Identifying the Relevance of Research Goals through Collecting Citizens' Voices on Social Media

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Abstract

Recent debates on the meaning and use of science are focused on addressing citizens' needs or concerns of society in different fields. Researchers have developed different methodologies for capturing the relevance of topics to be addressed by research in order to map them. This article proposes a new methodology for identifying the relevance of research goals through collecting citizen's voices on Twitter and Facebook combing two approaches: top down, starting with already defined research goals priorities, and bottom up, departing from the social media. The article presents the results of the application of this methodology through the research goals of Sustainable Development Goals to identify their relevance and if there are some topics not covered by them. Thus, researchers could integrate this methodology in their daily work and be more in line with the needs expressed by citizens in social media.

Keywords: social media, research, trends, citizens, voice

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Identificar la Relevancia de los Objetivos de Investigación a través de las voces de la ciudadanía en las Redes Sociales

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Resumen

Debates recientes sobre el sentido de la ciencia están centrados en cómo responder a las necesidades de las personas ciudadanas y a las preocupaciones de la sociedad en diferentes campos. Diversos equipos de investigación han desarrollado diferentes metodologías para capturar la relevancia de los temas a ser abordados como objetivos de investigación. Este artículo presenta una nueva metodología para identificar la relevancia de los objetivos de investigación a través de recoger las voces de las personas ciudadanas en Twitter y Facebook principalmente y combinando dos modelos; top-down, a través de palabras clave predefinidas extraídas de los objetivos de investigación seleccionados, y bottom-up, partiendo de los temas más recurrentes expresados a través de las redes sociales. El artículo presenta los resultados de la aplicación de esta metodología a través de la selección de los objetivos de investigación definidos en los Sustainable Development Goals identificando su relevancia, así como la identificación de temas no previstos en ellos. Los equipos de investigación pueden integrar esta metodología en su cotidianidad para valorar la relevancia de sus objetivos de estudio a partir de los resultados extraídos en las redes sociales.

Palabras clave: relevancia, redes sociales, investigación, ciudadanía, tendencias

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One of the key aspects discussed internationally by the scientific community is how research can be an answer to the citizens' concerns in different fields and how this knowledge can be available for any citizen in any part of world (Miyairi, 2014; Molloy, 2011; Whyte & Pryor, 2011; Woelfle, Olliaro & Todd, 2011). Hence, one of the current contributions that are addressing these questions are how different research areas can ensure social impact of their research, considering social improvements (Flecha, Soler-Gallart & Sorde, 2015) as one of the criteria for evaluating this impact. For instance, some of the priorities that society is concerned about is violence against women, and one of the trends is focuses on finding ways to overcome it. One first step is to break the silence in those spaces where silence still prevails. This is the case of violence against women in Spanish Universities (Valls, Puigvert, Melgar & Garcia-Yeste, 2016), research evidences are contributing to this aim. There is a wide list of examples of research that are addressing some of the priorities set out by society in different scientific fields with the corresponding evidences of their success. For instance, research on the improvement of soil quality reducing oil nitrous oxide emissions (Cayuela et al., 2014) is addressing one of the concerns of the farming community to maintain soil quality and reduce negative effects of the use of artificial products on the agricultural fields.

But a previous step is also how to identify the relevance of research goals in order to address them (Schulz, 2016). The scientific community has developed different methodologies for identifying this relevance (Altmann, Whichard & Motter, 2013; Camarinha-Matos & Afsarmanesh, 2004; Valkila & Saari, 2013). These methods are mainly based on expert's views or documentation being useful for identifying current research trends. However, the dialogic turn in our societies (Aubert & Soler, 2006) is a transversal fact that affects all different areas of society as well as research. This means that the inclusion of the citizens' voices could be helpful for the identification of the relevance of research goals. In fact, the participation of the citizens in an egalitarian way together with the researchers has a wide trajectory in the communicative methodology (Gómez, 2014) as well as in fields such as dialogic leadership (Redondo, 2016).

One method for including the citizens' voices in the identification of relevance of research goals is through data collection in social media.

Citizens are currently using social media and other relevant online sources to express their opinions and interests (Wandhöfer et al., 2012). Yet it is important to consider the limitation that these interests are representative of those citizens who are using social media and online sources. Therefore, this article presents a methodology for identifying the relevance of research goals considering citizen's voices collected in social media through two approaches; one departing from the goals set out by supranational organizations such as the UN (top down) and gathering data collection in social media related to their corresponding keywords. In addition, another one that gathers the most pressing issues and concerns that are present in the social media (bottom up). To exemplify this methodology, the present article provides a comparative analysis of the results obtained through social media and other relevant online sources related to the priorities defined under the Sustainable Development Goals (SDG, hereinafter) defined by United Nations.

Methodology for the Identification of the Relevance of Research Goals through Social Media

The use of social media data as an information source for research purposes has increased over the last years in different scientific fields as well as subject matters (Ngai, Tao & Moon, 2015; Wu, Sun & Tan, 2013). The fact is that the number of citizens that use social media is increasing year by year. According to Statista[2] there is an estimation of 2.51 billion social media users around the globe. Facebook has 1.87 billion active users monthly and Twitter has 319 million active users monthly. In this sense, content and communication shared by citizens through social media is influencing different sectors. For instance, the information is taken into account in business and marketing (Khang, Ki & Ye, 2012) as well as for the political agenda (Bastos, Raimundo & Travitzki, 2013; Torres-Nabel, 2015), news covered in media (Broersma & Graham, 2013) or as a crucial means in natural disasters in order to save lives (Bruns & Liang, 2012) among others.

Along these lines and with the aim to serve societal needs, research funded by different institutions must respond to the challenges that those institutions have designed in their priorities, which also need to be aligned to

the citizens' needs. Hence, this methodology aims to contrast data obtained through social media with the priorities designed by the corresponding institution or researchers for identifying the major trends among the citizens' interests as well as to find out if some of the trends are not covered in these priorities. Top down and bottom up approaches are designed to obtain these results.

Top Down Approach

The top down approach consists in defining keywords extracted from the research goals designed by the corresponding institution to contrast if these goals are present in the citizen's opinion expressed in social media. Once the keywords were selected, they were converted into searchable words in social media. In the case of Twitter, this conversion of keywords implies using Hashtags. The scientific literature found that the use of Hashtags is one of the criteria to identify relevant topics in the Twitter community (Grasso & Crisci, 2016; Small, 2011).

To provide an example, there are 17 Sustainable Development Goals defined by United Nations[1] that have been converted in 30 searchable keywords on Twitter. This conversion consists in finding the most suitable hashtag for the goals defined here.

Once the list of obtained keywords is ready the following step is capturing the data on the Social Media and online sources selected. In this case, there are four sources selected considering that they are popular among citizens and are included as information sources in Almetrics. These sources are two social media (Facebook and Twitter) and two relevant online sources, Wikipedia (Internet free encyclopaedia) and YouTube (video sharing website). The contrast of information between different social media and online sources data is considered an important step in order to get a more consistent map of the information obtained (Nam, Lee & Park, 2014).

Data Collection & Analysis

In order to capture and treat data from Twitter and Facebook a combination of two software programmes is used: R-program and NVivo Plus. Wikipedia

has an internal statistics tool, "Page view Statistics," and YouTube has its own search tool with a filter of view count.

Table 1.
Searchable Keywords

Sustainable Development Goal	Searchable Keyword/s
No Poverty	#nopoverty
Zero Hunger	#zerohunger
Good Health and Well-being	#wellbeing #goodhealth
Quality Education	#qualityeducation
Gender Equality	#genderequality #vaw (is a goal inside of this)
Clean Water and Sanitation	#cleanwater
Affordable and Clean Energy	#cleanenergy
Decent Work and Economic Growth	#decentwork #economicgrowth
Industry, Innovation, Infrastructure	#industry #innovation #infrastructure
Reduced Inequalities	#reduceinequalities
Sustainable Cities and Communities	#Sustainablecities #safecities #inclusivecities
Responsible Consumption and Production	#responsibleconsumption #responsibleproduction
Climate Action	#climateaction #climatechange
Life below Water	#oceansustainability
Life on Land	#biodiversity #combatdesertification
Peace, Justice and Strong Institutions	#inclusivesocieties #justice #peacefulsociety
Partnerships for the Goals	#globalpartnership #UN

Twitter

Data collection on Twitter is developed using the searchable keywords through the Twitter-R Package installed in the R-program. This Package is connected with the public Twitter API (free) that has a limitation of recovering information published in a period of 7/9 days previous to the search done. The user can define the "N" (Number of tweets) in the R-program. For the present study, N was set at 10.000. Thus, during the search the System can stop when 10.000 tweets are analysed or the period of 7/9 days is reached. An excel list is obtained with the tweets related to the searchable keywords. The value of the engagement determines the most used

keyword during the period analysed. This value represents the sum of interactions of the users with the content. In the R-program this includes replies, favourites, RTs, and Total RTs.

Facebook

Data collection on Facebook is developed using the Rfacebook Package installed in the R-program. In this case, the data obtained is the number of public pages on Facebook that contain the searchable keyword in its public name. In this case the "N" is also defined with the value N = 10.000, but there is no time limitation. The value of the "talking about" determines if there are more or less people interacting with this page.

Wikipedia

Data collection on Wikipedia is extracted through the internal data statistics tool of Wikipedia namely "Page view Statistics". In order to analyse the presence of a keyword, it is necessary to find out if the keyword is on Wikipedia or not. If it is present, the number of page visits determines the value of presence. Moreover, another indicator is the number of languages in which the definition of this keyword is available. This tool also provides the option to select the period to be analysed, in this case, the range chosen is 30 days. Once some of keywords are introduced in the search tool one is redirected to other keywords that are synonyms and that are quoted in parenthesis. For instance, quality education is part of another general keyword that is education and results of the latter are collected.

YouTube

Data collection in YouTube is conducted using YouTube's internal search engine and applying the filter of "view counts". YouTube has many videos in its platform, YouTube does not indicate an exact number instead of this an approximation represented with this quote "About X videos". In order to extract the data, the number of the approximated videos is annotated, and the number of view counts of the five most viewed videos is added. One of

strategies to refine results is to introduce the keywords in double quotes. Therefore, the relevance is determined by the number of view counts of the five most viewed videos for each keyword. It is noteworthy that this source is the only source where all keywords searched are present.

Results obtained by each social media and online source analysed are ranked by larger or smaller presence. The ranking is useful for analysing which keyword is most used by the citizens who are interacting in these social media or online sources allowing a map of these keywords. Finally, this allows us to have a global overview of the keywords' presence. This ranking is called Ranking of Total online interactions and is based on the sum of online interactions in the two social media selected (Twitter and Facebook) and two relevant online sources (YouTube and Wikipedia).

Bottom Up Approach

The bottom up approach consists in identifying topics emerging from those keywords most used by citizens in different social media and online sources. Once the list of topics is obtained, results should be contrasted with the priorities defined by the corresponding research institution and analyse if there are some issues that are not covered by the institution. In this case, the list of topics obtained is contrasted with the Sustainable Development Goals defined by United Nations.

Data Collection & Analysis

There are two strategies for obtaining data collection from this approach. One of them is to analyse social media secondary literature reports that collect topics with large presence in the social media. For instance, Facebook elaborates a report of the most talked about global topics in a year. For the present article the report of 2016 is analysed[3]. Twitter also elaborates a list of the trending topics (TT) of the year; therefore 2016 trending topics of Twitter are analysed[4]. Lastly, the report on Wikipedia's popular pages[5] during a year is also used for identifying topics with most online attention. In this case the report of the 5.000 popular pages in 2016 is selected in order to analyse the first 500 popular pages. The next step is to monitor in real

time the Trending Topics of Twitter in countries selected during a period defined. In order to do this monitoring the R-program is used with the application of extraction of the 50 Trending Topics. For the present research the code was designed for extracting the 50 Trending Topics for two moments of the day (noon and night) during one week (March 7- March 13, 2017) in 14 countries (Argentina, Belgium, Brazil, Canada, France, India, Ireland, Italy, Kenya, Mexico, Nigeria, Spain, United Kingdom, United States).

In both strategies, the selection of the topics includes all those keywords related to citizens' interests excluding all those topics related to TV shows, music, sports, religion, geography, entertainment that would be a subject matter for other research. Once the list is, obtained results are contrasted with the sustainable development goals in order to identify if there are some issues that are not covered by the institution's priorities.

Results

Results are classified in two sections those obtained through the Top down approach and those of the Bottom up approach. The first section of results is aimed to analyse which keywords of sustainable development goals have larger presence in each social media and online source selected as well as an overview of total online interactions for each keyword. This comparative analysis evidences those topics that receives most attention by citizens. On the other hand, results obtained through the bottom up approach is useful for the identification of emerging topics that are not yet covered under the sustainable development goals and could be a relevant information for developing the next strategies.

Top Down Results

Keywords with higher presence in Twitter are Climate Action and Justice, followed by the keywords with medium-high presence that are social topics such as gender equality or eradication of the hunger around the globe but also there are concerns related to the preservation of the Earth as well as natural resources (Climate Change, Clean Energy, Clean Water,

Biodiversity) and infrastructure. On the other hand, the five keywords with lowest presence are Inclusive Societies, Ocean Sustainability, Peaceful Society, and Responsible Production. Combat Desertification and Global Partnership do not have any tweet.

Table 2.
Ranking of Keywords – Twitter

Searchable Keywords	Search day	Engagement (replies+favorites+Rts+Total Rts)
#climateaction	14/03/2017	5.441.609
#justice	14/03/2017	1.060.001
#climatechange	14/03/2017	513.906
#genderequality	17/03/2017	431.909
#zerohunger	16/03/2017	379.785
#cleanenergy	17/03/2017	317.572
#cleanwater	14/03/2017	298.389
#biodiversity	14/03/2017	238.539
#infrastructure	17/03/2017	188.615
#wellbeing	16/03/2017	86.337
#innovation	14/03/2017	77.402
#vaw	14/03/2017	68.934
#industry	17/03/2017	17.937
#ecomicgrowth	14/03/2017	11.878
#decentwork	14/03/2017	4.565
#safecities	14/03/2017	4.058
#qualityeducation	16/03/2017	1.797
#goodhealth	16/03/2017	1101
#Sustainablecities	14/03/2017	719
#nopoverty	16/03/2017	119

(continued)

Searchable Keywords	Search day	Engagement (replies+favorites+Rts+Total Rts)
#inclusivecities	14/03/2017	103
#reduceinequalities	14/03/2017	75
#responsibleconsumption	14/03/2017	71
#inclusivesocieties	14/03/2017	39
#oceansustainability	17/03/2017	4
#responsibleproduction	14/03/2017	3
#peacefulsociety	17/03/2017	2
#combatdesertification	17/03/2017	0
#globalpartnership #UN	16/03/2017	0

Legend

☐ Not Found (0)
☐ High presence
☐ Medium –High
☐ Medium
☐ Low

Note. Range on Twitter (measured by Number of Engagement (replies+favorites+Rts+Total Rts), 1-9.999 (Low) 10.000-99.999 (Medium), 100.000-999.999 (Medium-High), (+) 1.000.000 (High).

Keywords appearing in the public names of Facebook pages with more "talking about" are Industry and Justice. The latter coincides with one of the keywords with higher presence in Twitter. Innovation, Infrastructure and Good Health are keywords with a medium-high presence on Facebook pages. On the other hand, the five keywords with lowest presence are Reduce inequalities, Global Partnership for Sustainable Development, Decent Work and Inclusive Societies. The keyword Ocean Sustainability appears in two names of Facebook pages, but nobody is talking about it.

Table 3.
Ranking of Keywords – Facebook

Keywords	Search day	Total number Pages	Talking about
Industry	16/03/2017	530	18.38.422
Justice	16/03/2017	537	12.41.246
Innovation	16/03/2017	491	878.471
Infrastructure	16/03/2017	469	513.109
Good Health	16/03/2017	497	267.324
Climate Change	16/03/2017	510	54.619
Well-being	16/03/2017	419	49.706
Biodiversity	16/03/2017	477	31.233
Clean Energy	16/03/2017	466	27.793
Clean Water	16/03/2017	466	18.030
Climate Action	17/03/2017	415	12.741
Violence Against Women	17/03/2017	327	8.856
Sustainable Cities	16/03/2017	105	8.681
Quality Education	16/03/2017	479	6.878
Gender Equality	17/03/2017	59	5.351
Economic Growth	17/03/2017	227	2.328
Peaceful Societies	16/03/2017	37	2.328
Safe Cities	16/03/2017	72	2.175
Combat Desertification	16/03/2017	8	250
Poverty	16/03/2017	83	183
Zero Hunger	16/03/2017	27	163
Responsible Production	17/03/2017	46	135
Responsible Consumption	16/03/2017	10	129
Inclusive Cities	16/03/2017	22	99
Inclusive Societies	17/03/2017	22	99
Decent Work	16/03/2017	56	83
Global Partnership for Sustainable Development	16/03/2017	7	23
Reduce Inequalities	16/03/2017	3	2
Ocean Sustainability	16/03/2017	2	0

Legend

	Not Found (0)
	High presence
	Medium –High
	Medium
	Low
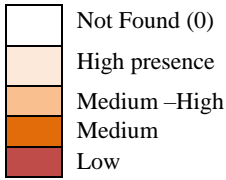
Note. Range on Facebook (measured by Number of Talking about (pages) 1-999 (Low), 1.000-99.999 (Medium), 100.000-999.999 (Medium-High), +1.000.000 (High).

Keywords with higher presence in Wikipedia are Quality Education (as part of the more general term Education), keywords related to preservation of the Earth (Biodiversity and Climate Change) and economy (Industry, Innovation). Those keywords with medium-high presence are social topics such as Poverty, Justice, Violence Against Women, Gender Equality and Economic Growth, on the other hand Infrastructure and keywords related to the Earth preservation (Clean Water and Combat Desertification). There are seven keywords without any presence because their definition is not included in Wikipedia (English version); these are Safe Cities, Inclusive Cities, Responsible Production, Ocean Sustainability, Inclusive Societies, Peaceful Societies and Global Partnership for Development. The five keywords with less page views are Good Health, Responsible Consumption (that redirects to the Sustainable Consumption), Decent Work, Reduce Inequalities (that redirects to Inequality) and Climate Action (that redirects to Climate Change Mitigation).

Table 4.
Ranking of Keywords – Wikipedia

Keyword	Search date	Languages	Page views
Quality Education (Education)	2017-02-14 - 2017-03-15	152	720.568
Biodiversity	2017-02-14 - 2017-03-15	80	364.847
Climate Change	2017-02-14 - 2017-03-15	64	340.059
Industry	2017-02-14 - 2017-03-15	135	337.566

Keyword	Search date	Languages	Page views
Innovation	2017-02-14 - 2017-03-15	53	337.566
Poverty	2017-02-14 - 2017-03-15	82	284.566
Justice	2017-02-14 - 2017-03-15	69	210.545
Violence Against Women	2017-02-14 - 2017-03-15	30	176.963
Economic Growth	2017-02-14 - 2017-03-15	50	176.142
Infrastructure	2017-02-14 - 2017-03-15	75	164.451
Gender Equality	2017-02-14 - 2017-03-15	43	162.090
Clean Water (drinking water)	2017-02-14 - 2017-03-15	63	120.232
Combat Desertification (desertification)	2017-02-14 - 2017-03-15	56	109.884
Hunger	2017-02-14 - 2017-03-15	54	54.362
Well-being	2017-02-14 - 2017-03-15	16	38.339
Clean Energy (Sustainable Energy)	2017-02-14 - 2017-03-15	16	23.140
Sustainable Cities (Sustainable City)	2017-02-14 - 2017-03-15	15	17.202
Climate Action (Climate Change Mitigation)	2017-02-14 - 2017-03-15	14	16.315
Reduce Inequalities (Inequality)	2017-02-14 - 2017-03-15	12	9.897
Decent Work	2017-02-14 - 2017-03-15	8	6.766
Responsible Consumption (Sustainable Consumption)	2017-02-14 - 2017-03-15	8	6.095
Good Health	2017-02-14 - 2017-03-15	1	83
Safe Cities	2017-02-14 - 2017-03-15	0	0
Inclusive Cities	2017-02-14 - 2017-03-15	0	0
Responsible Production	2017-02-14 - 2017-03-15	0	0
Ocean Sustainability	2017-02-14 - 2017-03-15	0	0
Inclusive Societies	2017-02-14 - 2017-03-15	0	0
Peaceful Societies	2017-02-14 - 2017-03-15	0	0
Global Partnership for Sustainable Development	2017-02-14 - 2017-03-15	0	0

Legend

Not Found (0)

	High presence
	Medium –High
	Medium
	Low
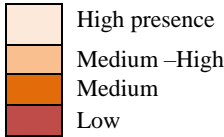
Note. Range on Wikipedia (measured by number of page views), 1-9.999 (Low), 10.000-99.999 (Medium), 100.000-299.999 (Medium-High), (+) 300.000 (High).

YouTube is the online source where all keywords are with larger or smaller presence. Keywords with more view counts are Innovation, Good Health, Violence Against Women, Clean Water and Climate Change. Keywords with medium-high presence are Industry, Poverty, Gender Equality and Infrastructure. On the other hand, the five keywords with lower presence are Justice, Peaceful Societies, Global Partnership for Sustainable Development, Reduce Inequalities and Responsible Production.

Table 5.
Ranking of Keywords - YouTube

Keyword	Search date	View counts (5 videos selected with more view counts)
Innovation	16/03/2017	49.632.612
Good Health	16/03/2017	48.406.818
Violence Against Women	16/03/2017	38.622.448
Clean Water	16/03/2017	37.374.362
Climate Change	16/03/2017	30.325.651
Industry	16/03/2017	17.280.769
Poverty	16/03/2017	15.915.425
Gender Equality	16/03/2017	14.876.578
Infrastructure	16/03/2017	10.050.049
Well-being	16/03/2017	5.337.771
Biodiversity	16/03/2017	2.189.272
Climate Action	16/03/2017	1.866.331
Clean Energy	16/03/2017	1.644.104
Economic Growth	16/03/2017	1.624.590
Sustainable Cities	16/03/2017	355.845
Quality Education	16/03/2017	292.029

(continued)

Keyword	Search date	View counts (5 videos selected with more view counts)
Safe Cities	16/03/2017	233.247
Combat Desertification	16/03/2017	192.258
Decent Work	16/03/2017	151.670
Zero Hunger	16/03/2017	113.280
Responsible Consumption	16/03/2017	67.176
Inclusive Societies	16/03/2017	40.462
Ocean Sustainability	16/03/2017	33.409
Inclusive Cities	16/03/2017	24.414
Responsible Production	16/03/2017	18.169
Reduce Inequalities	16/03/2017	14.347
Global Partnership for Sustainable Development	16/03/2017	7.796
Peaceful Societies	16/03/2017	7.791
Justice	16/03/2017	1.543

Legend

	Not Found (0)
	High presence
	Medium -High
	Medium
	Low
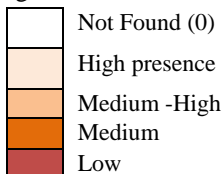
Note. Range on YouTube (measured by number of view counts (from 5 most viewed videos), 1-99.999 (Low), 100.000-9.999.999 (Medium), 10.000.000-29.999.999 (Medium-High), (+) 30.000.000 (High).

Lastly, a sum of total online interactions of the different social media and online resources is constructed in order to map the relevance of keywords depending on the citizens' interests. According to this ranking, the keywords with higher presence are Innovation (50.926.051), Good Health (48.675.326), Violence Against Women (38.877.201), Clean Water (37.811.013), Climate Change (37.811.013), Industry (19.474.694), Poverty (16.200.293), Gender Equality (15.475.928) and Infrastructure (10.916.224).

Table 6.
Ranking of Keywords – Total online interactions

Keywords	Twitter	Facebook	Wikipedia	Youtube	Total interactions
Innovation	77.402	878.471	337.566	49.632.612	50.926.051
Good Health	1.101	267.324	83	48.406.818	48.675.326
Violence Against Women	68.934	8.856	176.963	38.622.448	38.877.201
Clean Water	298.389	18.030	120.232	37.374.362	37.811.013
Climate Change	513.906	54.619	340.059	30.325.651	31.234.235
Industry	17.937	1.838.422	337.566	17.280.769	19.474.694
Poverty	119	183	284.566	15.915.425	16.200.293
Gender Equality	431.909	5.351	162.090	14.876.578	15.475.928
Infrastructure	188.615	513.109	164.451	10.050.049	10.916.224
Climate Action	5.441.609	12.741	16.315	1.866.331	7.336.996
Well-being	86.337	49.706	38.339	5.337.771	5.512.153
Biodiversity	238.539	31.233	364.847	2.189.272	2.823.891
Justice	1.060.001	1.241.246	210.545	1.543	2.513.335
Clean Energy	317.572	27.793	23.140	1.644.104	2.012.609
Economic Growth	11.878	2.328	176.142	1.624.590	1.814.938
Quality Education	1.797	6.878	720.568	292.029	1.021.272
Zero Hunger	379.785	163	54.362	113.280	547.590
Sustainable Cities	719	8.681	17.202	355.845	382.447
Combat Desertification	0	250	109.884	192.258	302.392
Safe Cities	4.058	2.175	0	233.247	239.480
Decent Work	4.565	83	6.766	151.670	163.084
Responsible Consumption	71	129	6.095	67.176	73.471
Inclusive Societies	39	99	0	40.462	40.600
Ocean Sustainability	4	0	0	33.409	33.413

(continued)

Keywords	Twitter	Facebook	Wikipedia	Youtube	Total interactions
Inclusive Cities	103	99	0	24.414	24.616
Reduce Inequalities	75	2	9.897	14.347	24.321
Responsible Production	3	135	0	18.169	18.307
Peaceful Societies	2	2.328	0	7.791	10.121
Global Partnership for Sustainable Development	0	23	0	7.796	7.819

Legend

	Not Found (0)
	High presence
	Medium -High
	Medium
	Low

Note. Range on Total interactions (measured by sum of total interactions obtained on Twitter, Facebook, Wikipedia and YouTube) 1-99.999 (Low), 100.000-999.999 (Medium), 1.000.000-9.999.999 (Medium-High), (+) 10.000.000 (High).

As result of this comparison, the relevance of Sustainable Development Goals for the citizens considering the online presence obtained is the following.

Table 7.
Relevance of Sustainable Development Goals

Sustainable Development Goal	Relevance
No poverty	High
Gender Equality	High
Clean Water and Sanitation	High
Industry, Innovation, Infrastructure	High
Good Health and Well-being	High

Sustainable Development Goal	Relevance
Climate Action	Medium - High
Peace, Justice and Strong Institutions	Medium- High
Quality Education	Medium-High
Affordable and Clean Energy	Medium-High
Life on Land	Medium-High
Decent Work and Economic Growth	Medium-High
Zero Hunger	Medium
Sustainable Cities and Communities	Medium
Reduced Inequalities	Low
Responsible Consumption and Production	Low
Life below Water	Low
Partnerships for the Goals	Low

Bottom Up Results

Bottom Up results are obtained through two strategies: secondary analysis of the social media reports and analysis of 50 Trending Topics of Twitter in 14 countries during one week. The topics of the secondary analysis were extracted from the yearly reports of Facebook, Twitter and Wikipedia.

Topics Emerged through Secondary Analysis

Facebook and Twitter provide ten issues as main topics of the year 2016. Among them, politics are relevant, for instance the US Presidential Election 2016 is present in the three sources analysed, Brazilian politics is a topic collected in Facebook's report and Euro2016 is from Twitter's report. Brexit is also a recurrent issue in Facebook and Twitter, it was a relevant concern by citizens from the United Kingdom, but also citizens from other countries have paid attention to this fact. Two controversial presidential candidates were topics during 2016; one of them is Rodrigo Duterte running in the Philippines' Presidential Election being a topic in Facebook, and the other one was Trump in Twitter, both candidates won the elections. Black Lives Matter also was a relevant topic during 2016 in Facebook and Twitter, this international activist movement began on Twitter under the hashtag #BlackLivesMatter and is aimed to combat violence against black people due to a systemic racism towards them. In the case of Wikipedia, higher

attention is paid to historical violent facts (World War I, World War II, September 11 attacks, Syrian Civil War, and Ku Klux Klan), also the list of stock market crashes and bear markets is a relevant topic in Wikipedia. Social media and other relevant online sources are themselves a relevant topic in Wikipedia, for instance Facebook, Google, YouTube and Gmail are topics included in the list of most accessed pages, as well other technological concepts such as Java (programming language). This matches with the current trend of "learn to code movement" and the aim to teach the young to program with codes since childhood. There are three more topics: one of them is Earth, representing a curiosity for knowing the place where humans are living and how it is defined; Millennials as a topic that defines a generation that are currently changing the work culture, with familiar uses of social media and technology and with more social conscientiousness; and the last one is the Zika Virus which was an important health concern during 2016.

Table 8.
Topics emerged from secondary analysis

Facebook	Twitter	Wikipedia
US Presidential Election	Rio2016	United States presidential election,2016
Brazilian Politics		
Pokemon Go	**Election2016**	Earth
Black Lives Matter		Facebook
Rodrigo Duterte & Philippine Presidential Election	PokemonGo	Java (programming language)
Olympics	**Euro2016**	Google
Brexit		YouTube
Super Bowl	Oscars	World War II
David Bowie		World War I
Muhammad Ali	**Brexit**	Millennials
		Wikipedia
		Zika virus
	BlackLivesMatter	List of stock market crashes and bear markets
	Trump	
	RIP	September 11 attacks
	GameOfThrones	Gmail
		Syrian Civil War
		Ku Klux Klan

Topics emerged from the Monitoring of Trending Topics in Twitter

Topics emerged from the analysis of Trending Topics in Twitter are diverse, but there is a high presence of women's movement probably because the week chosen included March 8, the International Day of Women. However, at the same time, there are other topics that are present in these Trending Topics, such as the Violence Against Women, Frauds, or civil movements are present in these topics. Results are introduced in two steps: first, an overview of topics selected by each country and, second a table comparing the topics selected and if they are or not among the Sustainable Development Goals in order to find out if some topics are not yet taken into account by the United Nations.

Table 9.

Topics emerged from Monitoring TT in Twitter (14 countries)

Country	Number of TT selected	Trending Topics (TT)
Argentina	15	#MarchaCGT #Movil #TrenBelgranoNorte #ParoDocenteNacional #TránsitoBUE #DiaInternacionalDeLaMujer #DíaMundialDelRiñón #Legislatura #NiUnaMenos #pobreza #AprenderEnEquidad #CambiandoJuntas #maspobres #CrisisPetrolera #Transporte
Belgium	27	#cities4Europe #womensday #privacy #openbelgium #opendata #refugees #CircularEconomy #WikiLeaks #cleanenergyeu #JourneeDesDroitsDesFemmes #genderequality #SolarPowerSummit #ManifesteDes350 #smartcitybru #SDGGender #BokoHaram #Invest4Future #equality #CleanEnergyEU #LEmissionPolitique #villapolitica #FutureofEurope #bitcoin #Kennedytunnel #Transatlantic2017 #fukushima #pulseofeurope
Brazil	6	Justiça Federal #ViasExpressas Wikileaks #DiaDaMulher #NiUnaMenos ##Via Campesina

(continued)

Country	Number of TT selected	Trending Topics (TT)
Canada	20	#InternationalWomensDay #MuslimBan Wikileaks #Budget2017 #LeadershipYQL Criminal Code #IWD17 #StartupWomen #EqualityMatters #nlschools #ÉgalitéCompte #NewMedicationSideEffects #united4cymh (mental health) #NoFrauds #changetogether #NativeNationsRise #ElectionResults #EqualityBreakfast #DevelopersDen #Fukushima
France	13	#LibéDesRéfugiés #techcare2017 #JourneeDesDroitsDesFemmes #InternationalWomensDay #ellesmarchent #journeemondialedelafemme #LEmissionPolitique #NoFrauds #JusticePourSofiane #Fukushima #NousAccusons #ResponsabilitéCivile #opensource
India	14	National Highways #NoConditionsApply (gender equality) #womensday2017 #WikiLeaks #solarpower #BeingAWoman #RespectWomenLikeSRK #GoogleNext17 #UnitedByHalf #pulwamaencounter (terrorism) #Parliament #InnovationHasAName #ElectionResults #SupremeCourt
Ireland	23	#Strike4Repeal #InternationalWomensDay #innovation #CITInnov8 #engineersweek #Budget2017 #localenterprise #GoggleboxIRL #March4Repeal #faircity #BeBoldForChange #solidarity #ISIS #GlobalGreening #Right2Water #foodwaste National Maternity Hospital #NoFrauds #RailsGirlsDUB #GAAHealth #FutureIsGreen #UCCFoodmatters #AutismAndMe
Italy	14	#giornatadelladonna #scioperodelledonne #IWD2017 #Wikileaks #InternationalWomensDay #MetticiEnergia #FestaDellaDonna #womensday #povertà #lavoroautonomo #Governo5Stelle #Fukushima #MafiaCapitale #comunicazione

Country	Number of TT selected	Trending Topics (TT)
Kenya	26	#DevCon2017 #HealthyNation #BeBoldForChange #LecturersStrike #WeAreAllKenyans (solidarity) #CleanEnergyKe #IWD2017 #InternationalWomensDay #HealthStrikeDay94 Kenyatta National Hospital #OperationSaveNyamai #SGRTransformingTransport #Equality #StrengtheningResponse #AdaptCleanEnergy #Kenyans4Peace No Frauds #Kenyapreneurship #VoteNowKenyaDecides #KaribuMtongwe #United4Kiambu #ShameOnKEMedia #HowNationsProsper #AfricaLD #LegalAbuse #AfricaIndustry
Mexico	5	#DiaInternacionalDeLaMujer #Wikileaks #DíaMundialDelRiñón #ViviendaPorMéxico #EquidadEnPuebla
Nigeria	9	#WomensDay #BeBoldForChange #PeerFundingPays #InternationalWomensDay #BreakFreeWoman #GirlsCount #PeerFundYourProject #EdoWomen4Agric StudyWorkAbroadABJ
Spain	21	#cierraUNICEF #LaPAHsePlanta #CientíficasPrecarias #IniciativaPymes #ConCienciaEscuela #DiaInternacionalDeLaMujer #CorrupciónARV #InternationalWomensDay #patera #HuelgaGeneralEducativa #LaUniSeRebela #DíaMundialdelRiñón #NiUnRoboMás #STOPCorrupció #ProtocoloContaminación #DíaDaClaseObreiraGalega #NoOlvidamos #Fukushima #biología #Sentencia9nARV #HuelgaNoEsDelito
United Kingdom	16	#tech4goodawards #digitransform17 #RewritingTheCode #InternationalWomenDay #Budget2017 #Strike4Repeal #GoogleNext17 #WIREDHealth #digitalgaggle #selfemployed #ReportItToStopIt #dyingfrominequality #NewEconomics #futureofwork #bloodcancerconf #brexitbill
United States	14	#womenASCOA #Trumpcare #ParoDeMujeresPR #Budget2017 #InternationalWomensDay #GoogleNext17 No Frauds #NativeNationsRise How Healthy Are You #ElectionResults #peoplepower #iwdtoronto #CancerMoonshot #PlanFiscalPR

Once the list of Trending Topics monitored is obtained, the second step is to compare if they are present or not among the Sustainable Development Goals defined. Therefore, a classification of Trending Topics (TT, hereinafter) is developed in order to compare if all topics are covered or not under the Sustainable Development Goals. In this classification, we distinguish between those topics that are included among the 17 SDG and those that are not.

Three TT are directly related to the goal of No Poverty, for instance the hashtag #pobreza. There are 34 TT collected that are related to the goal of Gender Equality. Most of them focused on the dissemination of the International Day of Women and Equality (ex: #IWD17, #JourneeDesDroitsDesFemmes, #genderequality, among others), others focused on the Sexual Reproductive Rights of Women (ex: #March4Repeal) and Violence Against Women (ex: #ReportItToStopIt). Clean Water and Sanitation has only 1 TT that is #Right2Water. Industry, Innovation, Infrastructure is another SDG that contains many TT, specifically 24, with hashtags such as #innovation for the keyword innovation; TT related to infrastructure and transport (ex: #Viasexpressas, #Transporte) are the most used. Good Health and Well-being have 7 TT of health in a global perspective and mental health particularly (ex: #united4cymh). Climate action has one TT that it is #NousAccusons. There are 28 TT identified related to the goal of Justice, Peace and Strong Institutions. Terrorism is one of them (ex: #BokoHaram #ISIS), others are against fraud (ex: #NoFrauds, #STOPCorrupció), related to political elections (ex: #VoteNowKenyaDecides), justice (ex: Justiça Federal, #SupremeCourt) and peace (ex: #Kenyans4peace). There are 7 TT related to Quality Education, most of them with mobilizations to claim rights in education focused also on teachers' rights (ex: #Parodocentenacional, #Lecturestrike). There are 10 TT related to the SDG Affordable and Clean Energy focused on clean energy mostly (ex. #cleanenergyEU) and specific energy (ex: #solarpower). Only one TT identified is related to Life of Land, that is #biología. There are 15 TT identified related to the goal Decent Work and Economic Growth with topics focused on autonomous jobs (ex: #lavoroautonomo, #IniciativaPymes, #selfemployed), workers' rights (ex: #MarchaCGT), and investment for future work (ex. #futureofwork), TT related to the general economy and

budgets are present (ex: #Transatlantic2017, #budget2017). There are two TT related to Zero Hunger and they focus on food and waste (ex: #UCCFoodmatters, #foodwaste). There are six TT related to Sustainable Cities and Communities that are focused on smart cities and innovation, fair cities (ex: #smartcitybru, #CITInnov8) as well as the Housing right claim (ex: #ViviendaPorMéxico, #LaPAHsePlanta). There are 7 TT related to Reduced Inequalities (ex: #equality, #equidadenpuebla, #egalitécompte). Lastly, no Trending Topics were identified that relate to the following three SDG: Responsible Consumption and Production, Life below Water, Partnerships for the Goals.

The Trending Topics identified that are not included in the Sustainable Development Goals are the following: topics related to Open Data (ex: #opendata, #openbelgium, #opensource) and debates focused on privacy and transparency of information (ex: #privacy #wikileaks). Also, debates around opening codes or learninh how to code are present among citizens (ex. #Rewritingthecode, RailsgirlsDUB). There is concern about racism (ex: #muslimban, #JusticePourSofiane) and about the most vulnerable people living in bad conditions, for instance refugees (ex: #refugees #patera), the recognition of minorities' rights (ex: #viacampensina, #NativeNationsRise) and solidarity itself (ex: #solidarity). Another trending topic is health, particularly striking are topics such as cancer (ex: #bloodcanferconf, #cancernoonshot) and kidneys, but also issues related to the health system (ex: #HealthStrikeDay94, #Trumpcare). Concerning the economy there are trending topics with new contributions such as bitcoin or circular economy, but also peer-to-peer investment for implementing new initiatives (ex. #PeerFundingPays, #PeerFundYourProject). There are worries related to disasters, as for instance, the consequences of Fukushima, as well as the scandal for not having a team to save Nyamai, or disagreeing with the information disseminated by Media (ex. #ShameonKmedia). Lastly, it is important to highlight that there are two trending topics defending the need of maintaining Europe united and its benefits (ex. #FutureofEurope, #pulseofeurope). Last but not least, there are concerns related to the consequences of breaking apart from Europe such as Brexit, with the Trending Topic of #brexitbill. And the last trending topic collected, which is

not present in the SDG, is the civil movement against Trump's policies that impair the civil rights acquired (ex: #peoplepower).

Table 10.
Comparative analysis of the topics emerged with Sustainable Development Goals

Sustainable Development Goal	Topics included in the Goal	Topics not included in 17 SDG
No poverty	#pobreza #maspobres #povertà	#privacy #openbelgium #opendata #refugees
Gender Equality	#DiaInternacionalDeLaMujer #NiUnaMenos #AprenderEnEquidad #CambiandoJuntas #womensday #JourneeDesDroitsDesFemmes #genderequality #ManifesteDes350 #SDGGender #DiaDaMulher #InternationalWomensDay #IWD17 #StartupWomen #ellesmarchent #journeemondialedelafemme #NoConditionsApply #womensday2017 #BeingAWoman #RespectWomenLikeSRK #UnitedByHalf Strike4Repeal #March4Repeal #BeBoldForChange #giornatadelladonna #scioperodelledonne #FestaDellaDonna #BreakFreeWoman #GirlsCount #EdoWomen4Agric #CientíficasPrecarias #ReportItToStopIt #womenASCOA	#WikiLeaks #fukushima #Via Campesina #MuslimBan #NativeNationsRise #LibéDesRéfugiés #opensource #solidarity RailsGirlsDUB #OperationSaveNyamai #ShameOnKEMedia #patera #RewritingTheCode #bloodcancerconf #CancerMoonshot #DíaMundialDelRiñón #Trumpcare #HealthStrikeDay94 #JusticePourSofiane #FutureofEurope #pulseofeurope #brexitbill #peoplepower #CircularEconomy #bitcoin #PeerFundingPays #PeerFundYourProject

	#ParoDeMujeresPR
	#iwdtoronto
Clean Water and Sanitation	#Right2Water
Industry, innovation, infrastructure	#TrenBelgranoNorte
	#TránsitoBUE
	#Transporte
	#Kennedytunnel
	#ViasExpressas
	#DevelopersDen
	National Highways
	#InnovationHasAName
	#innovation
	#SGRTransformingTransport
	#AfricaIndustry
	Movil
	#LeadershipYQL
	#techcare2017
	#GoogleNext17
	#engineersweek
	National Maternity Hospital
	#DevCon2017
	#Kenyapreneurship
	Kenyatta National Hospital
	#KaribuMtongwe
	#tech4goodawards
	#digitransform17
	#digitalgaggle
	#comunicazione
Good Health and Well-being	#NewMedicationSideEffects
	#united4cymh (mental health)
	GAAHealth
	#WIREDHealth
	How Healthy Are You
	#AutismAndMe
	#HealthyNation
Climate action	#NousAccusons

Peace, Justice and strong institutions	#Legislatura #LEmissionPolitique #villapolitica Justiça Federal #NoFrauds #Parliament #ElectionResults #SupremeCourt #Kenyans4Peace #LegalAbuse #CorrupciónARV #NiUnRoboMás #STOPCorrupció #pulwamaencounter (terrorism) #BokoHaram #ISIS #NoOlvidamos MafiaCapitale Criminal Code #WeAreAllKenyans #StrengtheningResponse #VoteNowKenyaDecides #ElectionResults #ResponsabilitéCivile #Governo5Stelle #HuelgaNoEsDelito #cierraUNICEF #Sentencia9nARV	
Quality Education	#nlschools StudyWorkAbroadABJ #ConCienciaEscuela #ParoDocenteNacional #LecturersStrike #HuelgaGeneralEducativa #LaUniSeRebela	
Affordable and Clean Energy	#cleanenergyeu #SolarPowerSummit #CleanEnergyEU #solarpower GlobalGreening #FutureIsGreen	

	#MetticiEnergia #AdaptCleanEnergy #ProtocoloContaminación #CrisisPetrolera
Life on Land	#biología
Decent Work and Economic Growth	#Invest4Future #changetogether #lavoroautonomo #IniciativaPymes #selfemployed #NewEconomics #futureofwork #Transatlantic2017 #Budget2017 #localenterprise #HowNationsProsper #AfricaLD #DíaDaClaseObreiraGalega #PlanFiscalPR #MarchaCGT
Zero Hunger	#UCCFoodmatters #foodwaste
Sustainable cities and communities	#cities4Europe #smartcitybru #CITInnov8 #faircity #ViviendaPorMéxico #LaPAHsePlanta
Reduced inequalities	#equality #EqualityMatters #ÉgalitéCompte #EqualityBreakfast #Equality #EquidadEnPuebla #dyingfrominequality
Responsible consumption and production	
Life below water	
Partnerships for the goals	

Discussion

This methodology introduces a new methodology to identify the relevance of the research goals that are defined by institutions or research teams. Until now, the consultations about issues of relevance and social impact were only addressed to an expert community on those topics. But now, with data available in social media we can analyse the voices of other social agents and citizens regarding these goals defined. The methodology serves to identify which goals are more relevant for the users of social media and if there are, some topics that are not covered by the research goals defined. This strategy is useful for being more connected to the needs and concerns of citizens and can help to refine the research goals according to this information collected.

Notes

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