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What is the public opinion about universities and sustainability? a social media analysis among ‘Spain’ and across the world

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Abstract: This exploratory study aims to identify, to cluster, and to set an emotional value of the content of tweets including ‘university’ and sustainability-related terms in Spain in comparison to the rest of the world. For six months, in Spain, 2370 tweets were collected and 53,567 tweets in the rest of the world (English language). To carry out this research, sentiment and topic clustering analyses were applied. The results present key factors that involve the environment, research, and innovation through the role of universities in communities. The outcome also adds an entrepreneurship vision and practical implication of academic knowledge in industries. The conclusions of the present study can be useful to evidence the contribution of universities in their pursuit of a sustainable environment. Our findings will also define important questions to be addressed through the main mission of universities as part of an innovative process of answering new challenges.

Keywords: Twitter; sustainability; social media; university; sentiment analysis; text mining; public opinion; environment.

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1 Introduction

In the last two decades, environmental and social effects in public and corporate spheres have suffered a radical transformation. According to Holt and Barkemeyer (2012, p.17), this transformation has been shown by “media coverage on television, newspapers, social media, films and documentaries”. Moreover, environmental and social issues have been communicated through more structured channels, such as environmental education programs and school curricula (Tilbury, 1995).

According to previous publications related to climate change, sustainability and environmental concerns, discourse and education have several lines of research. In recent years, researchers have tried to explain four main areas. First, the definition of sustainability (Merle et al., 2019; Orna-Montesinos, 2015; Pasquaré and Oppizzi, 2012); second, the tendency (Wei et al., 2015; Boykoff, 2010; Xiong et al., 2016); third, the increase of willingness to act on environmental (Guo and Marinova, 2011; Dür and Keller, 2019) and the last main area, the differences of prioritisations on sustainabilityrelated issues in different parts of the world (Schmidt et al., 2013; Barkemeyer et al., 2013). Most of these publications consider newspaper articles as their source of analysis.

In addition, the role of education and the emotions of society are also key aspects of change agents. Then, “the essential features of the content of university education are its universality and integrity. University education, in its essence, is not pure preparation for

the profession. However, it provides integrated orientation to a certain sociocultural sphere, which may come from different areas of science and practice” (Serikov et al., 2015, p.403). Moreover, “educational approaches are demanded to move beyond a content-based focus and to intellectually understand and solve problems, by using holistic pedagogies that emphasise perceptions, cognitive structures, emotions and actions of students” (Benito Olalla and Merino, 2019, p.240).

From a wider social perspective, these perceptions, cognitive structures, and emotions have an important power currently. Thus, “emotion is important to human communication and life, and so it seems that the time is ripe for exploiting advances and intuitions from opinion mining to detect emotion in a wider variety of contexts and for primarily social rather than commercial goals” (Thelwall et al., 2010, p.190). The impact of these emotions on social issues that include sustainability and education can be analysed through the analysis of content in resources such as social networks.

Considering that there is a lack of studies on sentimental analysis in the mentioned issues, and therefore, a gap of the literature. Emotions help to understand developments and institutions in opinion mining in different contexts, from social to commercial (Thelwall et al., 2010). The few approaches analysed until the year 2019 have four perspectives of the public opinion:

- 1 the role of media frames in the formation of public opinion (Bain and Chaban, 2017; Jang and Hart, 2015)
- 2 environmental and sustainability-related terms in social media (Cody et al., 2015)
- 3 the evolution of the communication of environmental issues on social media (Holmberg and Hellsten, 2015)
- 4 the content use of sources and information sharing about environmental issues (Veltri and Atanasova, 2017).

In the past decades, communications have suffered a switch from ‘one-to-many’ to ‘many-to-many’ (Boykoff, 2011). It is noteworthy that society has more intuitive communication channels due to advances in technology, such as social media. Social media has experienced rapid growth in the last decade and has enabled organisations to lift their profile and share their societal contributions without the editorial filter of traditional media (Killian et al., 2019). These channels have dispersed the generation of information because, at present, it does not only come from journalists, scientists, and writers, but almost any individual can communicate their ideas. As a result, the new way of communication is an extensive source of information with a great variety of views, opinions, remarks, and suggestions. Moreover, “social media serve many useful purposes such as assessing sentiment, engaging publics in causes, creating communities, and recruiting volunteers. Social media communication can have even more impact when it involves an educated and young campus population” (Carpenter et al., 2016, p.4868).

Twitter is a social media for microblogging (<https://twitter.com/>). This tool provides an easy, fast, and free communication way. Thereby, content on catastrophes, accidents, and environmental issues has been disseminated faster on this tool than other traditional media. Every post or ‘tweet’ has a limitation of a maximum of 280 characters. One of the characteristics of this tool is that it is possible to know how the population is identified with

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respect to the issue raised. Therefore, we considered Twitter for the present study because it includes high observational data, public opinion, and news from the general public, social, and scientists (Kirilenko et al., 2015). Richardson et al. (2016) published a review of the early researches on sentimental analysis with the main focus on sustainability, education, and social media.

There are few studies exploring general public sentiments regarding education and sustainability topics in social media. In fact, social media is a popular source of information from several countries that have not been heavily analysed. Especially, studies in Spain and the rest of the countries are very limited. Therefore, in order to fill this gap, the two main objectives of this research are:

- to identify the content of university and sustainability-related terms in tweets in Spain and compare it to the rest of the world (English language)
- to determine the emotional value of the tweets' content in Spain and the rest of the world (English language).

To reach these objectives, the following research questions are answered:

- (RQ1) What are the content of university and sustainability-related terms of tweets in Spain compared to the rest of the world?
- (RQ2) How is the emotional value of the content of tweets between Spain and the rest of the world?

Through answering the above-mentioned research questions, we will help to understand better the connection between social media debate on sustainability and education. This has practical implications for organisations (such as universities) that want to build communications strategies to reach and engage different audiences (Spain and the world). In addition, "micro-texts from Twitter and other social media can become very valuable for the real-time detection of problems that affect people, thus having a profound impact on the management of decision-making processes" (Periñán-Pascual and Arcas-Túnez, 2019, p.32).

Consequently, education can better adapt its policies by addressing the current concerns of society (e.g., helping to promote a sustainable university). This adaptation also opens alternative methodologies such as eco-methodology. In other words, a methodology which can lead to teaching-processes in higher education institutions improve environmental conscience among students (Escolano Benito, 2007).

The structure of the paper continues with a brief overview of sustainability addressed in social media from different perspectives, followed by a methodological guideline of the sentimental analysis. Then, findings and discussion are presented of the most relevant topics in Spanish and global context, as well as a comparative analysis from the different clusters, classified as positive and negative sentiments with other similar studies. The last section closes the paper with the main conclusions.

1.1 Social media and sustainability

Social media have developed and provided users with global information related to individual preferences and events. They are defined as “technological systems related to collaboration and community” (Joosten, 2012, p.7). Their content spread rapidly as people connect and post it openly on the web (Yoo et al., 2018). “Social media offers a mechanism for many people with diverse backgrounds to communicate and form their own opinions” (Cody et al., 2015, p.2). In other words, “participatory technologies have expanded the boundaries of our communities by bridging the local with the global” (Nagle, 2018, p.87). Nonetheless, the explosive growth of social media platforms such as Twitter, or Flickr, reported in Kirilenko et al. (2015, p.87), has allowed “‘passive’ surveying of public opinion”.

The media platforms have not only shown a wide range of daily concerns, such as: “the increase in the world’s population, growing demands for natural resources, global warming, waste management or social inequalities” (Yáñez et al., 2019, p.57) but also, influenced global economies and policies. In addition, environmental and sustainability issues are often addressed on these media platforms. In particular, when “sustainability issues are situated in a field of tension between the personal and the political, as almost every ‘private’ decision has ‘public’ consequences and social conditions affect individuals’ freedom of choice” (Van Poeck and Vandenabeele, 2012, p.542).

Previous findings from research on sustainable development and social media have demonstrated different perspectives in this area of research, including, for instance: cities human behaviour (Blewitt, 2015; Ilieva et al., 2014), human behaviour in business effectiveness (Lee et al., 2018; Lee, 2017; Meflinda et al., 2018; Reilly and Larya, 2018; Sogari et al., 2017; Tseng, 2017; Tugrul and Gocer, 2017; Veseli-Kurtishi, 2018; Vetrakova et al., 2018), in tourism (Budeanu, 2013; Mkono, 2016) and in educational contexts (Andersson and Öhman, 2017; Carpenter et al., 2016; Hamid et al., 2017).

In the last field, “critical social media literacy is needed within teacher education because social media spaces are not neutral. Students need strategies and tools to work within these spaces and to leverage their affordances for professional learning. They also need to be aware of how a diversity of people (including their peers) use and experience social media” (Nagle, 2018, p.91). Thus, “education likes to explore emerging technologies as new or improved tools to enhance instruction and learning. Moreover, when social media has emerged as a highly useful personal communication technology” (Tess, 2013, p.66).

Although many reviews in the social media sector have been conducted overall, Twitter was one of the leading social network platforms analysed concerning social media and sustainability topics. This microblogging platform is one of the most social media with more users worldwide and enables a contribution to a range of subjects and regional borders in real-time. These contributions are called ‘tweets’ that may include what the users feel, do, or think (Veltri and Atanasova, 2017). For this study, we considered Twitter because of its high volume of public opinion data, including ideas, comments, complaints, news, among others, which are reported from social and natural scientists to the general public. (Kirilenko et al., 2015).

2 Methodology

This work is an exploratory analysis of tweets, including words related to sustainability and the term ‘university’ using the following four-step methodological procedure:

- I *Data collection.* We collected tweets from the 16th of August 2018 to the 29th of January 2019, which included the word ‘university’ and sustainability-related words in Spain and the English-speaking world. The data was collected using the R programming language package *twitterR* (Gentry, 2013). The keywords in terms of sustainability were first based on the World Health Organization’s Seventh millennium development goal (MDG): ‘to ensure environmental sustainability’. Therefore, the first keywords were the terms ‘environment’ and ‘sustainable’. Then, further keywords were selected based on terms from the Sustainable Development Goals (SDGs) developed by the United Nations (www.un.org) focused on the environment (see Table 1).

Table 1 Searched terms related to SDGs

<i>Sustainable development goal</i>	<i>Related terms</i>
Goal VI: clean water and sanitation	Water Waste
Goal VII: affordable and clean energy	Energy
Goal IX: industry, innovation, and infrastructure	Innovation Development
Goal XI: sustainable cities and communities.	Transport Mobility Waster
Goal XIV: life below water.	Water

Additionally, seed words used to expand the collection data were taken from a R&D + I project (ref.: CSO2014-51916-C2-1-R) and doctoral thesis (Bayas Aldaz, 2019), both were focused on analysing social perception from Spanish media outlets. The main insights of the studies called the attention on ‘energy’, ‘transport’, ‘mobility’, ‘innovation’, ‘water’, ‘waste’, ‘engagement’, ‘environment’, and ‘development’ as most commons concerns topics related to university and sustainability.

- II *Data pre-processing.* The retweets have been filtered out because they have no new text in contrast to the original tweets. In addition, we gathered and cleaned unstructured data by applying a list of stopping words and removing various characters that could distort the analysis (e.g., punctuation, URLs, etc.).
- III *Sentiment analysis.* The sentiment analysis was carried out using Rinker (2013) included in the package ‘*qdap*’ in the R programming language. The goal of this review is to identify the tweets’ sentiment labels (positive, neutral, or negative) based on a polarity ranking. This score classifies words into positive or negative by comparing them on the Bing predefined lexicon (Liu, 2012) (e.g., *nice* evokes a positive polarity sentiment or *horrible* expresses a negative polarity).

On the other hand, segments are also considered; for instance, *it does not look well* evokes a negativity polarity. Therefore, amplifiers words and de-amplifiers words are also taken into account in the analysis. Each term in the text segment is assigned a positive or negative weight and amplifiers/de-amplifiers. Then, the polarity score is defined as the ratio of the sum of the words times the text clusters weights in a segment and the square root of the total number of terms in the text segment (Hu and Liu, 2004).

IV *Topic clustering.* We used an open-source software IRaMuTeQ (Ratinaud and Déjean, 2009) based on the framework known as ALCESTE, which clustered tweets based on a cooccurring lexemes approach of simple corpora statements. This approach is intended to create subject clusters of text segments based on the Reinert process (Reinert, 2000).

3 Results

After following the proposed methodology, a total of 2370 original tweets were collected in Spain and 53,567 original tweets in the rest of the world (English language), including the term ‘university’ and sustainable-related terms. The analysis in Spain displayed 64,960 occurrences and worldwide 1,542,650. Finally, a comparison between both was carried out, including the sentimental analysis and the most relevant terms in both contexts.

3.1 Spain

The results introduced five main topic clusters (classes) in Spain, which represented 84.81% of the collected tweets. The first cluster was represented by 42.5%. The overall corpus included the terms: innovation, development, professional, project, team, great, company, technology, country, train, employment, promote, activity, proposal, agreement, initiative, and results. The second cluster with 29.5% presented the words, social, responsibility, conference, congress, professor, international, vice, corporate, president, organise, hold, sustainability, forum, sustainable, rector, and ods (SDGs). The first and second clusters were the most representatives and were associated in a specific context of innovative projects related to technology from a business perspective, as well as corporate social responsibility activities. The third cluster represented by 6.7% contained the terms, mobility, aid, call, Erasmus, scholarship, academia, study, grant, au, period, contact, Castille, student, UCA, Santander, and program. It was related mostly to academic funding.

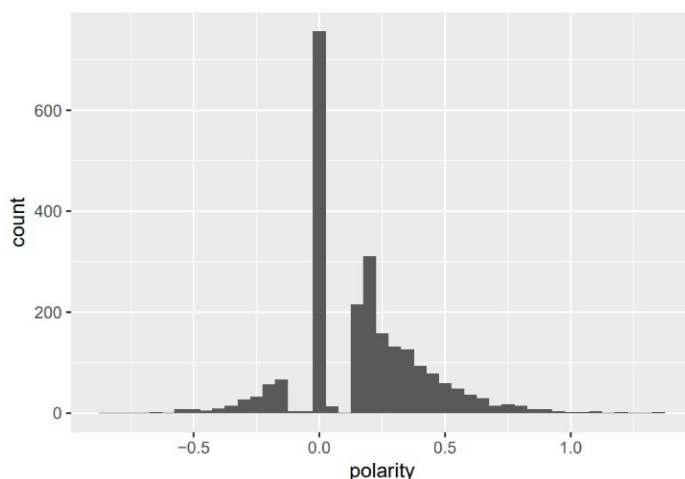
Thus, the fourth cluster represented only 6.9% and included the terms waste, renewable, artificial, hydrogen, economy, circular, plastic, intelligence, energy, collection, material, Stanford, treatment, electricity, store, fuel, container, solar, and Cambridge. It contained topics related to environmental initiatives with particular attention to the terms of artificial and intelligence. It might have suggested new alternatives for innovation in the environmental field. Finally, in the last cluster with 14.3%, included public transport, transport, water, stick, bus, college, tuition, pay, lot, live, bonus, thing, run, home, time,

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hour, free. In this last category, the majority of the terms might have projected daily activities and concerns of the university community.

According to the sentiment analysis (Figure 1), the mean polarity score was 0.168; if we do not consider the neutral text segments, the mean polarity score raised to 0.24. The analysis revealed that 31.90% were negative tweets, 9.91% neutral nuance, and the highest representation was 58.19% of the tweets classified as positive.

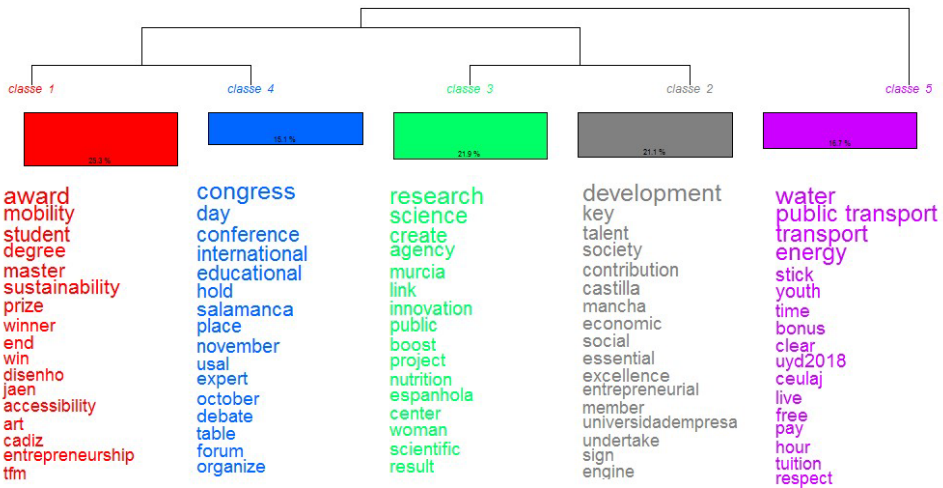
Figure 1 Polarity scores from tweets posted in Spain



3.1.1 Spain positive tweets

Our analysis of the positive tweets from Spain introduced five text categories, in which 1383 text segments were analysed. Figure 2 shows that the most representative set of words was class with 25.3%, including terms such as award, mobility, student, degree, and master. Sustainability was associated with the recognition of students' entrepreneurship in mobility and accessibility themes.

Figure 1 Topic clusters of positive tweets posted in Spain (see online version for colours)



In the same way, class 2 and class 3 were closely related. Firstly, the percentage of each cluster was similar, 21.1% and 21.9% respectively, and secondly, the thematic was under the same scope. Class 2 presented the university contribution to the economic and social development of societies. It also highlighted the talent and excellence of entrepreneurial. Thus, class 3 identified research-related thematic related to science with a promising factor concerning innovation in nutrition and gender studies. It included as well terms like public and boost, suggesting public funding or support.

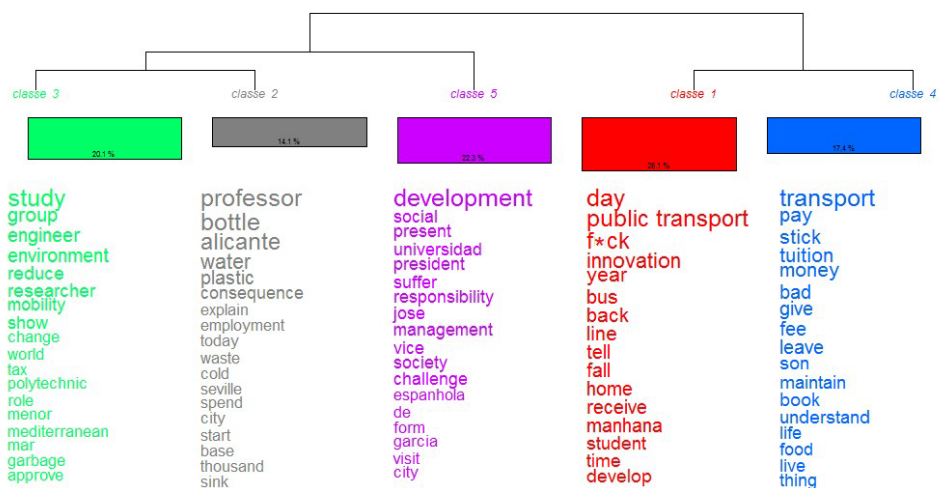
Furthermore, class 5 was represented by 16.7% introducing topics like water, public transport, transport, energy, and specific environmental concerns. Notice that this last class is isolated in the relationship with other classes. Nonetheless, last class 4 with 16.1% represented academic events at the national and international levels. Class 1 and Class 4 were closely similar, referring to research, and educational activities based on sustainability areas.

3.1.2 Spain negative tweets

Figure 3 shows the topic clustering analysis of the text segments classified as negative. Five clusters represented 242 text segments. Class 1, with 26.1%, involved negative content in themes like public transport, bus, line, innovation, and words that shown frustration and anger experiencing in daily commuting. Hence, class 5 evidenced a similar proportion, 22.3% being development, and university government elements included. This set of words nuanced responsibility, and challenges were reflecting concerns. Class 3, defined with 20.1%, involved topics linked to study, researcher, engineer, environment, and mobility. We suggest that this indicates the participation of the universities and their main educational, research, and outreach mission to contribute to issues like mobility or other studies towards reducing the impact in the environment. Next, in class 4, represented by 17.4% gave the focus of the economic limitations, maybe for the students' community, most notably transport, pay, tuition, money, book, life, food, fee, and bad. In the last class 2 defined by 14.1% indicated a specific thematic dominate with plastic, water, Alicante, and professor. It evidenced a concern in water consumption in the city of Alicante.

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Figure 3 Topic clusters of negative tweets posted in Spain (see online version for colours)



These results provided a correlation between clusters or classes. As such, class 1 and class 4 recognised a prominent issue with the modes of transportation and expenses related to students' daily lifestyles. Class 3 and class 2 suggested the impact of research and studies on the environment and specific to reduce consumption habits. Consequently, this last theme is yielded to class 5, which included university governance responsibility.

3.2 English-speaking world

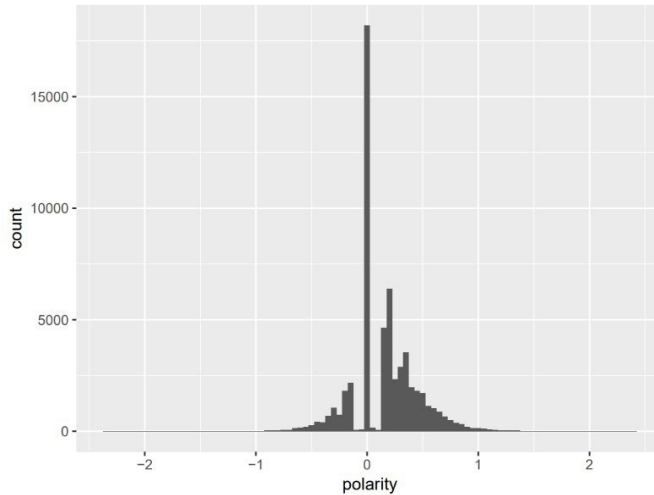
Tweets worldwide were detailed in five clusters, in which the number of the classified segments represented 94.53% original tweets collected. The most representative was class 1 with 28.1% including, waste, time, money, me, water, people, environment, know, feel, even, thing, need, good, pay, bad, tell, and lot. In this respect, the following cluster, class 5 with 23.6%, presented terms like innovation, research, technology, startup, hub, entrepreneurship, engineer, ai, launch, centre, award, lab, blockchain, design, project, announce, entrepreneur, partnership, and digital. These two main sets of words gave special attention to research in innovation, developing new technologies, and environmental nuances of saving resources.

Regarding class 3 with 20.2%, it contained topics like professional, development, student, engagement, career, community, program, learn, leadership, state, civic, staff, offer, course, opportunity, college, and scholarship. Themes similar aligned to class 2; in fact, both categories were focused more on academic activities, disseminating through conferences and professional development. In this context, class 2 represented by 16.5% showed the words sustainable, dr, conference, development, prof, international, seminar, vice, November, hold, speaker, African, president, organise, and host.

The last class number 4 with 11.5% introduced topics including terms such as energy, researcher, solar, renewable, scientist, fuel, reduce, plastic, power, major, wind, emission, hydrogen, study, plant, carbon, and battery. This last set of words discussed environmental solutions and alternatives, which was linked to class 1 in similar lines.

Finally, the sentiment analysis (Figure 4) showed that overall the tweets have 14.78% of negative sentiment strength, 31.23% are neutral, and 53.98% included positive sentiment strength. Because of the high amount of tweets, we subsetting them for the analysis based on the polarity score: 6642 absolute positives (polarity score > 0.5) and 767 absolute negatives (polarity score < -0.5).

Figure 4 Polarity scores from tweets posted worldwide

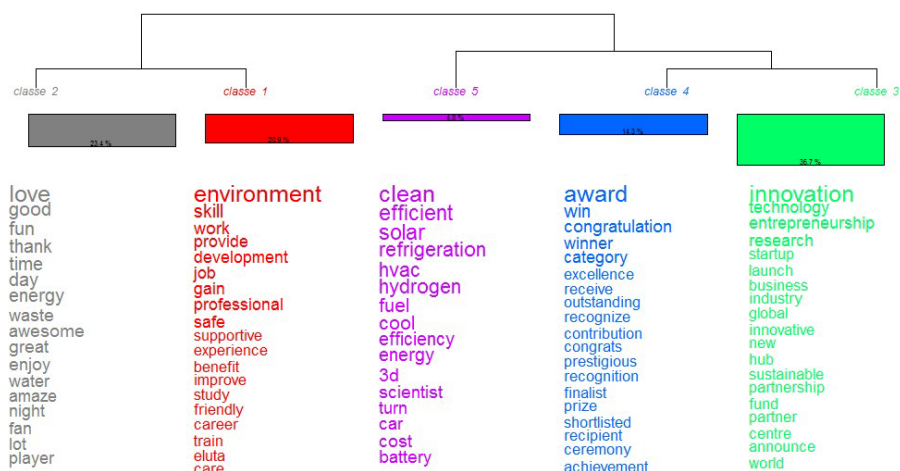


3.2.1 Absolute positive tweets

In order to identify the most relevant topics with positive nuances from the audiences, 6642 segments were analysed. Figure 5 represents five clusters, being the most relevant class 3 with 36.7%, which represented innovative and technological topics. They showed an affinity with research and partnership related to being academia a hub to launch a new business. Class 2, defined by 23.4%, evidenced prominent positive attitudes connected to energy, waste, and water, showing the influence of sustainability solutions or options. Class 1 introduced specific characteristics of professional profiles and interests. Moreover, class 4 represented by 14.3% highlights recognition of achievement may be in line with class 3 in areas of entrepreneurship and technology. Finally, the last class, number 5, with 4.8% exposed clean, efficient solutions based on alternative options as solar sources.

Figure 5 Topic clusters of absolute positive tweets posted worldwide (see online version for colours)

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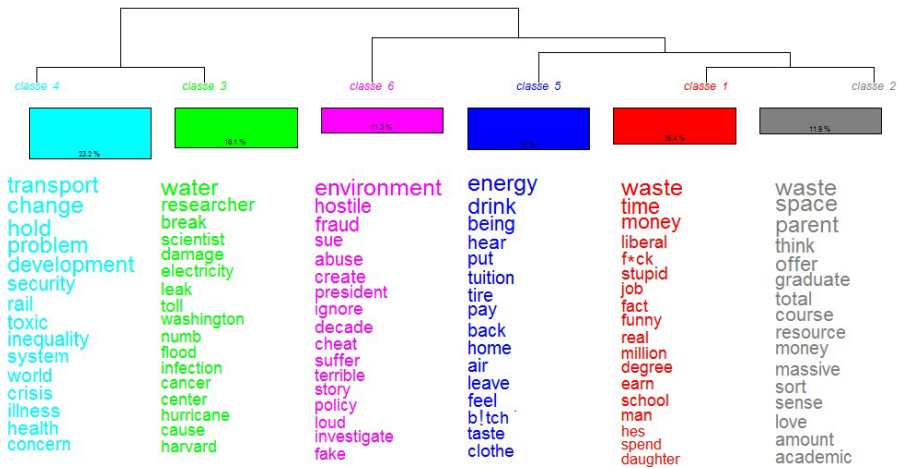
3.2.1 Absolute negative tweets

A closer look at the data in Figure 6 shows that negative tweets were analysed in 770 text segments. They were represented by six families of words; the most extensive representation is class 4, with 23.2% containing transportation concerns; it reflected concerns in the transportation system, security problems, and health issues. Class 3, with 18.1%, addressed topics like water, researcher, break, scientist, damage, and electricity. It might be that this set of words highlighted natural disasters and their impact on the health of the community, where researchers are challenging to find solutions.

In this connection class 3 and class 4 were related to each other approaching health issues as the main concern. The second most relevant cluster was number 5, with a similar percentage of 19%. We observed strong evidence of a negative image of terms like energy, drink, being, hear, put, tuition, tyre, pay, and others, giving a meaning of a complaint list not being listened to or addressed. Then, class 1, with 16.4% pointed out dominant disappointing emotions linked to waste, time, money, liberal, job, degree, and others. This last class mentioned is correlated to the next class number 2 with 11.9%. The most relevant terms in class 2 were waste, space, parent, think, offer, graduate, and total.

Probably, it elicited negative attitudes towards economic efforts that parents invest in education. Hence, class 1 and 2 referred to the economic limitation of the students' families in order to get an education and a career. Finally, class 6 in less proportion of 11.3% topics included environment, hostile, fraud, sue, abuse, create, president, ignore, and others terms. It described the negative impression of politicians giving particular relevance to the term environment and legal nuances.

Figure 6 Topic clusters of absolute negative tweets posted worldwide (see online version for colours)



Hence, the most interesting findings in negative tweets were the general meaning of worldwide audiences focus on natural disasters, transportation problems, and environmental issues and their effects on the health of society. It also highlighted research and sciences might be as challenges to be addressed.

3.3 Similarities Spain vs. the rest of the world

We observed strong evidence of the similar topics emerging from the analysis of a context in Spain and another in the rest of the world. We weighed the terms frequencies by the total number of tweets in order to make the comparison possible. Figure 7 shows the most repetitive common terms in the two cases. The most relevant terms in common were development, innovation, student, water, research, and energy. However, Spanish content focused more on innovation, transportation, and mobility themes. In a similar line, science and education were also dominant concerns in the analysis. In contrast, tweets from the rest of the world were mainly focused on development, waste, environment, and energy.

Regarding the correlation, a more in-depth look at the most common terms in both contexts.

Figure 8 indicates that tweets from Spain were more related to the Spanish cities and universities, emerging technologies, and some values as accessibility and responsibility. Mobility, innovation, and education were latent concerns for both contexts; however, the Spanish audience was calling the attention of negative nuances, which can propose a critical problem to be addressed.

Figure 7 Common terms pyramid of tweets and Spain and the rest of the world (see online version for colours)

Werde in common

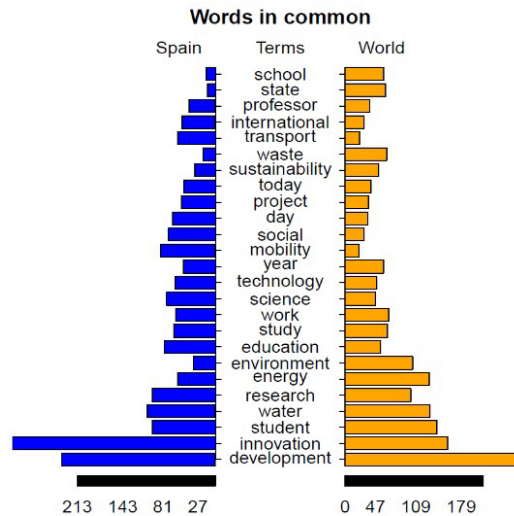
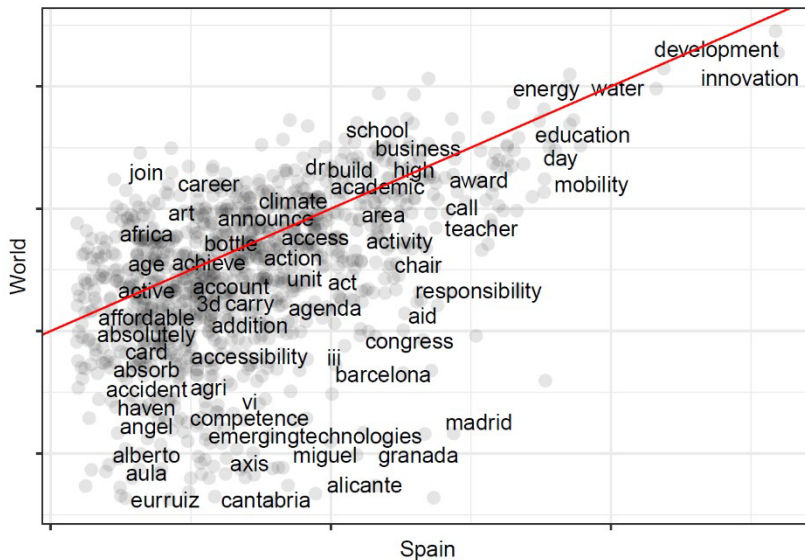


Figure 8 Pearson correlation analysis of tweets in Spain and across the world (see online version for colours)



On the other hand, in the rest of the world, the terms development, innovation, water, energy, education were the focus of the study (Figure 8). However, the most significant outcomes were business, award, high, academic, build, area, climate, announce, access, action, bottle, achieve, account, age, active, affordable, and absolutely. It emerged a consideration in higher education as access to develop outstanding business, and innovation to promote actions toward climate change, and environmental solutions.

4 Discussion

The results evidenced that in both geographical conditions, the most relevant topic clusters were focused on research and the outreach of academia from technological and innovative sustainable alternatives. However, in Spain, tweets were mainly focused on partnerships with companies and corporate social responsibility aspects. Tweets from around the world of English speakers refer to creative research and technology and potentially use the term 'university' as the main source for projects involving the community.

Additionally, there was a relevant implication of environmental activities, sentiments linked to social awareness, and mobility. Evidence in the negative Spanish tweets class 4 and class 1 highlighted public transportation matters probably faced especially by students because they were related to time, and commuting challenges to or from universities. Furthermore, worldwide negative tweets in class 4 also suggested transportation problems, demanding environment, and health concerns towards a change.

Positive Spanish perspective towards transportation clearly expressed mobility pricing initiatives strongly supported by students and the youth. On the other hand, the mobility topic was not significant in worldwide tweets. However, Serna et al. (2017) showed in their study an increasing interest in social media regarding urban transport, mobility, and infrastructure agendas.

This exploratory study links the main sustainability factors for the users related to universities. After the analysis of Saura et al. (2018) in order to improve the quality of their services and offer better products after understanding the influencing factors on hotels, the findings of this study regarding sustainability topics and universities might help to determinate the strength and weaknesses of universities' participation and identified the main concerns of society in a local and global context.

A study of polarised frames on 'climate change' and 'global warming' by Jang and Hart (2015) explored the stream of Twitter conversations over two years prevail in the US compared to the UK, Canada, and Australia. It illustrated the highest prevalence pattern concerning impact and action frames. Thus, similar to our results from both backgrounds, it attributed environmental solutions, especially in a negative frame. In the analysis of the Spanish tweets, the majority of the clusters make references to sustainable actions. However, worldwide tweets pointed out also the impact on health and illness concerns. In this connection, cluster 6 listed legal terms, including the word 'president'. It provided a comparable idea with the findings from Jang and Hart (2015) from the government's anti-environmental policies, which showed great popularity in Australia.

Cody et al. (2015) provided an exploration of the sentiment surrounding tweets containing the word 'climate'. It presented in their findings the words 'science' and 'scientists' in almost every word shift in their analysis as in the tweets in our study in Spain and the English-speaking world. Therefore, findings suggested the universities' role and impacted through research and development. Their responsibility to promote sustainability by developing more effective ways of dealing with environmental and social problems (Alshuwaikhat and Abubakar, 2008).

According to the sentiment analysis, around half of the posts were classified as positives, and 23% were negative. This fact contrasts the findings in Reyes-Menendez et al. (2018). They identified in social media greater negative content regarding the environment and factors such as climate change, problems with water in terms of pollution,

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deforestation, or massive tree felling, the pollution that drives climatic changes, and biodiversity issues. In addition, positive terms were associated with the environment, public concerns in public health, clean energy, and sustainability. However, our results from positive tweets in Spain gave greater relevance to research and academic activities, and only one cluster was a close link to water, energy, and transport. On the other hand, worldwide English tweets included environmental actions.

As demonstrated by our results, the sentimental analysis helped to identify questions addressed through the main mission of universities, teaching, researching, and transfer of knowledge. Global and local issues were debated in the posts that research agendas should include in a constant innovation process in academia as this analysis helps to capture the weaknesses and strengthens of the university system to be improved from the management approach.

5 Conclusions

This study focused on the analysis of tweets, including the keywords ‘university’ and sustainability-related terms. We identified the main topics that concerned Twitter’s English-speaking global users and also the Spanish audience. In the English-global context, the discussion was dominated by research and technology from an entrepreneurship vision and environmental matters. The main findings from tweets posted in Spain focused on university and business alliances to develop innovation and Corporate Social Responsibility transferring knowledge through solutions as well as transportation problems.

In the case of tweets from the English-speaking world, the most visible negative topics were health concerns linked to transportation problems. It also called attention to natural damage and their impact on social welfare. Additionally, it included a list of general topics associated with students’ concerns in their daily university life. Furthermore, in Spain, the most representative topics related to negative tweets involved frustration in their daily commuting, university governance, and responsibility to challenge society and the outreach of research and education.

On the other hand, the positive sentiments from the Spanish posters were mainly regarding entrepreneurship and outstanding education studies highlighting mobility and sustainability. The study might add the university contribution to the development of societies focusing on research and science. Similarly, posters from the rest of the world evidenced leading topics from innovation yield to research and the role of the academia to create partnerships with other industries as a hub of technology. Results also discussed positive attitudes toward sustainable solutions and characteristics of professional profiles. It might suggest elements currently needed to be implemented in the holistic educational process in academia.

The significance of our results evidenced the contribution of universities in the pursuit of a sustainable environment from two different perspectives based on one of the main university stakeholders ‘the society’. In other words, the outcome could serve managers, policymakers, and leaders in improving the efficiency of companies, institutions, and firms.

In conclusion, the findings of the sentiment analysis showed that the prevalence of tweets classified as positive worldwide (53.98%) and in Spain (58.19%) were similar.

Neutral tweets were, however, 9.91% in Spain and 31.23% internationally. Finally, negative tweets in Spain were 31.90% and worldwide 14.78%.

Social media constitute an increasingly vast pool of potential data for analysing public opinion dynamics (Veltri and Atanasova, 2017). Findings provide valuable data to scientists and universities to take the opportunity to innovate in their contribution to society, in local and global challenges. Beyond this, there are several interesting research directions to be approached from an environmental perspective.

In this context, according to MacDonald (2005), the university community must be challenged to re-think and re-construct their environmental policies and practices in order to contribute to sustainable development at all levels. Thus, social media tools can better enable campus sustainability leaders to share information to increase awareness about local efforts and issues among their audiences (Williams et al., 2014).

An area for further research is the increment of keywords framing specific interest to improve in academic programs by areas. Future research should dive into different languages to have a stronger international perspective.

As demonstrated by our results, the sentimental analysis helped to identify questions addressed through the main mission of universities, teaching, researching and transfer of knowledge. Global and local issues that research agendas should include in a constant innovation process in academia. Additionally, the new requirements that students as future leaders and professionals should incorporate in their profile and careers. It captures the weaknesses and strengthens of the university system to be improved from the management approach.

Finally, this study presented some limitations. First, the worldwide analysis was limited to tweets in the English language. Second, the monitoring was covered during a relatively short period. Another area for potential research is also to ask an increase in the list of keywords framing specific interest to improve in academic programs by areas. The future researcher should dive into different languages to have a strong perspective from other countries.

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