore, applying this formula is not possible. Another approach for calculating user activity is proposed by Bonson and Ratkai [29] (Table 1). The authors used likes to calculate the popularity, comments to calculate commitment, and shares to calculate virality. Later, Bonson et al. [32] introduced an additional formula to calculate stakeholder engagement, which is the sum of popularity, commitment and virality. The proposed metrics also allow researchers to use extensive content categories in order to identify and analyze

Facebook trends, and for this reason, in this study, stakeholder engagement was measured using these metrics. They have already been used to analyze Facebook trends in different sectors, such as the corporate sector [30,42], the public administration sector [31,32,43,44], and the academic sector [45]. Until now, the metrics have not specifically been used to assess user engagement on the Facebook pages of emergency management agencies.

Table 1. Facebook metrics for stakeholder engagement [1].

Name	Sign	Formula	Measures
Popularity	P1	Posts liked [2]/total posts	Percentage of posts that have been liked
	P2	Total likes [2]/total posts	Average likes per post
	P3	(P2/number of fans) × 1000	Popularity of messages among fans
Commitment	C1	Posts with comments/total posts	Percentage of posts with comments
	C2	Total comments/total posts	Average comments per post
	C3	(C2/number of fans) × 1000	Commitment of messages among fans
Virality	V1	Posts shared/total posts	Percentage of shared posts
	V2	Total shares/total posts	Average shares per post
	V3	(V2/number of fans) × 1000	Virality of messages among fans
Engagement	E	P3 + C3 + V3	Stakeholder engagement index

[1] Source: [29,32]; [2] In this study the number of reactions will be used to calculate popularity (Reactions are the sum of Like, Love, Haha, Wow, Sad and Angry).

In this study, in line with [31], only the metrics P3, C3, V3 and E are referred to, because they are independent of the size of the audience. Two factors that are proven to influence stakeholder engagement are analyzed in this study; namely, (1) media type and (2) content type.

Facebook posts can be enriched by using various multimedia features, such as photos, videos, hyperlinks, and events. The use of specific multi-media features can influence stakeholder engagement, but findings show mixed results with regard to how it works exactly [38]. Some studies conclude that media types requiring more time to assimilate (videos, text) generate lower engagement than photos [30,31,35,40], while other studies report high engagement for videos [36,37]. To test these theories in this study, the following media type categories were used: (1) event, (2) link, (3) live, (4) photo, (5) status, and (6) video. Event, link, photo, status, and video categories were automatically assigned by the software Facepager. Live posts were identified through the stories field and posts initially coded as videos were recoded accordingly.

Content type is another factor that influences stakeholder engagement. Content type complexity can vary from study to study. Usually, scientific theories serve as the foundation of content categories [29,36,38,41], but there are also other approaches. For example, Pletikova et al. [40] developed content categories based on the studied companies' existing social media marketing strategies. Some studies have applied a mixed method approach for developing content types, usually combining scientific literature reviews with an environmental scan of the analyzed data, to further enrich the categories [46–48]. In this study, the coding scheme was developed based on a literature review and the review of responsibilities of CIES stipulated by the national legislation [49]. Categories and subcategories were refined as the analysis evolved. In the end, the coding scheme was composed of 7 categories and 22 sub-categories (Appendix A). To test the accuracy of the coding scheme an interrater reliability analysis was performed on 15% of the content by two independent coders. Using the Kappa statistics, the result was 0.90 for categories and 0.81 for subcategories, which indicates substantial agreement; hence, the coding scheme was applied for the entirety of the data. Coding was done manually, and each post was classified under only one code. Popularity, commitment, virality, and engagement were calculated for media and content type. The Kruskal-Wallis test (significant at 1% level) was carried out in SPSS to test for possible differences.

To observe patterns in CIES risk and crisis communication practices regarding natural hazards, a more in-depth analysis was carried out on the category Natural hazard (NH). Posts were coded in accordance with the natural hazards that they were referring to. The codes were developed with regard to the natural hazards, with a probability of occurrence on the Romanian territory: (1) floods, (2) landslides, (3) earthquakes, (4) heat waves, (5) severe weather conditions (storms, blizzards, massive snowfalls, tornadoes), (6) wildfires, and (7) avalanches [50]. Findings show that six natural hazards were mentioned by CIES during the study period. 53.9% of the NH messages were related to severe weather conditions, 17.2% to wildfire, 15.2% to heatwaves, 8.8% to floods, 4.7% to earthquakes ant the remaining 0.2% to landslides. For the first five hazards, a monthly timeline of events and interventions was created as follows: (1) for severe weather conditions, floods and wildfire, data consisted of the number of interventions, extracted from the General Inspectorate for Emergency Situations monthly operative analysis [51]; (2) for heatwave, data consisted of meteorological warnings issued by the National Meteorological Administration, extracted from the archive of the Department for Emergency Situations mobile app [52]; (3) for earthquakes, data consisted of the number of earthquakes above a magnitude 4.0, extracted from the official website of the National Institute for Earth Physics [53]. Communication patterns were identified by comparing these timelines with the timelines of messages posted, using data visualization in Tableau Desktop.

4. Results

4.1. Stakeholder Engagement Patterns in Relation with Media and Content Type

Table 2 gives insights into what type of media CIES uses to communicate on Facebook. Photo is the most used media type (71.8%), followed by video (12.8%), link (8.5%), status (4.6%), event (1.3%), and live (1%). The Kruskal-Wallis test hints at the fact that media type has an effect on stakeholder engagement. Live generates the highest level of engagement, as this is the most reacted to, commented on and shared media type by far. Photos are the second-most engaging media type, with the second-highest popularity and commitment. However, video, the third-most engaging media type, seems to have a higher virality than photos. The least engaging media type seems to be the status, followed by event and link. Events are more popular than statuses, but they generate very few comments and shares. However, Facebook events offer a unique form of stakeholder engagement—they offer the possibility of showing interest in a public event or announcing a willingness to participate in it. Once a user clicks Interested or Going, their friends will be notified. This engagement form is not the subject of this analysis, and therefore results regarding stakeholder engagement with events are just partial. The average level of different engagement types confirms previous findings: reactions are the most common form of engagement, followed by shares and comments [31].

Table 2. Stakeholder engagement by media type.

Media Type	%	Popularity	Commitment	Virality	Engagement
Event	1.3	8.8868	0.0770	0.0011	8.9649
Link	8.5	8.7765	0.1971	1.5878	10.5614
Live	1	26.1485	3.4963	4.8425	34.4873
Photo	71.8	15.6679	1.1381	3.6235	20.4295
Status	4.6	5.2712	0.1371	1.6203	7.0286
Video	12.8	11.3032	0.5395	3.7931	15.6359
Total	100	13.0793	0.8281	3.2236	17.1311
Kruskal-Wallis test		149.622	177.669	142.073	156.323
Asymptotic Sig.		0.000	0.000	0.000	0.000

Table 3 shows the distribution of content categories and subcategories. It also gives an insight into stakeholder engagement regarding content type. The Kruskal-Wallis test, applied to categories and to subcategories individually, confirms the existence of heterogeneity among message topics

and popularity, commitment, virality, engagement. CIES uses Facebook mainly to promote their organization (38.1%), which is also the most engaging topic category. Within the category Organization promotion (***OP***), Compassion messages have by far the highest level of popularity, commitment and virality. Rescue of animals by the employees of CIES is another topic that is frequently reacted to, commented on and shared by stakeholders. Further engaging topics within ***OP*** are those related to the CIES image (Motto/values/display of symbols) and to the information about CIES human (Presentation of employees and volunteers and Participation in events for the community) and material resources (Acquiring new material resources). Posts summarizing past events have the lowest level of engagement within ***OP*** (Activity reports, Summary of awareness raising activities and Summary of activities to support public safety). Everyday and technological risk (***ER***) is not just the second-most posted topic by CIES (25.9%), but also the second-most engaging category. Awareness raising and education has the highest engagement, and it is the most shared and commented-on topic within ***ER***. The third category from the perspective of frequency (15.7%) is Natural hazards (***NH***). However, ***NH*** is the second-least engaging topic. Within ***NH***, Real-time communication during emergency situations generates the highest levels of engagement, followed by Summary of interventions. Posts related to Awareness raising and education are the second-lowest topics when it comes to engagement, with the lowest level of commitment, surpassed only by the topic *Warnings.* 9.6% of the CIES posts regard the Marketing of their own services (***MS***), with the third-lowest engagement level. Stakeholder engagement seems to be dependent on the size of the target audience of the messages. Topics that address a larger audience (Volunteer recruitment and Invitation to events) have a higher level of engagement, followed by topics that target a smaller group (Job ads, Offer of studies and Permits/certifications). Posts from the category Non-information (***NI***) generate a fair amount of engagement (7.3%); however, they have a very low virality. The most rarely (0.5%) used topic by CIES is First Aid education (***FA***). They are the least commented on or reacted to. In contrast, these posts are the third-most shared category.

Certain patterns exist regarding the media type used for different content categories and subcategories. As seen in Table 4, media types with the highest engagement levels are used for ***OP***. Live videos for ***OP*** were mostly used to present the employees and volunteers of CIES in important moments of their career, or participating in different activities to promote their organization in real time (91.3%). There were just a few occurrences of live videos being used for other content types: 3.8% were used for ***ER*** to share updates about ongoing response activities during intervention to emergency citations caused by everyday and technological risks; 3.8% were used for ***MS*** to invite the audience to ongoing events (2.5%) and to promote volunteering (1.3%) and 1.3% were used for ***AD*** to present alarm drill exercises in real time. The top three content categories in which photos were used were ***OP*** (40.9%), ***ER*** (23.2%) and ***NH*** (16.2%). Photos were mostly used to present employees and volunteers of CIES (18.9%) and to summarize interventions to everyday risks (17.2%). Also, the use of photos for awareness raising and education regarding natural hazards were fairly common (6.8%). When it comes to videos, in addition to using them for ***OP*** (41.4%), mainly to present employees and volunteers (26.3%), they were often posted to deliver information on past or on-going interventions to ***ER*** or ***NH***. Additionally, videos were used to disseminate educational content, when it comes to ***FA***, ***NH*** and ***ER***. However, while videos were the least used media type to propagate informative educational messages on natural, everyday or technological risk, the first aid education content was almost exclusively made of videos. Links were mostly used for ***ER*** (35.6%), mainly to relate past interventions to emergencies (32.2%), for ***OP*** (26.2%) to present CIES employees and volunteers (14.4%) and for **MS** (20.7%) to inform on job availability and requirements within CIES (6.6%). Events were common for ***MS*** (97%). Facebook events were created to invite the audience to specific actions or ceremonies (82.8%) or to volunteering activities and recruitment (14.1%). Very rarely, events were used for ***AD*** to inform about upcoming alarm drill exercises (3%). Lastly, status, the media type with the lowest engagement level, was used for ***ER*** (56.9%) and ***NH*** (28%). While for ***ER*** status was mostly used to report on past intervention during emergency situations generated by everyday and technological risks (51.5%), for ***NH***, the status usually carries information regarding prevention and preparedness measures (8.1%).

Table 3. Stakeholder engagement by content type.

Category	Sub-Category	%	Popularity	Commitment	Virality	Engagement
Natural hazard (NH)	Awareness raising and education	6.2	5.6285	0.0422	2.3121	7.9827
	Warning	3.3	3.3938	0.0150	1.3922	4.8010
	Summary of interventions	3.3	11.9913	0.1208	2.3895	14.5015
	Real-time communication	2.4	11.1401	0.3270	4.4542	15.9213
	Request for support	0.5	6.0719	0.0270	2.8017	8.9005
	Total NH	15.7	8.0380	0.1126	2.6640	10.8147
	Kruskal-Wallis test		62.755	28.813	8.167	44.769
	Asymptotic Sig.		0.000	0.000	0.086	0.000
Everyday and technological risk (ER)	Awareness raising and education	3.6	10.8041	0.8756	4.6568	16.3365
	Summary of interventions	20.1	11.5749	0.3820	3.6572	15.6140
	Real-time communication	2.2	11.5747	0.6027	3.4723	15.6496
	Total ER	25.9	11.2915	0.6099	3.9856	15.8871
	Kruskal-Wallis test		19.611	35.850	9.076	16.455
	Asymptotic Sig.		0.000	0.000	0.011	0.000
Organization promotion (OP)	Presentation of employees and volunteers	19	20.7175	1.2999	3.0955	25.1129
	Summary of awareness raising activities	7.6	12.7085	0.1135	1.5865	14.4085
	Acquiring new material resources	0.7	27.5103	0.7452	3.3074	31.5629
	Summary of activities to support public safety	0.9	12.2860	0.0520	1.0449	13.3829
	Participation in events for the community	1.5	16.6022	0.3570	2.6481	19.6072
	Rescue of animals	1.2	26.7208	2.1315	7.2677	36.1201
	Compassion messages	0.8	39.3825	19.6157	18.6162	77.6143
	Motto/values/display of symbols	5.5	23.3097	0.7941	4.1201	28.2239
	Activity reports	0.9	15.1492	0.1451	1.4113	16.7056
	Total OP	38.1	20.7959	1.9680	4.1318	26.8957
	Kruskal-Wallis test		31.141	114.670	28.8200	35.774
	Asymptotic Sig.		0.000	0.000	0.000	0.000

Table 3. *Cont.*

Category	Sub-Category	%	Popularity	Commitment	Virality	Engagement
Marketing of their own services (MS)	Offer of studies	2.2	6.9110	0.0605	1.9964	8.9678
	Permits/certifications	1.6	5.1973	0.0372	1.4458	6.6803
	Job ads	0.7	9.0175	0.1255	0.8652	10.0083
	Volunteer recruitment	1	11.8744	0.2966	4.1336	16.3046
	Invitation to events	3.7	12.0285	0.2354	3.2301	15.4939
	Promotion of mobile applications and other SM networks	0.4	4.6336	0.0146	0.3901	5.0383
	Total MS	9.6	8.5788	0.1362	2.3398	11.0547
	Kruskal-Wallis test		55.650	34.614	40.403	55.213
	Asymptotic Sig.		0.000	0.000	0.000	0.000
Alarm drill (AD)		2.9	5.5138	0.1066	2.8474	8.4678
First Aid education (FA)		0.5	8.5374	0.1111	3.8790	12.5275
Non-information (NI)		7.3	12.4515	0.2608	0.8514	13.5636
Total		100	13.0793	0.8281	3.2236	17.1311
Kruskal-Wallis test			238.365	180.634	37.792	173.446
Asymptotic Sig.			0.000	0.000	0.000	0.000

Table 4. Percentage of posts by content and media type.

Content Type	Event	Link	Live	Photo	Status	Video	Total
Awareness raising and education	-	4.7	-	6.8	8.1	4.1	6.2
Warning	-	3.8	-	3.7	5.9	0.2	3.3
Summary of interventions	-	3.9	-	3.0	7.8	3.5	3.3
Real-time communication	-	1.2	-	2.4	5.9	3.3	2.4
Request for support	-	0.6	-	0.3	0.3	2.1	0.5
Natural hazard (NH)	-	14.2	-	16.2	28.0	13.2	15.8
Awareness raising and education	-	3.3	-	3.8	4.8	2.8	3.6
Summary of interventions	-	32.2	-	17.2	51.5	21.2	20.1
Real-time communication	-	0.2	3.8	2.2	0.6	4.2	2.2
Everyday and technological risk (ER)	-	35.7	3.8	23.2	56.9	28.2	25.9
Presentation of employees and volunteers	-	14.4	71.3	18.9	2.8	26.3	19.0
Summary of awareness raising activities	-	3.5	1.3	9.5	1.4	3.2	7.6
Acquiring new material resources	-	0.8	1.3	0.7	-	0.5	0.7
Summary of activities to support public safety	-	0.3	-	1.1	0.3	0.5	0.9
Participation in events for the community	-	1.5	-	1.7	0.3	0.8	1.5
Rescue of animals	-	1.7	-	0.9	0.8	2.6	1.2
Compassion messages	-	0.2	1.3	1.0	0.3	0.3	0.8
Motto/values/display of symbols	-	1.7	16.3	6.1	0.8	6.5	5.5
Activity reports	-	2.3	-	0.9	-	0.7	0.9
Organization promotion (OP)	-	26.1	91.3	40.9	6.7	41.4	38.1
Offer of studies	-	3.8	-	1.9	0.6	3.5	2.2
Permits/certifications	-	2.9	-	1.6	3.4	0.2	1.6
Job ads	-	6.7	-	0.2	0.3	-	0.7
Volunteer recruitment	14.1	3.2	1.3	0.8	-	-	1.0
Invitation to events	82.8	3.5	2.5	2.8	2.5	1.2	3.7
Promotion of mobile applications and other SM networks	-	0.8	-	0.4	-	0.3	0.4
Marketing of their own services (MS)	97.0	20.7	3.8	7.7	6.7	5.2	9.5
Alarm drill	3.0	2.1	1.3	3.2	1.1	2.1	2.9
First Aid education (FA)	-	-	-	0.1	-	2.8	0.5
Non-information (NI)	-	1.2	-	8.7	0.6	7.2	7.3
Total	100	100	100	100	100	100	100

Understanding how CIES uses media types for particular topics is important, because the use of different media types influences stakeholder engagement with different topic categories (Table 5). For example, while status generates low engagement levels, when it comes to ***NH*** and ***ER***, engagement levels are above average. In contrast, links work for ***OP*** or ***NI***, but they are not so effective when it comes to risk communication (***NH*** and ***ER***). ***NI*** messages posted in the form of statuses generate an extremely low level of engagement. Live videos are more engaging than pre-recorded videos for ***OP***, but when it comes to ***ER***, stakeholder engagement with pre-recorded videos has a higher value than for live videos. However, due to the data limitations of live ***ER***, further investigation is called for.

Table 5. Stakeholder engagement by content and media type.

Category	Engagement						
	Event	Link	Live	Photo	Status	Video	Total
Natural hazard (NH)	-	5.7052	-	13.9484	7.5201	9.2304	10.8147
Everyday and technological risk (ER)	-	5.3047	17.7046	15.7226	9.0778	21.8463	15.8871
Organization promotion (OP)	-	16.8422	39.8231	32.1358	5.9181	21.1716	26.8957
Marketing of their own services (MS)	9.5265	7.6697	16.1908	13.1728	6.1567	9.3712	11.0547
Alarm drill (AD)	4.4721	6.5619	25.3833	9.3107	5.3000	7.3494	8.4678
First Aid education (FA)	-	-	-	10.0757	-	13.8477	12.5275
Non-information (NI)	-	15.3822	-	16.3512	0.2079	10.0929	13.5636
Total	8.9649	10.5614	34.4873	20.4295	7.0286	15.6359	17.1311

4.2. Disaster Risk and Crisis Communication Patterns Observed in CIES FACEBOOK Use

As indicated in Figure 2, posting messages about severe weather conditions is largely subject to the occurrence and the impact of these events. Most messages about severe weather conditions were posted in January, when in South-Eastern Romania several roads were affected by massive snowfall, resulting in the deployment of CIES units from the center of Romania to the most affected regions [54]. The educational message ratio in January was 27.2%—out of the 283 posts, 77 contained information on preventing frostbite and safety measures for those stranded in a blizzard.

From February until August, posts about severe weather focused mainly on disseminating information on the actions and interventions performed by CIES, with a low educational message ratio. Most of the interventions took place in September, when heavy rains and strong winds struck the territory of Romania, resulting in 8 casualties, 137 injured [55], and several instances of infrastructure damage [56,57]. In this context, an increase of educational messages can be observed: out of 126 messages posted in September, about half were regarding storm safety. This pattern also continued in October, despite the fact that there were far fewer interventions and no injuries were reported.

The number of monthly interventions has an effect on posting frequency regarding wildfire risk communication, as well (Figure 3). The number of interventions and Facebook posts reached their peak in March, with the start of agricultural activities. The number of interventions and, subsequently, that of posts also increased over the summer period due to the aridity and heatwaves that were recorded. The educational message ratio was higher than in case of severe weather, and it was mainly related to fire safety and open agricultural burning restrictions to promote disaster risk reduction.

A similar pattern of proportionality characterizes the relationship between heat warnings and heatwave-related posts (Figure 4). The educational message ratio was high, i.e., over 79% of post promoted heat protection behaviors for each of the three months.

Flood risk communication (Figure 5) does not follow the pattern observed so far: the number of interventions is not directly proportional to the number of Facebook posts. While the number of interventions reached its peak in May, the most numerous messages about floods were posted in February. In February CIES units intervened in 8 counties to prevent and mitigate ice jam flooding [58]. The ratio of educational messages was extremely low and can be characterized as falling into two

categories: messages requesting the population to notify authorities if they observe events that endanger the life or property of citizens, and messages regarding flood protection.

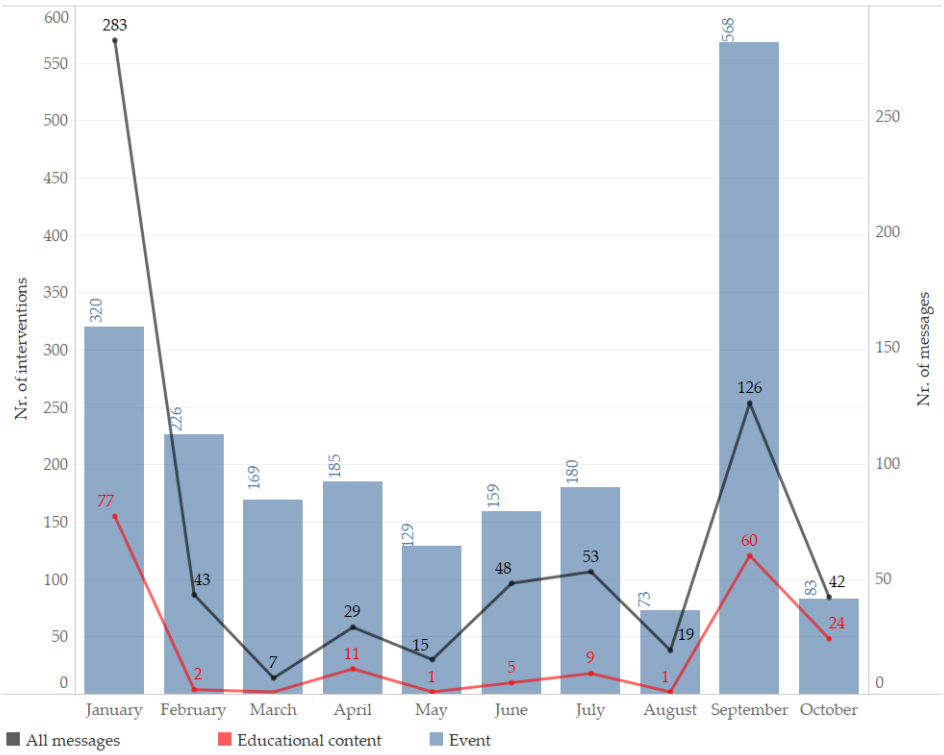

Figure 2. Monthly overview of interventions and post frequency related to severe weather conditions.

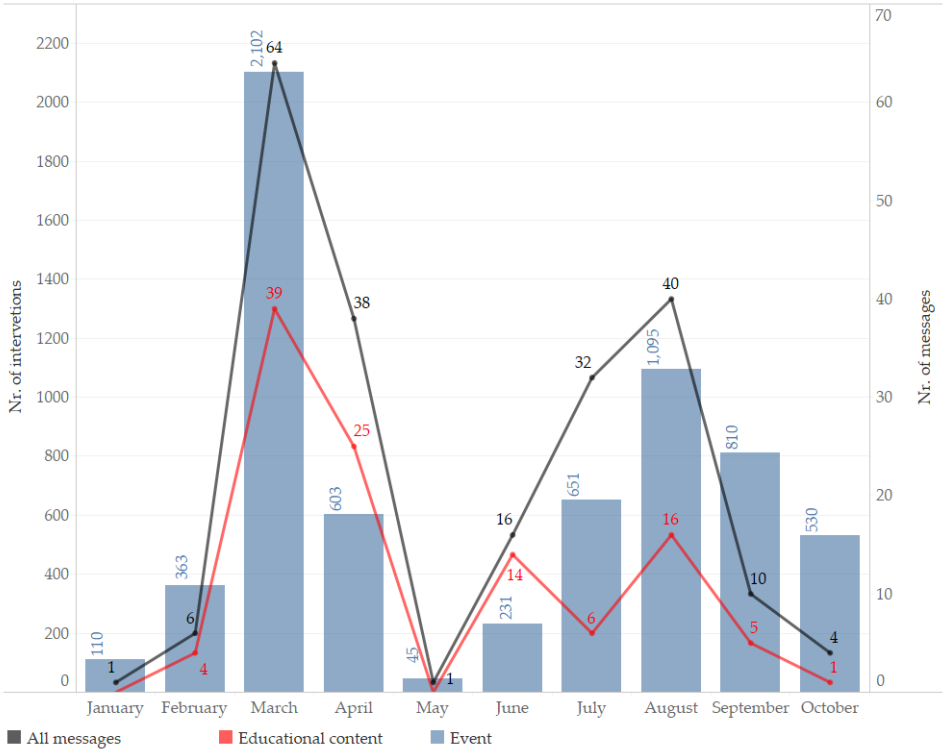

Figure 3. Monthly overview of the number of interventions and posts related to wildfires.

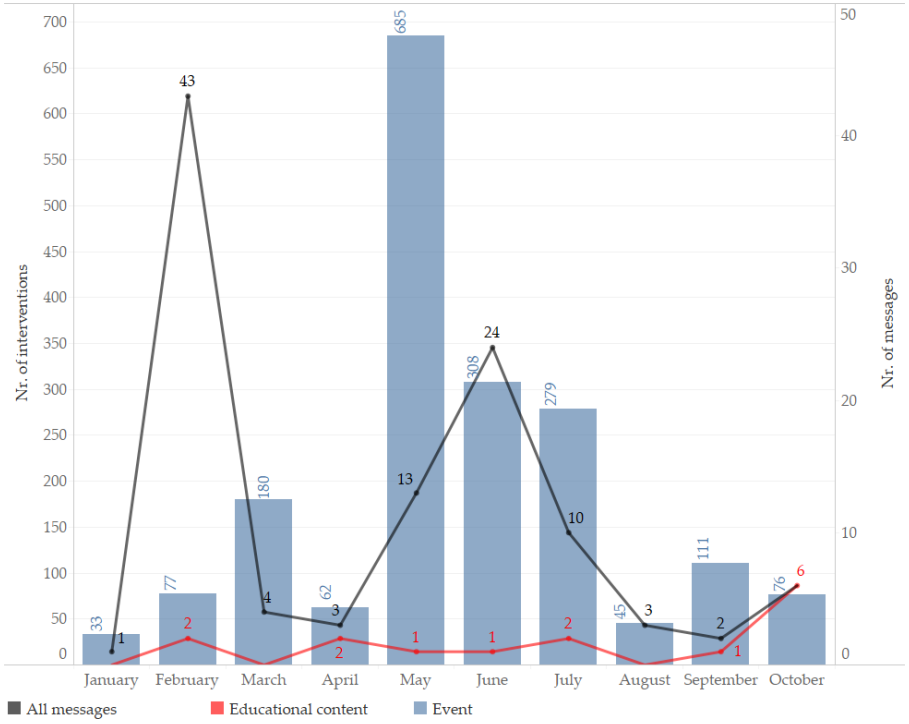

Figure 4. Monthly overview of the number of interventions and posts related to floods.

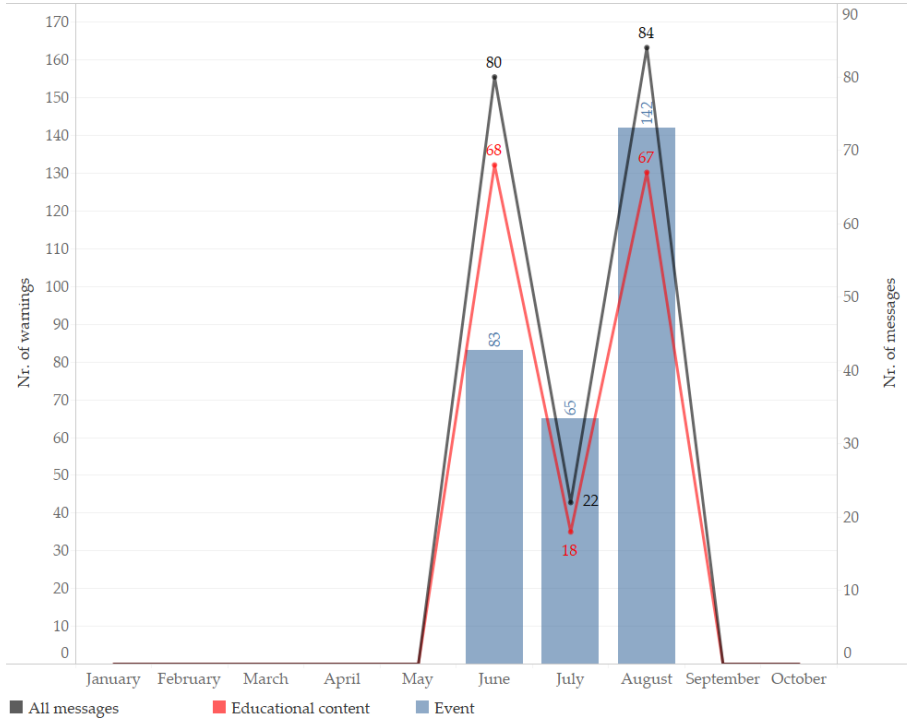

Figure 5. Monthly overview of the number of meteorological warnings and posts related to heatwaves.

During the study period, 17 earthquakes with M $\geq$ 4 where registered in Romania, of which 7 were lightly felt in several cities. The number of earthquakes (M $\geq$ 4) per month does not have a direct effect on the number of posts. Communication of earthquake risk seems to be focused on raising awareness and education—93% of the total messages contained information on earthquake safety (Figure 6). Posting frequency was the highest in March. All of these messages were posted to

commemorate 40 years since the 4 March 1977 earthquake, which was the most devastating earthquake in Romania's history [59].

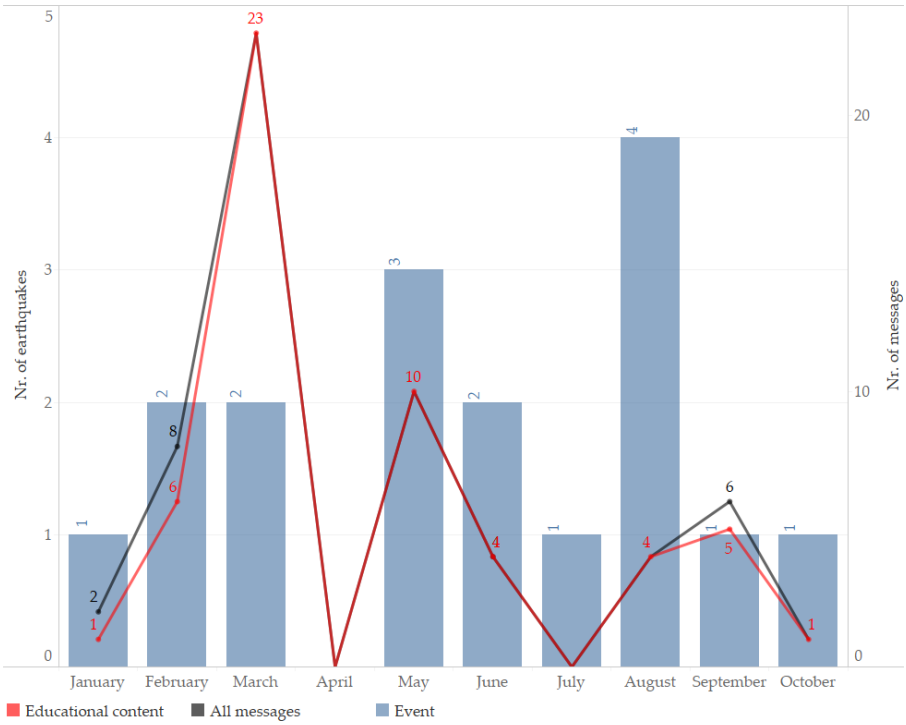

Figure 6. Monthly overview of the number of earthquakes (M ≥ 4.0) and posts related to earthquakes.

In accordance with the findings in Table 3, posts with educational content regarding risk preparedness, aiming to raise public awareness about specific risks and to educate stakeholders on behavioral rules and recommendations in order to increase self-protection, generate lower engagement than other posts regarding natural hazards (Table 6). In addition, the types of natural hazards the posts are referring to also impact stakeholder engagement. Stakeholders like to interact more with educational content regarding severe weather conditions and wildfire, but even in these cases, engagement levels are below the average. Furthermore, very low stakeholder engagement is observed for messages related to earthquake safety.

Table 6. Stakeholder engagement by hazard type and the presence of educational information.

Hazard	%	Engagement		
		Educational	Non-Educational	Total
Severe weather conditions	53.9	10.0107	11.4837	11.0791
Wildfire	17.2	10.0806	12.7322	11.8153
Heatwaves	15.2	8.5095	10.4015	9.1188
Floods	8.8	8.5349	13.7643	12.8056
Earthquakes	4.7	3.8793	5.4492	4.0312
Landslides	0.2	-	5.9197	5.9197
Total	100	7.9827	12.0268	10,8147

5. Discussion

The first part of this study focused on how CIES utilize Facebook to build a relationship with their stakeholders, and how stakeholders reacted to these efforts. As of 25 October 2017, 83% CIES had already launched an official Facebook page. This percentage affirms the existence of an effort

to establish a Facebook relation with stakeholders from early on, which is recommended in the field of emergency management [60]. Facebook adaptation levels are low in the south-east of Romania. There is also diversity in posting frequency. While approx. 50% CIES post twice or at least once in a day, which is in line with the recommendations of Romania's Ministry of Internal Affairs of a maximum of 3 posts per day [61], there are also CIES with low Facebook activity.

While in previous studies it was found that local governments use mostly links [31] and rarely add photos and videos to their Facebook posts [47], this study indicates that CIES rely heavily on multimedia features when publishing content on Facebook. This is particularly good from the perspective of stakeholder engagement, because, according to this study, photos and videos have a positive effect on stakeholder interaction. The engaging nature of photos and infographics was also proven in the SM practices of local emergency management from Central New York [62]. Although photos tend to suppress videos when it comes to stakeholder engagement [39], the findings of this study indicate that live video streams are by far the most preferred media type by stakeholders. Live, launched by Facebook in April 2016, lets CIES connect with their stakeholders instantly by sending them notifications when the institution starts a live video stream and also allows real time interactions. In addition to confirming previous findings on higher commitment to live videos than pre-recorded videos [63,64], this study also reports higher popularity, virality and engagement for this media type. CIES going live during different events almost doubles stakeholders' interactions with ***OP*** messages. However, because the engagingness of live streams is dependent on the topic [65] and on the context [66] of the video posts, the manner in which stakeholders engage with live videos of different content, besides ***OP***, is not conclusive, due to limited data availability. Live is the least used media type by CIES. Live streaming by CIES is mostly limited to ***OP***, with just a handful of videos streamed for ***ER***, ***MS*** or ***AD***, and it is not used at all for ***NH***, ***FA*** and ***NI***.

With respect to content type, CIES uses Facebook mostly to promote institutional transparency by providing up-to-date information on their activities regarding emergency response, risk prevention or public safety. Post content is tightly related to institutional activities. For example, during the study period, the number of interventions carried out in response to everyday incidents was almost five times higher than those carried out during natural disasters [67]; similarly, posts containing summaries of emergency response to everyday accidents are five times more frequent than those regarding natural disasters. Other frequently posted categories were those dedicated to promoting the organization's image in the virtual space, followed by marketing-oriented posts, both conforming to CIES communication principles of brand orientation.

From the perspective of stakeholder engagement to content type, messages promoting the organizations' image received the most engagement from stakeholders. However, while in a study conducted by Bonson et al. [31], stakeholders engaged most with content related to matters directly affecting citizens life, in the study at hand engagement seemed to be related to the newsworthiness of the post. Selecting stories based on their news values by public relations professionals to influence news media is not unheard of [68]. According to the present study, posts with a high potential of becoming a news story [69] are usually the most engaging topics. For example, bad news with a particularly negative tone may attract audiences due to its drama and shock value, which seems to be the case in this study. The topic that stakeholders interacted with the most, representing just 0.8% of the total posts, was related to remembering the departed employees and to expressing compassion for communities affected by disasters. Drama, particularly stories concerning rescue activities, seems to also be an important factor in engaging stakeholders in online interactions, especially if they have a happy ending. For example, stories about animals rescued by CIES employees from dangerous situations had the second-highest stakeholder engagement. Stories in line with the organizational agenda to promote its image and values also generate online interactions, especially if the post portrays a person's or a smaller group's professional or other achievements. Entertainment, consisting of lighter human interest stories, such as depicting CIES employees participating in events for the community or in different training exercises or sports events, also generated above-average stakeholder engagement.

Posts with marketing content generate lower stakeholder interactions, just as indicated in previous studies [31,46]. However, engagement levels for this kind of content are dependent on the size of the target audience. Posts with a restricted target-group—for example, messages regarding different permits that CIES issues for legal persons only—generate low levels of engagement.

The second part of this study focused on CIES risk and crisis communication practices. Just 15.7% of the posts were related to natural hazards, indicating that CIES Facebook communication strategy is more transparency- and brand-oriented. In contrast, previous research on United States state-level emergency management organizations found that risk and crisis communication is more prominent in their Facebook use [18].

In their risk and crisis communication, CIES mostly apply push tactics, not taking full advantage of web 2.0 techniques. Only 0.5% of the messages actually call to the stakeholders by requesting support during emergency situations. This suggests that CIES try to comply with the institutions' multi-channel approach, disseminating information on as many channels as possible, but not necessarily adapting the information to the specific requirements of SM channels. This is proven by the high percentage of status messages used for talking about natural hazards. The predominant use of push tactics by emergency management agencies is consistent with other studies, and it can be considered a safe way of disseminating official information on SM [62,70].

There are also indications for good practices applied by CIES for disaster risk and crisis communication on Facebook. Previous studies indicated that individuals tended to direct their attention to SM to find information and aid immediately after a significant event had occurred [71]. The results showed that in the months with high intervention frequency or higher numbers of meteorological warning messages related to severe weather, wildfire and heatwave were also boosted, making timely safety information on Facebook available for stakeholders. Furthermore, posting real-time information during an on-going emergency situation to keep stakeholders updated almost doubles post virality.

Messages containing preparedness information regarding natural hazards are twice as high as those regarding everyday and technological risks. This suggests that CIES focuses their educational efforts on Facebook more on natural hazards. However, stakeholders seem more likely to interact with messages about everyday risk. Furthermore, messages with educational content regarding first aid, few in number, generate also higher engagement levels than those regarding natural hazards. Stakeholders may interact with messages about everyday risk and first aid more, because they perceive these risks more likely to occur, due to their familiarity [72]. Also, some of the educational messages regarding everyday risks are coupled with narratives. For example, messages concerned with prevention of drowning are usually posted with regard of a recent drowning incident, adding bad news values to the safety issues. Meanwhile, safety instructions regarding natural hazards are usually posted as a simple list of safety tips or infographics. The positive effect of human interest narratives for stakeholder engagement has also been proven in previous research on online health promotion practices [46].

With regard to hazard type, stakeholders seem to engage more with educational content about hazards with higher probability of occurrence. Engagement with earthquake safety messages is particularly low. Earthquake safety is an important issue in Romania. Hence, in 2015, the Department for Emergency Situations launched a public campaign "No tremor during an earthquake", which was partly designed for SM [73], containing a number of video animations regarding earthquake safety. However, the findings of this study suggest that CIES post rarely about this issue, which is proven by the low percentage of earthquake-related messages. There are hints on the use of good communication strategy for earthquake safety in the study sample, such as keeping memories of past events alive [74], by commemorating the 4 March 1977 earthquake. Nevertheless, stakeholder engagement is really low, which is worrisome, considering the high level of impact an earthquake would have, despite its low likelihood of occurrence [50].

6. Conclusions

The study at hand contributes to the understanding of Romanian local emergency management agencies' round-the-clock Facebook use. Some of CIES communication principles seem to translate quite effortlessly into their Facebook communication, especially when it comes to promoting the agency. In this sense, Facebook holds great potential for emergency management agencies to establish and strengthen the connection with their stakeholders, alongside the traditional communication channels. Understanding stakeholder engagement, which mirrors their content and media type preferences, can improve Facebook usage a great deal in the future. The results obtained suggest several possible approaches to such improvements. CIES-designated personnel for Facebook communication should select messages considering their news value, because content choice impacts how stakeholders engage with CIES posts a great deal. It is also recommended for them to include rich multi-media features and abstain from the use of status messages and links. When it comes to live videos, they proved to be well-suited for ***OP***, but the findings were not conclusive in terms of their effect on stakeholder engagement with different content types. However, live videos have some features that make them stand out from other media types. They are more time-efficient and less expensive to make then pre-recorded videos; messages can be tailored according to stakeholders' information needs in real-time, in contrast to infographics, which are harder to adapt to specific situations, and while status messages are also easily adaptable in real-time, they are far less engaging than live videos. These features may be of value to disaster risk and crisis communication; therefore, further scientific inquiries on the subject are called for in the future. In the meantime, CIES should consider extending the use of live videos for different content types. Regarding the use of events, this study came to partial conclusions—while reported levels of commitment and virality concerning this media type were extremely low, it should be acknowledged that this kind of post has offered stakeholder engagement beyond liking, commenting and sharing, which were not the subject of the present study. Additionally, to achieve further improvement is to comply with the communication principle of audience orientation—CIES should define more precisely whom CIES Facebook communication is addressed to, because some inconsistences are found, especially with regard to marketing oriented messages. This may have an influence on content style, an issue not addressed in the present study.

Another conclusion of this study, and maybe the most important one, is that at the moment, CIES does not make extensive use of Facebook for disaster risk and crisis communication. Local emergency management leaders consider preparing the population to cope with risk to be the most important issue, calling for a long-term approach when talking about emergency preparedness in Romania [75]. Disaster risk communication is a core part of these efforts, so not taking full advantage of interaction opportunities offered by Facebook and focusing just on pushing information to stakeholders may be considered a missed opportunity. Even if there are some indications for appropriate Facebook usage for disaster risk and crisis communication by CIES, such as posting real-time updates on ongoing emergencies, disseminating timely safety information when an emergency situation occurs, or remembering past events, stakeholder seem unlikely to interact with these types of content. They are most likely to interact with real-time updates on ongoing emergency situations. The virality of these posts was above average; however, only 2.4% of the messages contained real-time updates, while 3.3% contained after-event summaries. In the future, CIES should consider allocating the necessary time and resources for disseminating such updates, because due to stakeholders' willingness to share them, the reach of such messages can be amplified greatly. As for low levels of interactivity for other NH subcategories, the study uncovered some possible explanations for their behavior. Firstly, the natural hazard the post is referring to may be unfamiliar for the stakeholders, or have a low probability of occurrence. Additionally, media types used for disaster risk and crisis communication are less engaging. However, this issue is complex; therefore, in the future, if CIES decides to integrate disaster risk and crisis communication more into their everyday Facebook communication, a stakeholder needs assessment should be carried out to understand their risk perception, communication needs and

expectations, in order to be able to design messages that resonate with stakeholders and encourage them to take action.

The study has a number of limitations. Firstly and most importantly, while stakeholder engagement with regard to risk and crisis communication was assessed, the effectiveness in terms of protective action behavior [76] was not studied. Risk communication is effective if stakeholders are exposed to risk information, they pay attention to it and, most importantly, if they comprehend it [71]. This study merely gives an insight into how stakeholders are exposed to risk information on Facebook and how they pay attention to it by interacting with certain messages. Secondly, the study sample was comprised of a very specific segment of the Romanian emergency management system. There are also other organizations vested by national regulations with disaster risk and crisis communication responsibilities, so in the future, the sample could be extended to draw a more complex picture of Romanian risk narratives. Additionally, this study focused on the communicational practices of local emergency management agencies, but in the future, national agencies should be also investigated, because according to this study, messages posted by the General Inspectorate for Emergency Situations and the Department for Emergency Situations were frequently shared by CIES. Last, future studies should extend to how CIES employees evaluate and define their Facebook communication objectives and how stakeholders use Facebook to find information on disaster risk. These inquiries will put the present study in a wider context leading to understand in-depth how emergency management agencies use Facebook as a tool to communicate with their stakeholders on an everyday basis.

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Appendix A

Table A1. Contains the summary of the coding categories.

Category	Subcategory	Definition
Natural hazard	Awareness raising and education	Messages promoting structural and non-structural prevention measures and preparedness measures for natural disasters: - behavioral rules and recommendations for the increase of self-protection and protection of family and goods;' - rules and recommendations for disaster risk reduction; - information on risk, including their characteristics; - information campaigns
	Warning	Messages that warn the population regarding the higher occurrence probability of a risk at a specific time
	Summary of interventions	Messages narrating interventions in emergency situations generated by past natural hazards and those regarding the damages recorded as a result of dangerous events and the preventive measures applied in order to reduce their effects.
	Real time communication	Messages containing information on the evolution of an emergency situation triggered by natural hazard in real time. Also messages that contain containing traffic information during the emergency situations triggered by natural risks.
	Request for support	Messages addressed directly to the population in order to: - ask for help during interventions; - IMPOSE or PROHIBIT certain behaviors in order to reduce certain risks.

Table A1. *Cont.*

Category	Subcategory	Definition
Everyday and technological risk	Awareness raising and education	Informative educational messages/campaigns/actions regarding: - measures that can be taken for the reduction of these risks; - adequate behavior in case of these events to reduce vulnerability (i.e., Call 112).
	Summary of interventions	Messages narrating past interventions in emergency situations, others than those generated by past natural hazards. This also includes the messages regarding the damages recorded as a result of dangerous events and the preventive measures applied in order to reduce their effects.
	Real time communication	Messages containing information on the evolution of an emergency situation triggered by other types of hazards in real time
Organization promotion	Presentation of employees and volunteers	Messages on the participation of employees, either individually or in group in: - intervention exercises in emergency situations at local/national/international level; - training courses; - competitions involving members of the Inspectorates and sports competitions. - Messages on the employees in important moments of their career. The important events may refer to: - taking the oath; - retirement; - promotion; - act of bravery.
	Summary of awareness raising activities	Messages presenting previously conducted education activities in the communities and news and briefings on civil protection drills involving population
	Acquiring new material resources	Messages on purchases conducted to improve the response capacity by acquiring new material resources
	Summary of activities to support public safety	Messages on the participation of Inspectorates in public events in order to ensure the safety of the participants.
	Participation in events for the community	Messages on the participation of Inspectorates in events for the community service such as: - Donation of blood; - Planting of trees
	Rescue of animals	Messages narrating the intervention of the employees of Inspectorates in order to rescue animals.
	Compassion messages	Messages by which the Inspectorate expresses its compassion for the persons affected by a disaster/emergency situation. Messages for the remembrance of employees who died on duty or under other circumstances.
	Motto/Values/ display of symbols	Messages to promote the values/motto of the Inspectorates. References to important events such as Firefighters' Day, Civil Protection Day and the anniversary of founding of units within the Inspectorates. Participation in official parades in uniforms on the national day or other holidays.
	Activity reports	Messages which present annual or quarterly reports on the activity of the Inspectorates
Marketing of their own services	Offer of studies	Messages promoting the "Pavel Zăgănescu" School for Firefighters and Civil Protection

Table A1. *Cont.*

Category	Subcategory	Definition
	Permits/ certifications	Messages promoting the permits/certifications services: - Fire safety permit/authorization - Civil protection permit/authorization - Events and meetings for certification purposes - Certifications in the field of emergency situations.
	Job ads	Job ads in the units of the Inspectorates for Emergency Situations.
	Volunteer recruitment	Volunteers recruitment ads for the voluntary services for emergency situations
	Invitation to events	Invitation to events organized by the Inspectorates
	Promotion of mobile applications and other SM networks	Messages which promote other social media channels or the mobile application designed for disaster risk and crisis communication, developed by the Department for Emergency Situations
Alarm drill	-	Messages referring to alarm drills for the population at national/county/local level: - notification of drills; - summary of drills; - information on the behavior rules during alarm
First Aid education	-	Messages contain practical information on the correct manner to provide first aid.
Non-information	-	Messages referring to bank holidays or other important historical. Examples of such messages: - wishes sent on the occasion of Women's day, Easter, Christmas, etc. - wishes sent to other governmental or non-governmental institutions (i.e., wishes addressed to gendarmes on the National Day of Gendarmerie).

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